United States Patent

[11] 3,586,231

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[54] **STAPLING MACHINE**
13 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **227/111,** 227/120, 227/132
[51] **Int. Cl.** **B25c 5/06**
[50] **Field of Search** 227/5, 6, 7, 107, 110, 111, 120, 129, 132; 29/429, 432; 227/156, 82, 83

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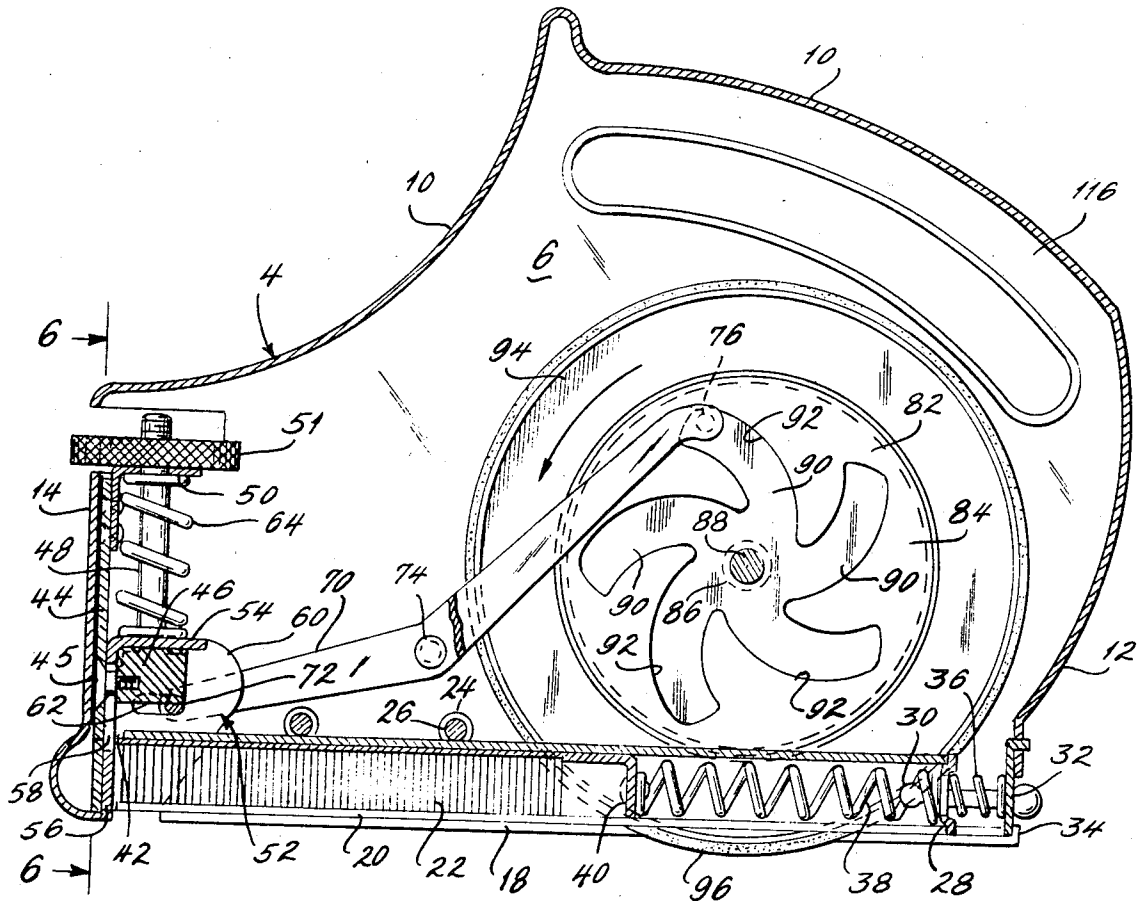
ABSTRACT: A stapling machine includes a housing having a drive wheel journaled therein, and a portion of the drive wheel projects beyond the housing and engages the surface across which the machine is advanced. As the machine advances across the surface the drive wheel rotates and drives a trip wheel having camming surfaces which move an operating lever. The operating lever cocks a hammer against the bias of a drive spring so that when the trip wheel releases the lever staples are driven from a magazine located in the path of the hammer through the housing. Thus, staples are driven automatically at spaced intervals as the stapling machine is advanced across the surface. The trip wheel may also be rotated independently by an operating handle so that staples can be inserted individually at selected locations.



