Dec. 4, 1962 E. F. WANTLAND 3,066,304

DRIVING TOOL

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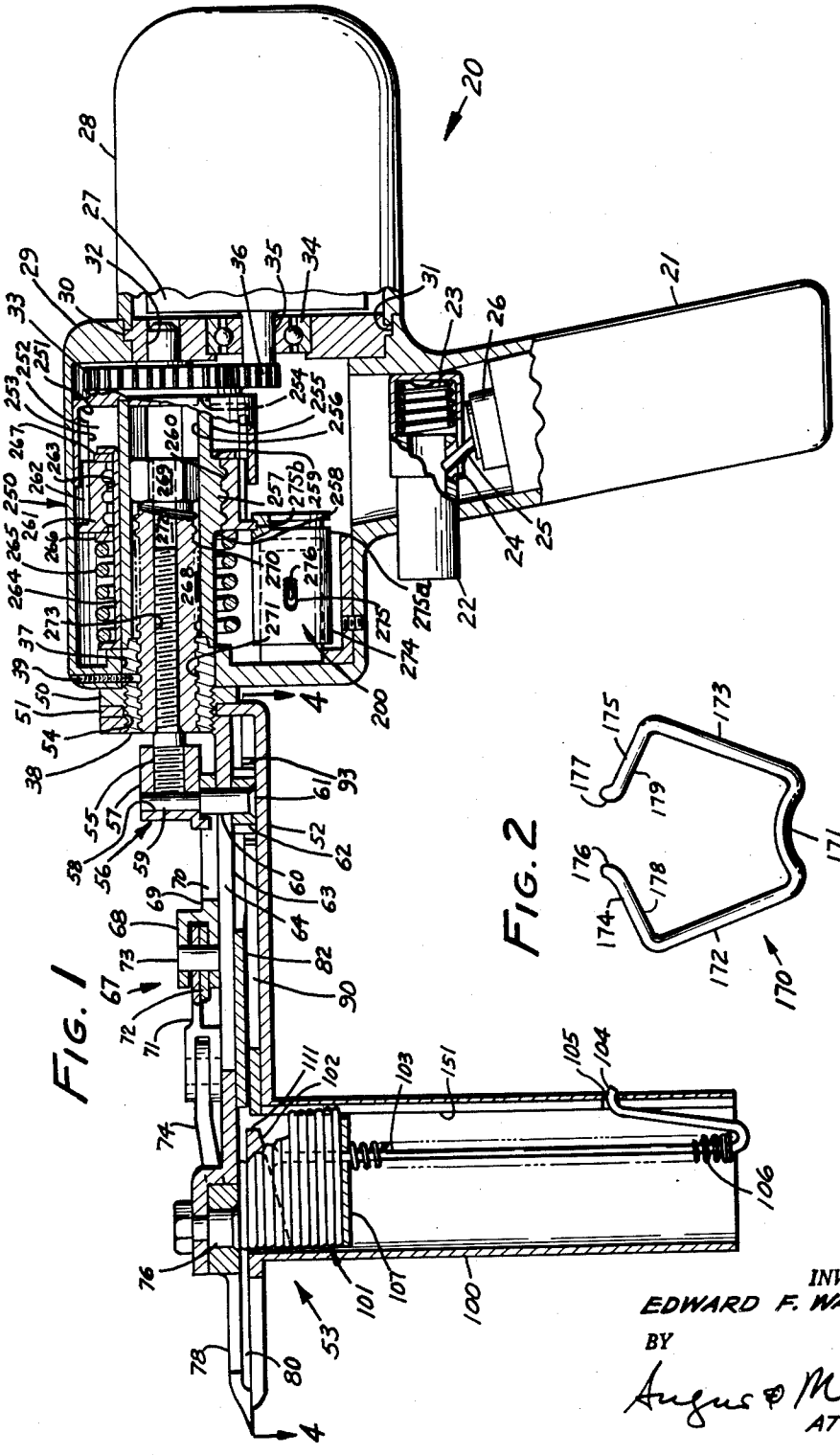


FIG. 1

FIG. 2

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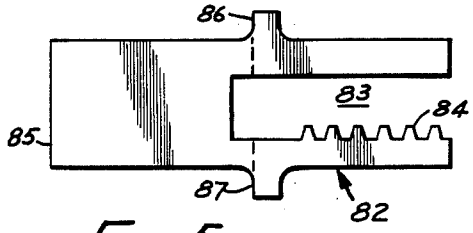


