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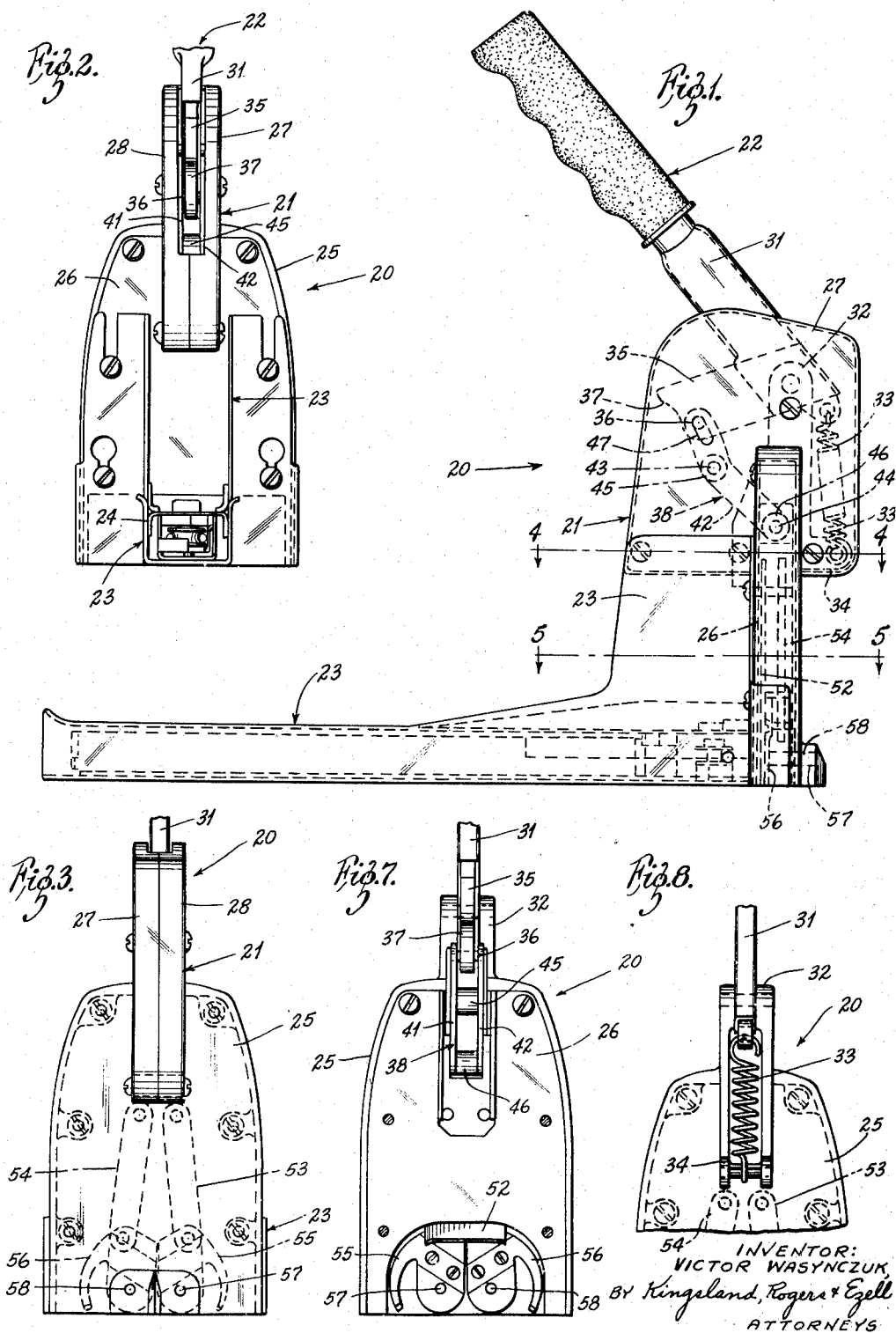
V. WASYNCZUK