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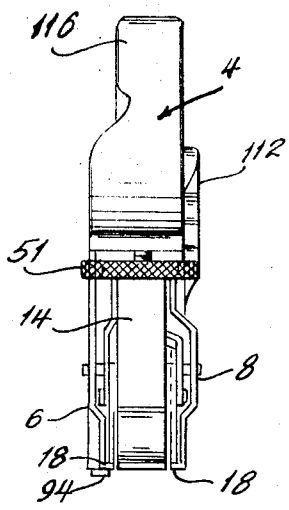

FIG. 2

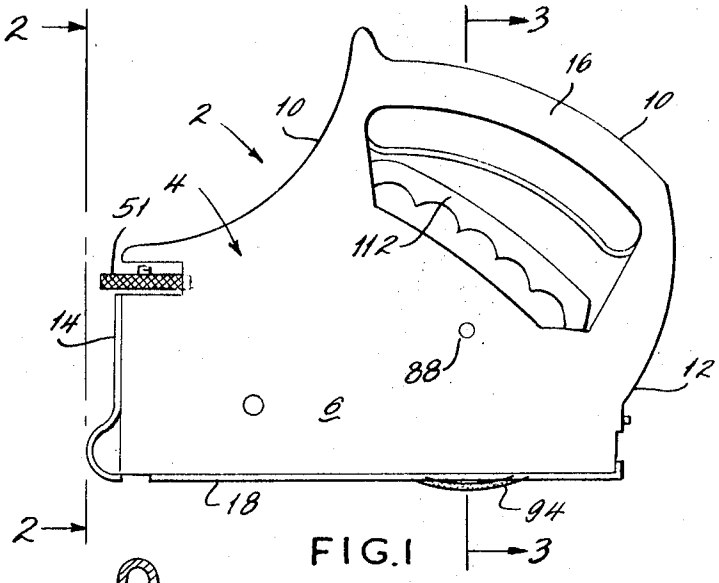