FIG. 5

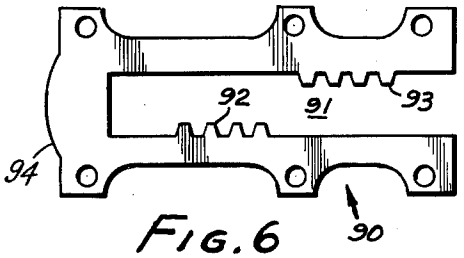


FIG. 6

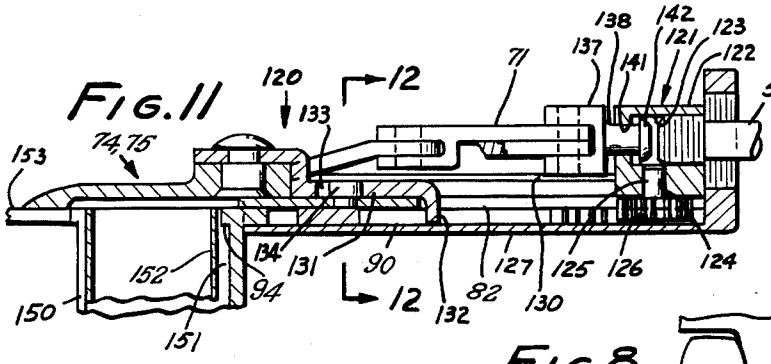


FIG. 11

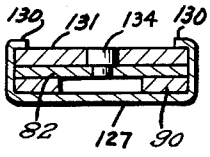


FIG. 12

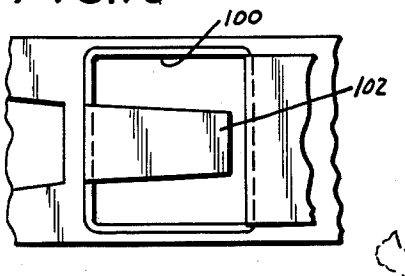


FIG. 10

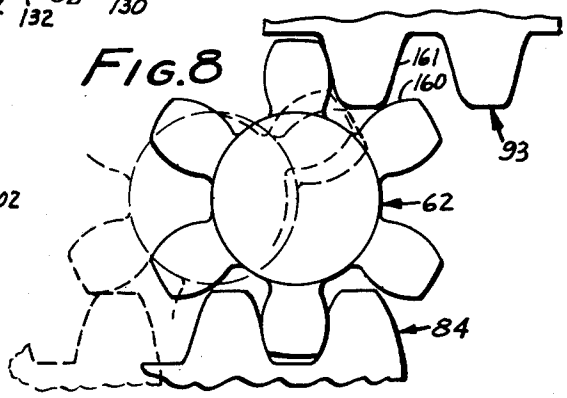


FIG. 8

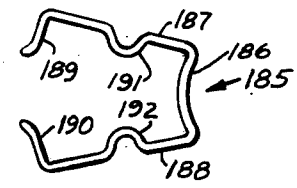


FIG. 13

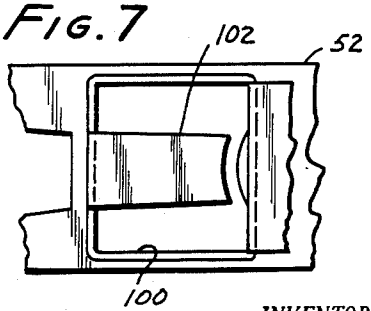


FIG. 7

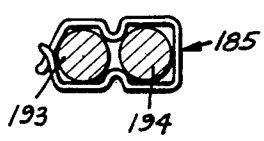


FIG. 14

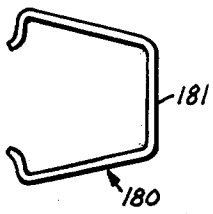


FIG. 9

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FIG. 3

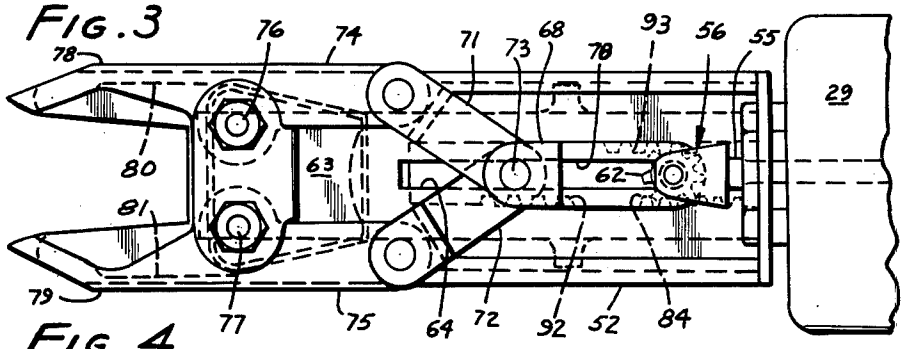


FIG. 4

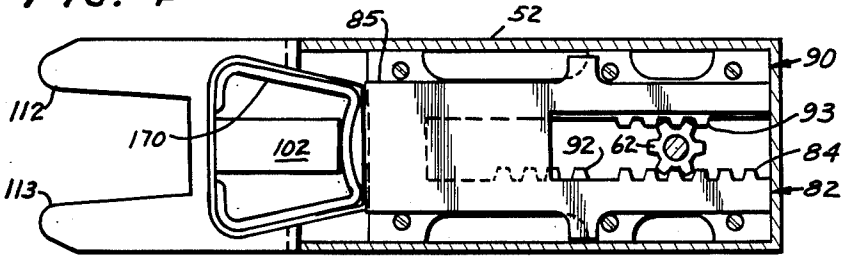


FIG. 15

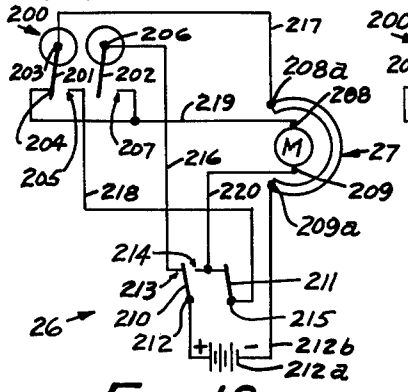


FIG. 16

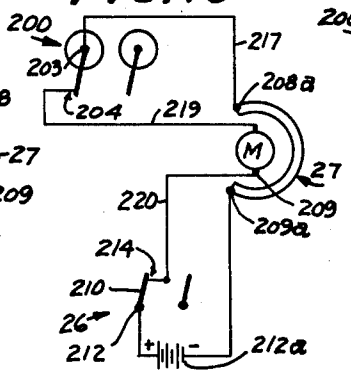


FIG. 17

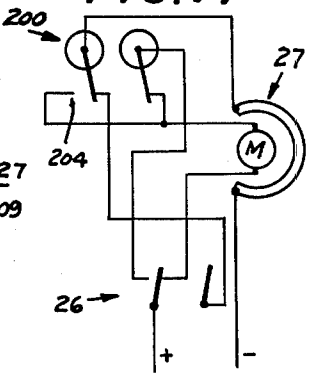


FIG. 18

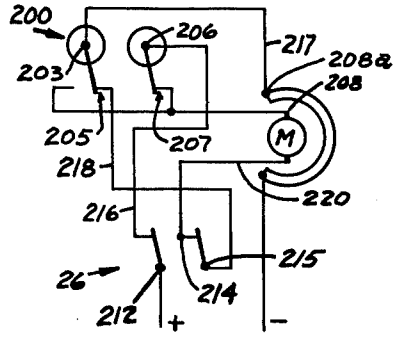


FIG. 19

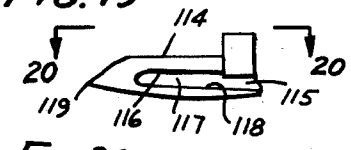
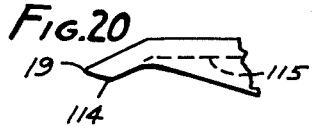


FIG. 20



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United States Patent Office

3,066,304
Patented Dec. 4, 1962

3,066,304

DRIVING TOOL

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Filed June 6, 1960, Ser. No. 34,004
3 Claims. (Cl. 1—187)

This invention relates to a tool for driving and setting staples, both of the pointed type and also of the ring type (sometimes known as "hog rings"), and to an actuator for such a tool which can be operated by a rotary motor.

Tools for setting hog rings are known which operate to clamp the ring around a plurality of objects by first gathering the objects together, picking up the ring from a stack of rings, pushing the ring to straddle the objects, and then bending the arms of the ring around the objects, the jaws carrying out all of these operations. Such a tool is shown in applicant's co-pending patent application Serial No. 861,592, filed December 23, 1959, entitled "Hog Ring Clinching Tool," now abandoned. This tool is very satisfactory for a wide range of applications, but it does have one shortcoming for some applications. That shortcoming is that there is no means for opening up a hole for the ring, other than by the impulse given to the jaws as they perform the other operations. Thus the ring acts as a nail, forcing material aside in order for it to straddle an object. In most hog ring tools, the clinching of the ring begins as soon as a threshold value of resistance to ring insertion is reached. Normally this threshold value occurs when the jaws strike a stop, but other resistances, such as resistance to the jaws entering the material, also cause the jaws to close. Thus many hog ring tools are limited in their usefulness to applications wherein there is no resistance to entry of the ring into its place of application, because the ring will be prematurely clinched as a consequence of the resistance to its entry into the material.

It is an object of this invention to provide a hog ring clinching tool which permits the clinching jaws to be pressed into the work by the operator, and which then shoves the open ring into the jaws, whereupon the jaws clinch the ring. Thus the tool is rendered universal in its application. It can be used in normal applications the same as other tools, wherein the ring does not have to displace material when it is being set, and it can also be used where material has to be displaced to accommodate the ring.

An optional object of the invention is to provide a tool wherein the tool itself may provide an impulse to the jaws to aid in displacing material where the ring is to be installed. This supplements the strength of the operator in difficult applications and makes it easier for the operator to use the tool all day long.

Still another optional object is to provide a tool which can be modified for use as a stapler.

Still another object of the invention is to provide the tool with a power source operated by a rotary motor, such as an electric, hydraulic, or air motor. The electric motor is preferred because it frees the tool from dependence on a source of compressed fluid. Most hog ring tools are powered either manually or by fluid pressure operating a piston-cylinder motor. The manual actuation is tiring for the operator, and the latter ties the device to a compressor of some sort which is an additional expense. Because electricity is available at nearly every building site or factory, an electrically powered tool is more convenient and cuts down the cost of equipment needed to do the job. However, a rotary fluid motor could be used in this device, if desired.

This invention is carried out in combination with a magazine from which staples are to be detached, one by

one, and driven. The device is provided with a pair of pivotable jaws and a toggle linkage to cause them to pivot. The toggle linkage itself is engageable by a pusher assembly.