FIG. 1

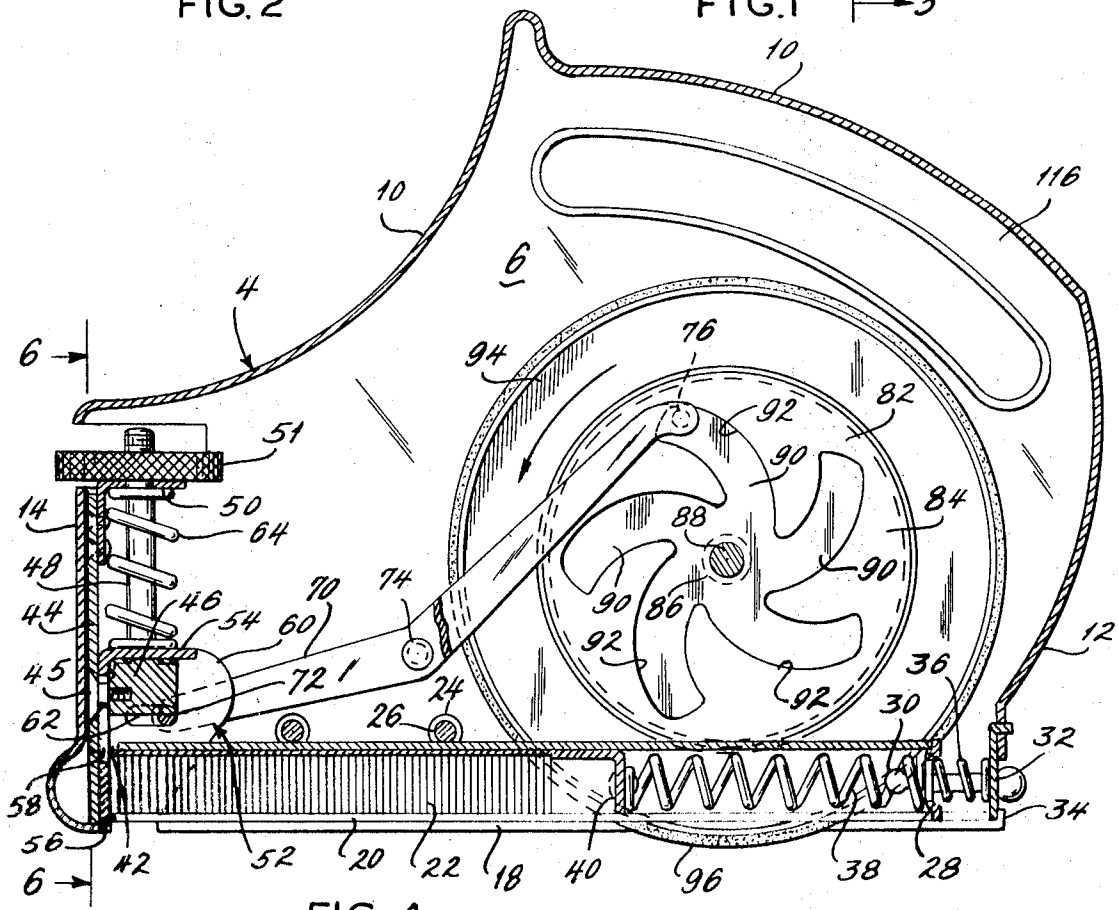

FIG. 4

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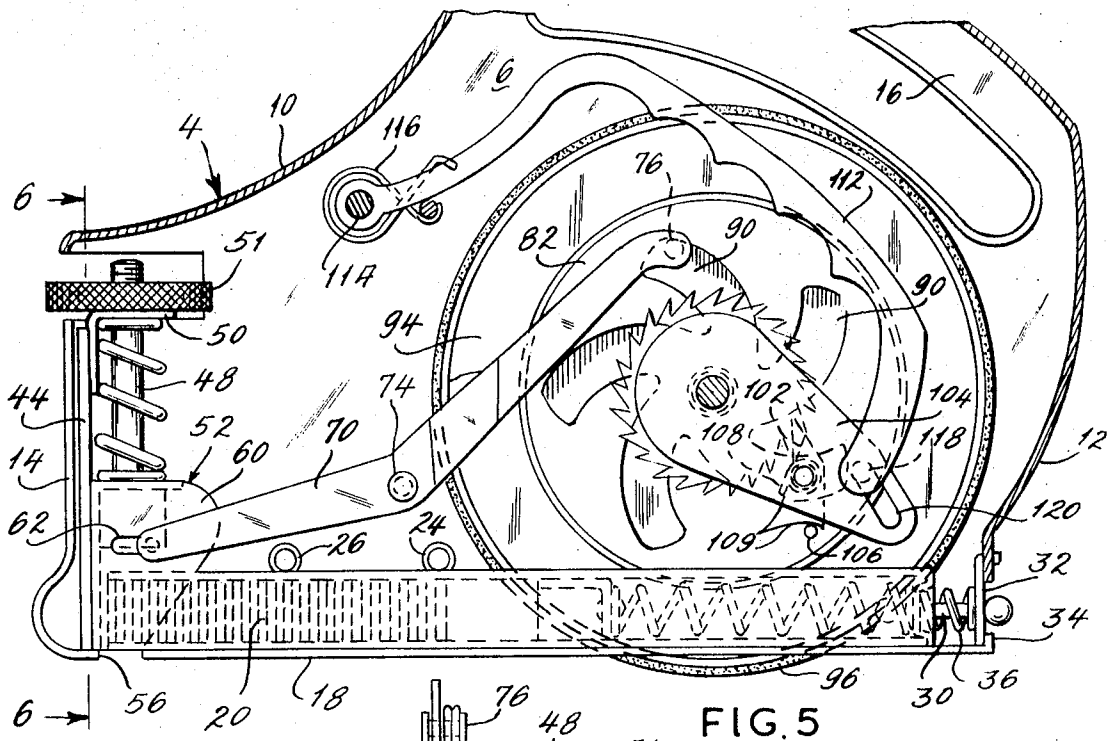