The stroke of the pusher assembly is greater than that of the toggle assembly, and there is a spacing wherein they do not engage each other at the first portion of the operation of the machine. The pusher assembly is operated by power means to which the frame of the device is attached. Within the device, there is a ring adjuster plate provided with a channel having teeth on one side thereof for a portion of its length. Abutting and slidedly engaged to the ring adjuster plate, is a stationary plate having a channel with gear teeth on opposite sides thereof. One set of teeth on the stationary plate concurrently engages a pusher gear that is mounted to the pusher assembly and the teeth on the ring cutter plate, so that the ring adjuster plate is caused to move to force a ring between the jaws during a portion of the movement of the pusher assembly. During this time the toggle assembly is not actuated by the pusher assembly.

After the ring is inserted into the jaws, the pusher gear disengages from the first set of teeth on the stationary plate and transfers to engage in the other set of teeth in that plate, as well as with the teeth in the ring adjuster plate, thereby holding the ring adjuster plate immobile. At this time also, the pusher assembly actuates the toggle mechanism and causes the jaws to close.

According to an optional feature of this invention, the jaws are mounted to a jaw plate, which itself is shiftable by the ring adjuster plate for a portion of its movement, thereby giving an impulse to the jaws as well as to the ring.

According to still another preferred but optional embodiment of the invention, an electrical means is provided for actuating the pusher assembly, and a control means is supplied therefor, this electrical means including a differential screw operated by a motor means and incorporating an overriding, floating nut for the purpose of actuating the switches to reverse the direction of movement of the screw when it reaches its limits.

The above and other features of this invention will be fully understood from the following detailed description and the accompanying drawings, in which:

FIG. 1 is a side elevation, partly in cutway cross-section, of the presently-preferred embodiment of the invention;

FIG. 2 is a plan view of the preferred embodiment of ring for use with the tool of FIG. 1;

FIG. 3 is a plan view of a portion of FIG. 1;

FIG. 4 is a cross-section taken at line **4—4** of FIG. 1;

FIGS. 5–7 are plan views of portions of FIG. 1;

FIG. 8 is a magnified view which shows portions of the device of FIG. 1 at one stage of its operation;

FIG. 9 shows an alternate embodiment of hog ring useful with this invention;

FIG. 10 shows a modification of the structure of FIG. 1 to use the ring of FIG. 9;

FIG. 11 shows an alternate embodiment for a portion of FIG. 1;

FIG. 12 is a cross-section taken at line **12—12** of FIG. 11;

FIGS. 13 and 14 show still other ring embodiments for use with the invention;

FIGS. 15–18 show the switch action for a control for the device of FIG. 1; and

FIGS. 19 and 20 are side and top views of another jaw embodiment.

FIG. 1 shows a tool **20** according to the invention. The tool is provided with a hollow handle **21** for a handle grip with a switch button **22** projecting therefrom. A spring **23** loads the button outwardly from the handle.

The button has a cavity 24 to receive the toggle 25 of a starter switch 26 which forms part of a circuit yet to be described. A reversible electric motor 27 is mounted in a case 28, and thus to a frame 29 which forms an extension of the handle. A bearing plate 30 fits in an opening 31 in the rear of the frame, and has a bore 32 to act as a bearing for a driven gear 33. A ball bearing 34 is fitted in the bearing plate, which journals motor shaft 35 which has a spur gear 36 inside the case to engage with and drive driven gear 33.

At the opposite end of the housing from the motor, there is an opening 37 through which projects a fixed nut 38 that is non-rotatively mounted to the frame. This fixed nut is held to the housing and restrained against rotation by a set screw 39 threaded through the frame and into the fixed nut. The fixed nut serves as means for attachment of the setting mechanism which will next be described. The actuating mechanism within the housing will be described later, together with the electrical circuits for connecting it.

A spacer nut 50 is threaded onto the fixed nut 38 on the other side of the housing, and spaces flange 51 forming a portion of a frame 52 of the hog ring clinching means 53 from the housing. Exterior threads of fixed nut 38 thread into threads 54 on a flange on the upper frame plate 63 of the frame.

An actuating screw 55 projects from the actuating means and is threadedly attached to a pusher assembly 56, particularly into a pusher block 57 which forms a portion of that assembly. The pusher block has a hole 58 that receives a post 59 integral with a bearing 60. The bearing projects downwardly and has a head 61 on its lower end. A pusher gear 62 is journaled to the bearing. The gear slides along the upper surface of the bottom portion of frame 52, and along the under surface of upper frame plate 63. Upper frame plate 63 has a longitudinal slot 64 therein in which bearing 60 moves back and forth.

A toggle joint 67 has a fork 68 with a projection 69 having a slot 70 therein within which the bearing moves. A pair of toggle plates 71, 72 are joined to the fork by pin 73. Toggle arms 71, 72 connect respectively with jaw levers 74, 75 (FIG. 3) which are pivotally mounted to the frame, and are disposed at a distance from the fulcrums 76, 77 for those levers.

The levers have pointed jaws 78, 79, respectively, thereon, and within the jaws there are guide channels 80, 81, respectively, to receive the rings which are to be set by the device.

Just beneath the upper frame plate 63, there is a ring adjuster plate 82 (FIG. 5) which moves the ring into the guide channels 80, 81. Ring adjuster plate 82 is sometimes called a ring cutter plate. This plate has a channel 83 with teeth 84 facing into the channel at the lower right-hand portion thereof. It has a projecting ring cutter portion 85 to detach a ring from a stack, and stop shoulders 86, 87 on each side thereof.

Lying immediately beneath the ring adjuster plate 82 and atop frame member 52, there is a stationary plate 90 (FIG. 6). This plate has a channel 91 and two sets of teeth 92, 93. Teeth 92 are on the lower side of the channel, as shown in FIG. 6, and teeth 93 are on the opposite side. These sets of teeth are not axially aligned, and leave room for transfer of the pusher gear from one set to the other.

A magazine 100 holds a stack 101 of open rings. A ring cutter 102 may be used to assist in cutting rings which are more strongly connected together. A spring retainer 103 has a hook end 104 that is removably sprung into a hole 105 in the wall of the magazine. A spring 106 biases a plate 107 against the bottom end of the stack to press the stack upward against the bottom side of upper frame member 63. Plate 107 receives the upper end of spring retainer 103, to guide it and hold the assembly together.

Ring cutter 102 has an edge 111 which restrains the next to the top of the rings so that the ring adjuster plate can shear off the top ring of the stack.

Beneath the jaws and integral with the frame is a pair of tines 112, 113 (FIG. 4) which form the bottom of a channel for the rings and serve to bunch the objects to be ringed as well as to confine the ring from below while it is being closed.

FIGS. 19 and 20 show one jaw 114 of a pair of jaws (the other being the mirror image of the illustrated jaw) which can be substituted for jaws 78 and 79. When these are used, tines 112 and 113 can be eliminated, because these jaws carry their own channel 115 with top, side and bottom, 116, 117, 118, respectively. A point 119 on the jaw enables it to be forced into material. The difference between these jaws and the jaws in the other embodiments is only in the free end. The remainder of the jaw is identical, so that these jaws may be substituted in all embodiments merely by mounting them as the others were mounted, and eliminating the tines.

FIGS. 11 and 12 show an alternate embodiment of clinching means 120 wherein the motive power for the tool can be utilized to force the jaws, and thus the ring, into the work. In this device there will be recognized the protruding actuating screw 55. A pusher assembly 121 is threadedly mounted to screw 55. A pusher block 122 has a threaded bore 123 to thread onto the end of the actuating screw, and the bottom has an opening 124 to mount a bearing 125. The bearing extends down and journals a pusher gear 62. The pusher gear extends between the bottom of the pusher block and the upper face of a lower frame plate 127. Attached to and lying flush with the lower frame plate is stationary plate 90. Atop plate 90 is ring adjuster plate 82. As can best be seen in FIG. 12, the lower frame plate 127 has a pair of flanges 130 which crimp over the top of the two plates, and also over a jaw plate 131 which fits atop the ring adjuster plate at the left-hand end in FIG. 11. This jaw plate has a lug 132 which projects into the channel of both plates, and has a slot 133 therein which is of greater length than the diameter of a pin 134. The pin has a head in slot 133 and is affixed to the structure of ring adjuster plate 82 so as to slide therein.

Jaw levers 74, 75 are mounted on the jaw plate 131, and are connected to fork 137 by toggle links 71. The fork has an arm 138 which is engaged in socket 141. The arm has a head 142 in bore 123 in the pusher assembly. The clearance between the end of bore 123 and the end of the actuating screw is greater than the thickness of the head so that a certain amount of play is possible therein.

Fixed plate 90 may have a special shape 94 to assure that only specific types of staples or rings can pass from magazine 150 which is fixed to lower frame plate 127. It can also include guide 152 controlling the path of staples or rings upwardly in the magazine. Guide 152 may, for example, constitute a core which fits within the inside of a stack of staples or rings to guide them in their upward path. The fasteners are guided in the opening 151 between the core and the back of the magazine. Lower frame plate 127 may have tines 112, 113 fixed thereto.

To adapt the devices of FIGS. 1 or 11 for a stapler, the tines 112 and 113 are removed.

In both illustrated embodiments, the pusher gear has had a uniform diameter contacting both plates. It is to be understood that the gear may have different tooth counts or different diameters or both for each of the plates, if desired, so as to change the ratio of rate of movement of the ring adjuster plate and pusher gear. Thus greater speed or power can be provided.

The construction of actuating means 250 suitable for providing axial reciprocatory power to a clinching or stapling means is shown in FIG. 1. The driven gear has integral with it a cup extension 251 which has within

it an opening 252 with axial splines 253 therein. At the base of the cup there is an annular groove 254.

A driving cylinder 255 has its annular end in groove 254 so that it can spin free thereof. Driving cylinder 255 has a hexagonal passage 256 therein which is axially prismatic. The driving cylinder has a raised section 257 which provides a pair of shouldlers 258, 259. This section between shoulders 258 and 259 carries threads 260. These threads have a very steep pitch, about 45°.

To threads 260, there is threadedly engaged a driving nut 261. Relative rotation between the driving nut and the driving cylinder will cause the driving nut to move axially relative to the driving cylinder.

The driving nut 261 has splines 262 on its exterior surface which engage with the splines in opening 252 so that rotation of driven gear 233 turns the driving nut.