FIG. 5

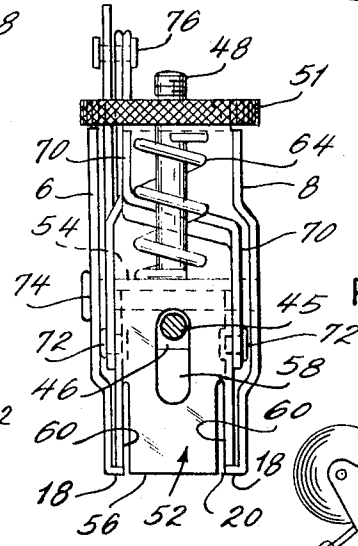

FIG. 6

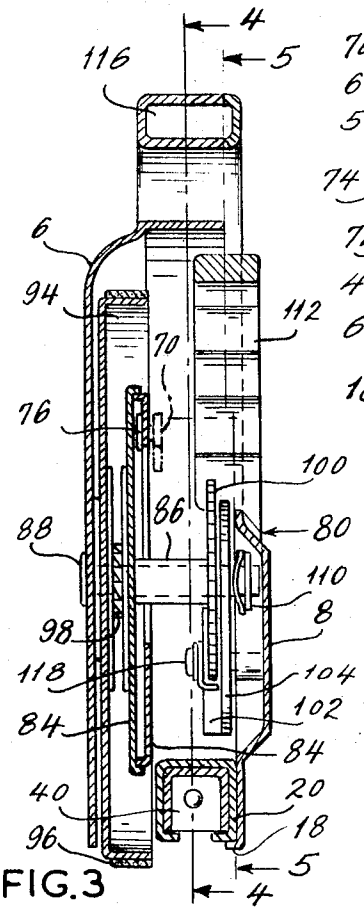

FIG. 3

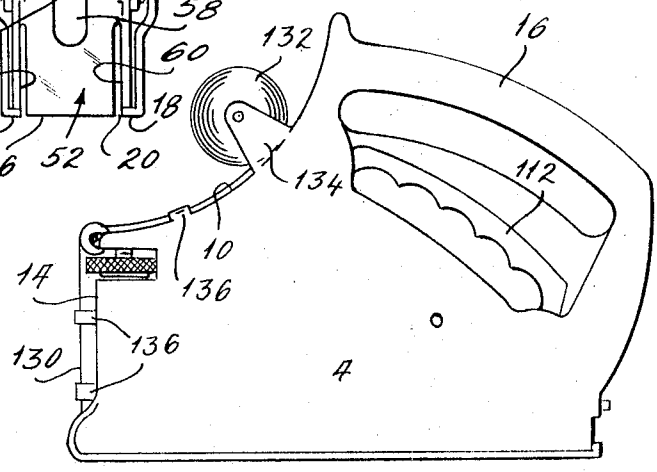

FIG. 7

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STAPLING MACHINE

BACKGROUND OF THE INVENTION

This invention relates in general to stapling machines and more particularly to a stapling machine which automatically ejects staples as it is advanced along a surface.

Generally speaking, conventional stapling machines are actuated by a handle which is either squeezed or pushed, and with each actuation of the handle a single staple is ejected. While conventional stapling machines are ideally suited for stapling operations which require one or two staples, they are not suited for stapling operations which require a succession of staples located at equally spaced intervals. For example, it is often desirable to secure sheet material to a supporting structure such as a wall, floor or roof by means of staples, but when the stapling machine must be actuated manually at each point along the sheet material where a staple is desired, the stapling operation becomes tiresome and time consuming. Thus, conventional stapling machines are not entirely acceptable for securing roofing, siding, insulation, carpets, and other forms of sheet or roll material to a supporting structure which will accept and retain such staples.

SUMMARY OF THE INVENTION

One of the principal objects of the present invention is to provide a stapling machine which automatically ejects staples as it is advanced along a path selected by the operator. Another object is to provide a stapling machine which requires no outside power source. A further object is to provide a stapling machine which operates rapidly and requires little effort to operate it. An additional object is to provide a stapling machine which operates either automatically or by actuating an operating handle. Still another object is to provide a stapling machine which is extremely versatile, light in weight, and easy to operate. These and other objects and advantages will become apparent hereinafter.

The present invention is embodied in a stapling machine including drive means for driving staples and actuating means for operating the drive means as the stapling machine is advanced along a surface. The actuating means engages the surface and derives the power necessary to operate the drive means from the advancement along the surface. The invention also consists in the parts and in the arrangements and combinations of parts hereinafter described and claimed.

DESCRIPTION OF THE DRAWINGS

In the accompanying drawings which form part of the specification and wherein like numerals refer to like parts wherever they occur:

FIG. 1 is a side elevational view of a stapling machine constructed in accordance with and embodying the present invention;

FIG. 2 is an end elevational view of the stapling machine taken along line 2–2 of FIG. 1;

FIG. 3 is a sectional view taken along line 3–3 of FIG. 1;

FIG. 4 and FIG. 5 are sectional views taken along lines 4–4 and 5–5, respectively, of FIG. 3;

FIG. 6 is a sectional view taken along line 6–6 of FIG. 5; and

FIG. 7 is a side elevational view of the stapling machine provided with a tape dispensing assembly.

DETAILED DESCRIPTION

Referring now to the drawings, 2 designates a stapling machine including a housing 4 comprised of a pair of spaced sidewalls 6 and 8 connected along their contoured upper and rear margins by relatively narrow upper and rear walls 10 and 12, respectively, and at their front margins by a generally planar front wall 14. Near the upper wall 10 the sidewalls 6 and 8 are provided with elongated cutouts sized to receive the fingers of an operator's hand so that the portion of the housing above the cutouts serves as a gripping handle 16.

At their lower margins the sidewalls 6 and 8 turn inwardly in the provision of opposed flanges 18, and resting on the flange 18 at the bottom of the sidewall 8 is a staple magazine 20 (FIGS. 3—5) which is sized to receive a strip of conventional staples 22. The magazine 20 is retained in place not only by the flange 18 on the sidewall 8, but also by a pair of rollers 24 which are journaled in the housing 4 between the sidewalls 6 and 8 thereof and are provided with shoulders 26 for preventing lateral movement of the magazine 20. Neither the flanges 18 nor the rollers 24 impede longitudinal movement of the magazine 20, and consequently it can be shifted to and fro between the front and rear walls 12 and 14.