Three slots 263 are formed in the driving cylinder between shoulders 258 and 259, and these pass a U-shaped retainer 264. There will preferably be three of these retainers spaced 120° apart. A spring 265 is held between one end of the retainer, and a washer 266, which washer is axially movable along the driving cylinder, but which is restrained in one direction by shoulder 258. A smiliar washer 267 is against shoulder 259 and is held against it by the other end of the U-shaped retainer.

Within hexagonal passage 256 there is a driving screw 268 which has a hexagonal head 269 so that it is driven by the driving cylinder. This driving screw has an exterior thread 270 which engages with interior threads 271 in the fixed nut 38 so that rotation of the driving cylinder will cause the driving screw to shift axially. A central threaded passage 272 is formed through the driving screw which has interior threads 273. These threads are of the opposite hand from exterior threads 270, and actuating screw 55 threads into threads 273. Because screw 55 is held against rotation by pusher means 56, this assembly is a differential screw such that screw 55 is moved out at a faster rate than the driving screw.

A switch 200 has an actuating sleeve 274 with a slot 275 therein. A projection 275*a* from the sleeve has a groove wherein the flanged rim 275*b* of the driving nut 261 can rotate. The sleeve is moved to the left so as to actuate switch toggle 276 when the driving nut is moved completely to the left, and moved to the right to actuate the switch toggle when the driving nut is moved completely to the right.

The operation of the actuating means should be evident from the drawings. When the motor is rotated by virtue of pressing the starter button 22, this would rotate the driving nut 61 clockwise if viewed from the motor toward the clinching means, the exterior thread 260 on the driving nut 261 spiralling clockwise and away from the point of view. The retainer 260 which has its right-hand end held against washer 267 causes the spring 265 to hold washer 266 against the driving nut, and this force is enough to keep the driving nut from axially moving along threads 260 at least so long as the driving cylinder 255 can turn relatively freely. Therefore, the driving nut 261 drives the driving cylinder 255 which in turn turns the driving screw 268 which moves in the threads of the fixed nut 38, thereby contributing one component of motion to the actuating screw, and its own rotation combined with the restraint against rotation of the actuating screw 55 causing an additional component of motion due to the opposite hands of the threads on the actuating screw. This type of motion continues until the jaws are closed, at which time there is firm resistance to any further motion of the pusher assembly. Then further rotation of gear 33 will, because the driving cylinder can no longer turn, overcome the resistance of spring 265, causing the driving nut 261 to move axially relative to the driving cylinder, and contact the actuating sleeve 274 of switch 200. This will change the switching condition in the manner to be disclosed below, to permit reverse movement. When the starter button is released, the motor will reverse its direction, and the driving nut 261 will tend to be centered again, and also the actuating screw will be returned to the right in FIG. 1. The driving nut's rim flange will now move the switch actuating sleeve to reverse the switch toggle, thus reversing the switch to stop the motor.

The operation of the clinching mechanism of FIG. 1 will now be described apart from the operation of the actuating means, it being understood that movement of the actuating screw to the left in FIG. 1 will cause screw 55 to move to actuate whatever device is connected to it.

Upon pressing starter button 22 in FIG. 1, the actuating means is started in operation and the pusher assembly begins to move to the left. Starting at the right-hand-most position of pusher gear 62 as shown in FIG. 1, the gear is meshed with teeth 93 on the stationary plate, and also with teeth 84 on the ring adjuster plate. Moving the pusher assembly to the left will cause the gear to move the ring adjuster plate at a rate twice as fast as the pusher assembly moves, which will dislodge the topmost ring from the stack and push it into the guide channels.

When the pusher gear reaches the position shown in solid line in FIG. 8, it is nearing the end of its travel along teeth 93. Tooth 160 will continue to be engaged with tooth 161 until the pusher gear about reaches the position shown in dotted line, at which time the pusher gear will become disengaged from threads 93, but will continue to be engaged with threads 84, and will then come into engagement with threads 92. This locks the ring cutter plate into position and the pusher gear reverses its direction of rotation. It now rolls along threads 84 and 92, keeping the plates locked together. At this time, the pusher block will make engagement with the fork of the toggle linkage, and this will cause the toggle arms to spread apart, forcing the pointed ends of the jaws together and clinching the ring.

When the end of the stroke is reached, the actuating means will be reversed, at which time the pusher gear will roll back along threads 84 and 92. In this movement, it strikes the right-hand end of slot 70, and further movement retracts the toggle linkage. At about the same time, the pusher gear will transfer from teeth 92 to teeth 93, unlocking the ring adjuster plate and retracting it, thereby opening the top of the magazine for admission of the next ring to be set.

Note that in the clinching device just described, the jaws can be forced into the material, and there will be no tendency for them to close, because with the pusher gear retracted all the way, they cannot close. After the jaws are positioned, the ring in injected into them, and then they are closed.

For installations where it is desired to have some impulse given to the jaws to help get them into the material, the device of FIG. 11 can be used. In this device, the pusher gear functions in substantially the same manner in first actuating the ring cutter plate to inject a ring into the jaws, and then locking the ring cutter plate and the stationary plate together for the remainder of the reaction. The difference between the devices of FIGS. 1 and 11 is that in the device of FIG. 11, the jaws are mounted on a jaw plate which itself is moved a short distance before the jaws clinch the ring. This can be seen from FIG. 11, starting at the position shown, which is that of repose, the topmost of the staples being in the guide channels beneath the upper surface of the jaws, and then the actuating screw will be moved to the left. Initially, there is no movement of the toggle linkage because of the clearance between the headed pin 142 and the actuating screw. No push is given to the linkage. During this interval, the only effect of actuation of screw 55 is to start the ring cutter plate, moving the ring into the guide channel. Shortly thereafter, the pusher assembly will make contact with some portion of yoke 141, at which time there will be an impulse to move the toggle linkage. However, at just about this time, the pin 134 will engage

the left-hand end of slot 133 and will move the jaw plate along with it, so that there will be no clinching movement of the jaws as yet.

Finally, however, lug 132 reaches the end of the end of the slot in the ring cutter plate, thereupon striking the ring adjuster plate 82 which is held stationary now by the engagement between the stationary plate and the ring adjuster plate, made by the pusher gear so that no further axial movement of the jaw plate can occur. Thereafter, further movement of the pusher assembly clinches the jaws together. The reverse of these reactions will occur when the actuating screw is reversed.

This particular tool is able to utilize staples having particularly useful properties. For example, in FIG. 2 there is shown the presently-preferred embodiment of a ring for use with this device. Ring 170 has a bight 171, two arms 172, 173, one attached at each end of the bight, a pair of inwardly directed arms 174, 175 at the ends of arms 172 and 173, respectively, and sloping curved arms 176, 177 on the end of arms 174 and 175, respectively. The bight is convex into the region between the arms. It is intended that in the unset condition, arms 176 and 177 point rather generally in the direction of movement of the ring which will allow them a slight snapping action over devices which they are to straddle, if necessary. Furthermore, when the rings are brought together, their inner surfaces 178, 179 will tend to guide and compress material contained therein toward the inside of the ring. When the ring is closed, this bight will tend to straighten out and will give a more nearly rectangularly set ring than will that of ring 170. The magazine shown in FIGS. 1 and 7 is keyed to receive only the ring of FIG. 2 so that there can be no confusion in the rings which are to be utilized. While this key conveniently extends the full length of the magazine, it can be much shorter, so long as it in some manner impedes improperly shaped staples from reaching the upper end of the magazine.

FIG. 9 shows a variation wherein a ring 180 has a straight bight 181, the other arms being substantially the same as those of ring 170. FIG. 10 shows magazine 100 without a key, which will admit the ring of FIG. 9.

FIGS. 13 and 14 show a ring 185 with curved bight 186, two arms 187, 188, and curved end arms 189, 190. Arms 187 and 188 have detents 191, 192, respectively, for more effectively grasping objects, such as objects 193, 194.

The control circuit for operating the device and operation of the electrical actuating of FIG. 1 will now be described with particular relation to FIGS. 15–19. Switch 200 is a snap-acting, two-pole switch having a pair of blades 201, 202. Blade 201 has a common terminal 203 and switch contacts 204, 205. Blade 202 has a common terminal 206 and only one active switch contact 207. Motor 27 has commutator terminals 208, 209. The motor will be grounded in accordance with safety standards found in most codes. Motor 27 also has field terminals 208*a*, 209*a*.

It will be recognized that the motor will be run in opposite directions depending on which of its two terminals has the positive current. Switch 26 has two blades 210, 211. Blade 210 has a common terminal 212 and two switch contacts 213, 214. Blade 211 has a common terminal 215 and only one active switch contact, that is, contact 214, which it shares with blade 210. Switch 200 is snap-acting, depending on the position of driving nut 261, and the starter switch is also snap-acting, depending on the position of the switch button.

FIG. 15 shows the circuit in its repose (non-operating) condition with the starter switch released, and switch 200 at the position illustrated, that is, that which it assumes when the jaws are opened. Switch contact 213 is connected by a lead 216 to common terminal 206. Common terminal 203 is connected by lead 217 to field terminal 208*a*. Common terminal 215 is connected by lead 218 to switch contact 205. Switch contact 204 is connected by lead 219 to commutator terminal 208 of the motor, and switch contact 214 is connected by lead 220 to commutator terminal 209 of the motor. Common terminal 212 is connected to one pole of a current source 212*a*. Lead 212*b* connects the other pole to field terminal 209*a*.

In the position shown in FIG. 15, current applied to the common terminal 212 is conducted to common terminal 206 of switch 200, but this switch is open, and therefore all power is off.

In FIG. 16, starter switch 26 has been switched over so that switch blade 210 connects common terminal 212 and switch terminal 214 to pass current through lead 220 to commutator terminal 209, and thence through lead 219, to switch contact 204, thence to common terminal 203, and thence through lead 217 to field terminal 208*a*, and thence from field terminal 209*a* back to current source 212*a*. This will operate the actuating screw to the left in FIG. 1. When the device has finally been set, switch 200 will reverse, as shown in FIG. 17, to stop the motor, even with the trigger closed. When the trigger is held closed, current is stopped at switch contact 204 and the motor is shut off.