At its rear end the magazine 20 receives an end cap 28 (FIG. 4) through which a locking pin 30 extends, and the locking pin 30 also passes through a cover plate 32 which when urged rearwardly engages and is positioned against the rear wall 12 as well as against abutment tabs 34 on the rear ends of the flanges 18. The end cap 28 is urged forwardly by means of a recoil spring 36 encircling the locking pin 30 between the cap 28 and the cover plate 32. The magazine 20, being in engagement with the end cap 28, is likewise urged forwardly in the housing 4. On the side of the end cap 28 opposite the recoil spring 36, a staple feed spring 38 is disposed within the magazine 20, and it terminates at a plunger 40 which bears against the rearmost staple 22 in the strip. Accordingly, the strip of staples 22 is biased forwardly within the magazine 20 as well as within the housing 4. The plunger 40 may be removed from the magazine 20 by pushing the cover plate 32 inwardly and then canting it such that it can be withdrawn from the aperture it normally covers. As the cover plate 32 is withdrawn from the housing 4 the spring 38 and plunger 40 are withdrawn from the magazine 20. Accordingly, it is a simple procedure to load the magazine 20 with staples 22. At its forward end the top wall of the magazine 20 is provided with a transversely extending slot 42 (FIG. 4) which is located directly above the forwardmost staple 22 in the magazine 20.

The front end of the magazine 20 is permanently attached to a backing plate 44 (FIGS. 4 and 5) which extends upwardly against the inwardly presented surface of the front wall 14, on the housing 4, but is not attached thereto. Attached to the backing plate 44 by means of a shoulder bolt 45 is a hammer guide block 46 having a hammer guide pin 48 (FIGS. 4—6) projecting upwardly from it. The upper end of the pin 48 extends through a restraining tab 50 which is secured to the backing plate 44 by rivets. The upper end of the pin 48 is furthermore threaded to accommodate a knurled adjusting nut 51, while the rivets which secure the tab 50 are set in vertical slots so that the tab 50 is free to shift upwardly and downwardly with the adjusting nut 51 as that nut is turned. The shoulder on the bolt 45 positions the guide block 46 slightly inwardly from the backing plate 44 so as to form a hammer guideway between the plate 44 and the block 46, and that guideway aligns with the transversely extending slot 42 in the magazine 20.

The guide pin 48, the guide block 46, and the rear surface of the backing plate 44 guide a hammer 52 (FIGS. 4—6) including a head 54 which extends across the top of the block 46 and a drive blade 56 which fits within the guideway between the block 46 and the backing plate 44. The lower portion of the drive blade 56 is slightly narrower than its upper portion to enable the lower end of the blade 56 to fit through the transverse slot 42 in the magazine 20, while the upper portion of the blade 56 is provided with a vertical slot 58 (FIG. 6) through which the shoulder bolt 45 extends so that the hammer 52 can shift upwardly and downwardly against the plate 44. The hammer 52 further comprises a pair of sideplates 60 which extend rearwardly across the block 46 from the upper portion of the blade 56. The sideplates 60 are spaced apart a distance slightly greater than the width of the magazine 20 so that the magazine 20 will fit between the plates 60 when the hammer 52 is depressed to the position wherein its head 54 rests upon the guide block 46. The

sideplates 60 near their upper margins are, furthermore, provided with horizontal slots 62 for purposes presently more fully appearing. Finally, the hammer 52 is biased to and normally maintained in its depressed position by means of a drive spring 64 which encircles the guide pin 48 between the restraining tab 50 and head 54 of the hammer 52, and the force exerted on the hammer 52 by the drive spring 64 is dependent on the setting of the adjusting nut 51.

The hammer 52 is shifted upwardly against the bias of the spring 64 by a bifurcated actuating lever 70, the tines of which extend along the outer faces of the sideplates 60 and are provided with pins 72 which project through the horizontal slots 62 in those sideplates 60. The tines of the lever 70 are furthermore pinned to the housing 4 by a fixed pin 74 which extends between and is secured to the sidewalls 6 and 8. The pin 74 thus serves as a fulcrum point for the actuating lever 70. Rearwardly beyond the pin 74 the tines of the lever 70 merge into a single actuating arm which extends upwardly and rearwardly into the housing 4. At its opposite or rear end the lever 70 is provided with a cam follower 76 which is engaged by a tripping mechanism 80 for pivoting the lever 70 about its fixed pin or fulcrum 74 so as to raise the hammer 52 against the bias of the drive spring 64. The lever 70 and the tripping mechanism 80 constitute actuating means for operating the hammer 52.

The tripping mechanism 80 (FIGS. 3—5) includes a trip wheel 82 consisting of a pair of spaced discs 84 connected together at their outer peripheries (FIG. 3). The center portion of one of the discs 84 is connected to the end of a sleeve 86 which is journaled on a fixed spindle 88 extending transversely between the sidewalls 6 and 8, while the innermost portion of the outer disc 84 is free and is set away from the sleeve 86. The latter disc 84 has a plurality of circumferentially spaced cutouts 90 which emanate from the void at the free innermost portion of that disc 84 and generally radiate outwardly in slightly curved configuration (FIG. 4). Each cutout 90 is wide enough to receive the cam follower 76 on the operating lever 70, and, furthermore, is defined in part by a curved camming surface 92 which engages the follower 76 as the trip wheel 82 rotates in the direction of the arrow in FIG. 4 and cams that follower 76 toward the spindle 88. As the follower 76 moves toward the spindle 88, the front end of the lever 70, of course, rises and this in turn shifts the hammer 52 against the base of the drive spring 64.

The fixed spindle 88 also serves as a journal for a drive wheel 94 which is located to one side of the magazine 20 and between the trip wheel 82 and the sidewall 6 of the housing 4. The drive wheel 94 projects slightly beyond the opposed flanges 18 on the sidewalls 6 and 8, and indeed the flanges 18 on the sidewall 6 is cut away to accommodate it. At its outer periphery the drive wheel 94 is flanged and provided with a tire 96 formed from a friction inducing material such as rubber. The sleeve 86 and the drive wheel 94 are connected through a one way slip clutch 98 (FIG. 3) composed of engageable teeth on both the drive wheel 94 and the adjacent or outermost disc 84 of the trip wheel 82. The teeth are oriented such that the drive wheel 94 will rotate both the sleeve 86 and the trip wheel 82 when it is rotated in the direction indicated by the arrow in FIG. 4, but the sleeve 86 will not rotate the drive wheel 94 when rotated in the same direction.

AT its end opposite the slip clutch 98, the sleeve 86 is fitted with a ratchet wheel 100 (FIGS. 3 and 5) having teeth which are engaged by a pawl 102 mounted on an arm 104 which is also journaled on the fixed spindle 88. Movement of the arm 104 toward the magazine 20 is limited by a stop 106 (FIG. 5) mounted on the sidewall 8, and that stop 106 also holds the pawl 102 away from engagement with the teeth of the ratchet wheel 100 when the arm 104 is adjacent to the stop 106. In particular, the pawl 102 is pinned to the arm 104 for pivotal movement thereon and is spring biased toward the teeth of the wheel 100 by a spiral spring 108 which wraps around the pawl's mounting pin. At its lower end the pawl 102 is provided with a camming surface 109 which engages the stop 106 as the arm 104 is swung toward the magazine 20. The stop 106 pivots the pawl 102 away from the ratchet wheel 100 as the arm 104 settles into its rest position adjacent to the stop 106.

The arm 104 is biased toward the ratchet wheel 100 and likewise the sleeve 86 is biased toward the drive wheel 94 and by a Belleville or beveled spring 110 (FIG. 3) interposed between the sidewall 8 and the arm 104. Accordingly, the opposed teeth of the clip clutch 98 are maintained in engagement.

The arm 104 is lifted away from the stop 106 by an operating handle 112 (FIGS. 3 and 5), and this of course allows the pawl 102 to pivot into engagement with the teeth of the ratchet wheel 100. In particular, the handle 112 possesses an inverted U-shaped configuration, and at its forward end it is pivotally connected with the housing 4 by means of a pin 114 which is secured to the sidewall 8 generally above the fixed pin 74 on which the actuating lever 70 pivots. The pin 114 also carries a spiral spring 116 which biases the operating handle 112 toward the magazine 20. The mid or bight portion of the handle 114 is positioned generally beneath the gripping handle 16 on the housing 4, while the opposite or free end of the handle 114 carries a pin 118 which projects into a slot 120 formed in the arm 104. Thus, when the mid portion of the operating handle 114 is gripped and squeezed toward the gripping handle 16, the arm 104 will be lifted away from the stop 106 and its pawl 102 will engage the ratchet wheel 100.

OPERATION

The stapling machine 2 may be used to insert staples 22 individually at desired locations or it may be used to insert a succession of staples 22 in a row at equally spaced intervals. In the latter case, the stapling machine 2 is merely advanced along the surface into which staples 22 are to be inserted with the operator maintaining a slight force on the gripping handle 16 to insure good frictional engagement between the tire 96 and the surface. Thus, as the stapling machine 2 advances along the surface the drive wheel 94 will rotate in the direction indicated by the arrow in FIG. 4. Since the sleeve 86 is connected to the drive wheel 94 through the slip clutch 98, it too will rotate and likewise so will the trip wheel 82.

Assuming now that the cam follower 76 is initially in the outer end of one cutout 90 (FIG. 4), then as the trip wheel 82 rotates in the direction of the arrow, the follower 76 will move along the camming surface 92 of that cutout 90 and will be cammed toward the spindle 88. This, of course, depresses the rear end of the operating lever 70 and raises its forward end. Inasmuch as the forward end of the lever 70 is pinned to the hammer 52 at the slots 62, the hammer 52 will be elevated against the bias of its drive spring 64. In time the drive blade 56 of the hammer 52 will rise to a position above the strip of staples 22 and allow the forwardmost staple 22 in the strip to advance under the force of the feed spring 38 to a position against the backing plate 44, in which position that staple 22 will be located directly beneath the transverse slot 42 in the magazine 20.