To reverse the actuating screw and retract the jaws, the start button is released as shown in FIG. 18. Then current from common terminal 212 passes to lead 216, thence through common terminal 206 to switch terminal 207, and thence to commutator terminal 208 of the motor, through lead 220, switch terminal 214, common terminal 215, lead 218, through switch contact 205, common terminal 203, and lead 217 to field terminal 208*a*, and thence back to the current source, thereby reversing the motor. When the device is completely retracted, switch 200 switches over, and the circuit is returned to the repose condition of FIG. 15, and is ready for the next actuation.

The purpose of the curved end arms on the various rings is to cam the arms around objects to be joined. This makes a more effective ring, which is able to gather in material from a region much greater than a simple straight ring. The purpose of the curved bight in the rings of FIGS. 2 and 13 is to clinch and make tight the clamped objects. Thus, when various thicknesses of clamped objects are encountered by rings of the same dimensions, the bight can, for wider bunches, expand the ring by straightening out. Thus, a single ring can accommodate bunches of widely varying dimensions, and keep them all tightly joined.

This invention thereby provides an easily actuable means suitable for use where hog rings need to be applied with some effort by the operator. The jaws may either be forced into the material prior to clinching of the ring, or may even be given an assist by the device itself. A simple electrical device for actuating the tool is shown (which is also useful for nail-type stapling) along with an automatic control which requires no more than the operation of a trigger switch for its complete management. It is to be understood that the electrical source is particularly suitable for powering a device of this type, but that it is not to be limited to electrical sources, it also being possible to substitute fluid pressure sources and even manual linkages, if desired.

This invention is not to be limited by the embodiments shown in the drawings and described in the description which are given by way of example and not of limitation, but only in accordance with the scope of the appended claims.

I claim:

1. A mechanism for clinching a ring comprising: a frame adapted to be attached to a reciprocable actuating means having an axis of movement; a stationary plate fixed to the frame and having an axially extending channel; a set of gear teeth on each side of the channel, the sets of teeth being axially spaced from each other; an axially reciprocable ring adjuster plate lying against said stationary plate and having an axially extending channel;

gear teeth along one side of and facing into the channel; a rotatable pusher gear axially movable in said channels and engaging teeth on both of said plates; pusher means engageable with the actuating means for axially moving the pusher gear; a pair of jaws hingedly mounted to the frame, said jaws including guide channels for receiving rings to be clinched; arms on said jaws; toggle linkages connected to said arms; an axially reciprocable fork to which said toggle linkages are connected; an arm projecting from said fork, said arm having an axial slot therein and receiving a portion of said pusher means; and a magazine beneath the frame between the stationary plate and the jaws for introducing rings between the ring adjuster plate and the guide channels, whereby initial movement of the pusher gear engages one set of teeth of the stationary plate and teeth of the ring adjuster plate to move the ring adjuster plate to place a ring into the guide channels, the pusher gear then transferring to the other set of teeth on the stationary plate to lock it with the ring adjuster plate, further movement of the pusher means moving the fork to cause the toggle linkage to close the jaws on the ring.

2. A mechanism for clinching a ring comprising: a frame adapted to be attached to a reciprocable actuating means having an axis of movement; a stationary plate fixed to the frame and having an axially extending channel; a set of gear teeth on each side of the channel, the sets of teeth being axially spaced from each other; an axially reciprocable ring adjuster plate lying against said stationary plate and having an axially extending channel; gear teeth along one side of, and facing into the channel; a rotatable pusher gear axially movable in said channels and engaging teeth on both of said plates; pusher means engageable with the actuating means for axially moving the pusher gear; an axially reciprocable jaw plate overlying the stationary plate and ring adjuster plate, said jaw plate having an axially extending slot therein; a pin in said ring adjuster plate movable in said slot; a pair of jaws hingedly mounted to the jaw plate, said jaws including guide channels for receiving rings to be clinched; arms on said jaws; toggle linkages connected to said arms; an axially reciprocable fork to which said toggle linkages are connected; an arm projecting from said fork and connecting to said pusher means; and a magazine beneath the frame between the stationary plate and the jaws for introducing rings between the ring adjuster plate and the guide channels, whereby initial movement of the pusher gear engages one set of the teeth of the stationary plate and teeth of the ring adjuster plate to move the ring adjuster plate to place a ring in the guide channels, whereupon the pin engages one end of the slot in the jaw plate and moves the jaw plate axially, the pusher gear thereafter transferring to the other set of teeth on the stationary plate to lock it with the ring adjuster plate, further movement of the pusher means moving the fork to cause the toggle linkage to close the jaws on the ring.

3. A mechanism for driving a staple comprising: a frame adapted to be attached to a reciprocable actuating means having an axis of movement; a stationary plate fixed to the frame and having an axially extending channel; gear teeth along one side of and facing into the channel; an axially reciprocal adjuster plate lying against said stationary plate and having an axially extending channel; gear teeth on the opposite side of the channel from those on the stationary plate; a rotatable pusher gear axially movable in said channels and engaging teeth on both of said plates; pusher means engageable with the actuating means for axially moving the pusher gear; and a magazine beneath the frame for introducing staples between the adjuster plate and the guide channels, whereby movement of the pusher gear engages the teeth of the stationary plate and adjuster plate to move the adjuster plate to drive the staple.

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