Once the follower 76 reaches the inner end of the camming surface 92, no further restraint is imposed upon it, and it is released and driven upwardly through the succeeding cutout 90 by the force of the compressed drive spring 64 which is transferred to it through the actuating lever 70. In this connection, it should be recalled that the trip wheel 82 is composed of two discs 84 which are connected at their peripheries. The outer disc 84 is further connected to the sleeve 86 while the inner disc 84 contains the cutouts 90. Aside from being connected to the sleeve 86 through the outer disc 84 the inner disc 84 is otherwise completely free of the sleeve 86. Consequently, the follower 76 moves within the cutouts 90 without interferring with the sleeve 86. When the cam follower 76 is released the hammer 52 is driven downwardly by the spring 64, causing its blade 56 to advance through the transverse slot 42 and engage the leading staple 22 in the magazine 20. Continued movement of the blade 56 drives the

leading staple 22 from the strip and ejects it from the housing 4. Since the drive spring 64 stores considerable energy when compressed, the force with which the leading staple 22 is driven from the strip of staples 22 is quite large and is sufficient to drive the staple 22 into most surfaces capable of retaining it. Moreover, the force with which the spring 64 drives the staple 22 can be varied by turning the adjusting nut 51. In particular, if the nut 51 is screwed downwardly on the upper end of the guide pin 48, the force exerted by the drive spring 64 on the hammer 52 when compressed will be greater, and consequently when the spring is released the hammer 52 will be driven downwardly with greater force.

The horizontal slots 64 in the sideplates 60 of the hammer 52 coupled with the shiftable mounting of the magazine 20 and backing plate 44 against the bias of the recoil spring 36 enables the stapling machine 2 to advance at a constant velocity, even when the blade 56 of the hammer 52 is driving a staple 22 into the surface. In other words, the mere fact that the staple 22 enters the surface and thereby becomes stationary once it is ejected from the magazine 22, does not impede movement of the stapling machine 2 across the surface. On the contrary, the magazine 20, the backing plate 44, and the guide block 46, as well as related components, merely remain stationary for the short interval of time during which the hammer 52 drives the staple 22 into the surface, and during that interval the housing 4 and the remaining components of the machine 2 continue to advance, compressing the recoil spring 36 as they do so and causing the pins 72 to slide in the horizontal slots 62. Once the staple 22 is completely free of the magazine 20, that is, when it is embedded in the surface, the recoil spring 36 shifts the magazine 20, backing plate 44, and the hammer 52 back to their initial positions.

Thus, as the stapling machine 2 is advanced and the drive wheel 94 continues to rotate, the staples 22 will be ejected in quick succession and at equally spaced intervals into the surface along which that advancement occurs.

Since the drive wheel 94 is laterally offset with respect to the magazine 20, it is possible to engage the drive wheel 94 along one surface and drive the staples 22 through another surface. For example, if a piece of cloth or other flexible sheet material is to be secured to a relatively firm surface such as wood, cork or plaster board, the drive wheel 94 may be brought into engagement with the firm surface at the edge of the sheet material such that the magazine 20 is positioned over the sheet material. Consequently, the sheet material will not tend to buckle as the machine 2 is advanced along it.

When it is desired to eject the staples 22 individually at selected locations, the forward end of the housing 4 is placed over a selected location and the operating handle 112 squeezed toward the gripping handle 16. This causes the handle 112 to rotate about its pin 114 and against the bias of the spiral spring 116. As the handle 112 moves upwardly, it lifts the arm 104 upwardly away from the stop 106. Moreover, the camming surface 109 on the pawl 102 moves along the stop 106 and allows the opposite end of the pawl 102 to intime engage a tooth of the ratchet wheel 100. When this occurs, the lifting of the handle 112 is translated into rotation of the ratchet wheel 100. Since the trip wheel 82 is connected to the ratchet wheel 100 through the sleeve 86, it too will rotate. The operating handle 112 is afforded sufficient free movement to enable it to rotate the trip wheel 82 enough to cause the cam follower 76 to advance entirely across the camming surface 92 of the cutout 90 in which it is disposed, and thereafter release into the succeeding cutout 90. Of course, as the follower 76 moves along the camming surface 92, the operating lever 70 compresses the drive spring 64, and as the follower 76 releases into the succeeding cutout 90, the drive spring 64 drives the blade 56 of the hammer 52 through the magazine 20, ejecting a staple 22 therefrom. Thus, staples 22 are ejected into the surface against which the machine 2 is pressed at any desired location on that surface.

Referring now to FIG. 7, with slight modifications it is possible to utilize the stapling machine 2 to tack a thin strip of tapelike material 130 which is supplied in a roll 132 to a desired surface. More specifically, the roll 132 is journaled in a holder 134 which is secured to the upper wall 10 of the housing 4 ahead of the gripping handle 16. The tape 130 is then fed downwardly along the upper wall 10 and the front wall 14, and at the bottom of the front wall 14 it is turned beneath the housing 4 and passes under the magazine 20. To retain the tape 130 in the walls 10 and 14, guide clips 136 are provided. Thus, as the stapling machine 2 is advanced along a surface the staples 22 will be driven first through the tape 130 underlying it and then into the surface so that the tape 130 is attached to the surface.

While the stapling machine 2 as illustrated in the drawings is designed primarily for used by left-handed operators, a mere reversal of the parts will make it more convenient for use by right-handed operators.

This invention is intended to cover all changes and modifications of the example of the invention herein chosen for purposes of the disclosure which do not constitute departures from the spirit and scope of the invention.

What I claim is:

1. A stapling machine comprising a housing, staple retaining means in the housing for holding staples arranged in a strip, drive means engageable with the endmost staple of the strip for ejecting that staple from the housing, and actuating means connected with the drive means for operating the drive means as the stapling machine is advanced along a surface, the actuating means engaging the surface and deriving the power necessary to operate the drive means from the advancement of the stapling machine along the surface.

2. A stapling machine according to claim 1 wherein the actuating means includes a wheel journaled in the housing for engagement with the surface.

3. A stapling machine according to claim 2 wherein the drive means comprises a hammer reciprocally mounted in the housing, and a spring for driving the hammer a against the endmost staple; and wherein the actuating means moves the hammer against the bias of the spring and then staple from the hammer, allowing it to drive the endmost staple from the strip.

4. A stapling machine according to claim 2 wherein the drive means is a hammer reciprocally mounted in the housing and wherein the actuating means further comprises trip means rotated by the wheel and provided with at least one camming surface, and connecting means connecting the trip means with the hammer, the connecting means having a follower which engages the camming surface for translating the rotary movement of the camming surface into reciprocal movement at the hammer.

5. A stapling machine according to claim 4 wherein the drive means includes a spring for driving the hammer against the endmost staple; wherein the camming surface when it engages and moves the follower shifts the connecting means in opposition to the force exerted on the hammer by the spring; and wherein the trip means releases the follower at the end of the camming surface allowing the hammer to be driven by the spring against the endmost staple in the strip.

6. A stapling machine according to claim 5 wherein the connecting means comprises a lever pivoted intermediate its ends in the housing and having the follower on it.

7. A stapling machine according to claim 6 wherein the trip means comprises a trip wheel journaled for rotation with the drive wheel and having cutouts extending into it from a central void in the wheel, the camming surfaces being on the margins of the cutouts.

8. A stapling machine according to claim 1 wherein the actuating means further comprises means for operating the drive means without moving the stapling machine along the surface.

9. A stapling machine according to claim 3 wherein the hammer is mounted for shifting movement generally parallel to the direction of movement so that movement of the housing along the surface will not be interrupted as a staple is ejected from the housing and inserted into the surface.

10. A stapling machine according to claim 3 wherein the actuating means comprises a drive wheel journaled in the housing for engagement with the surface, a trip wheel journaled in the housing for rotation about the same axis as the drive wheel and having camming surfaces thereon, and an operating lever pivoted in the housing and provided with a follower which engages the camming surface, one end of the lever operating the hammer in opposition to the spring when the follower rides along the camming surface.

11. A stapling machine according to claim 10 wherein each camming surface terminates at a common void so that once the follower passes beyond one of the camming surfaces it is free to move adjacent to the succeeding camming surface to the lead end of that succeeding camming surface.

12. A stapling machine according to claim 11 wherein the actuating means further comprises a ratchet wheel connected for rotation with the trip wheel, a pawl for engaging the teeth of the ratchet wheel, and an operating handle connected with the pawl for moving the pawl in a direction which causes it to engage the ratchet wheel and move the ratchet wheel in a direction which causes the trip wheel to operate the hammer; and wherein the drive wheel is connected through a one-way clutch which enables the drive wheel to rotate the trip wheel in a direction which operates the hammer but prevents the trip wheel from rotating the drive wheel when the trip wheel is rotated by the ratchet wheel in the same direction.

13. A stapling machine according to claim 1 and further characterized by a holder mounted on the housing for retaining a roll of strip material, and guide means on the housing for guiding the strip material from the roll to a position where the strip means extends across the portion of the housing through which the staples are ejected.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,586,231 Dated June 22, 1971

Inventor(s) LeRoy H. Wilson

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 38, cancel "a" second occurrence, line 40, "staple from" should read -- releases --.

Signed and sealed this 9th day of November 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents

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