2,847,674

HAND OPERATED STAPLING MACHINE

Filed Nov. 1, 1956

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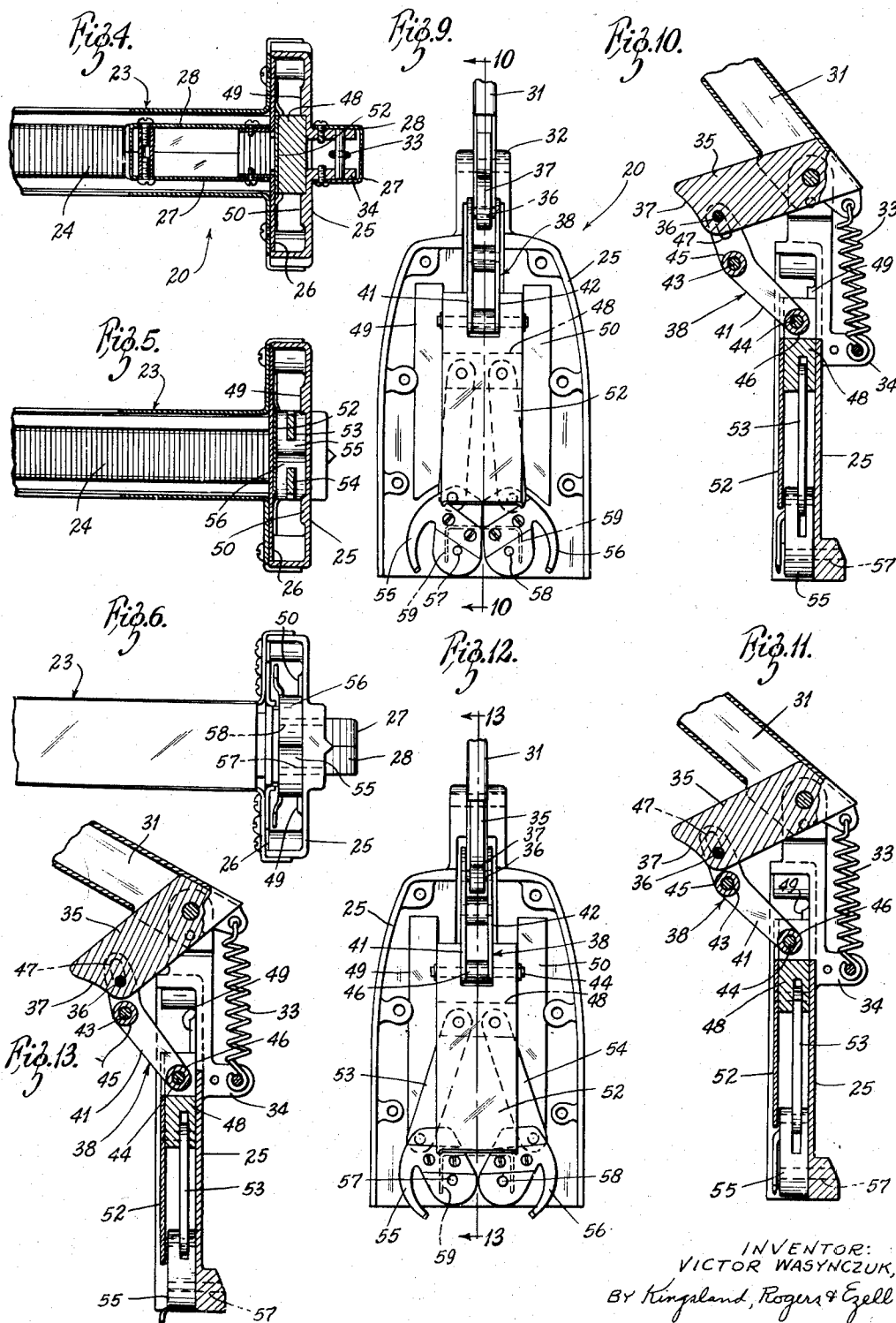
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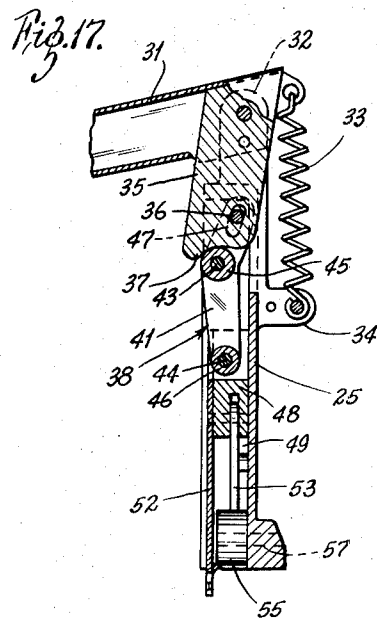
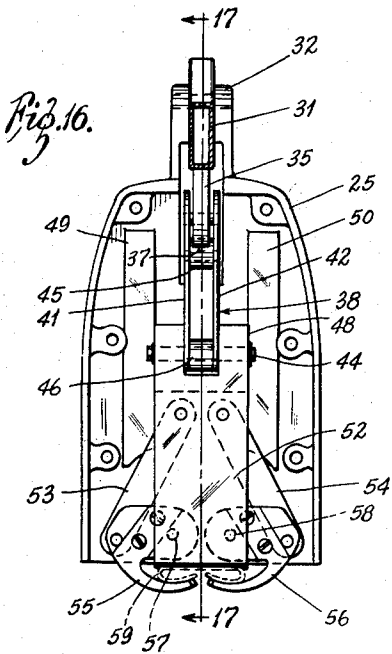
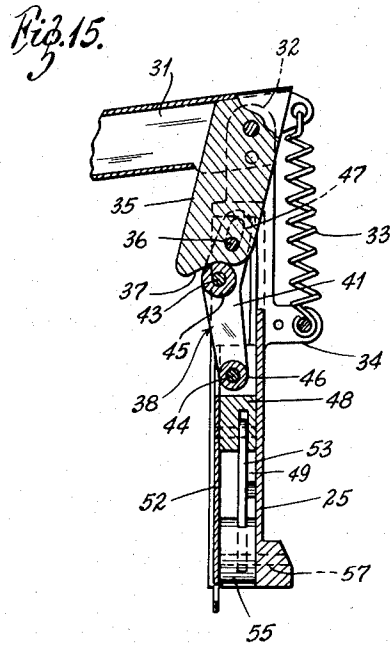
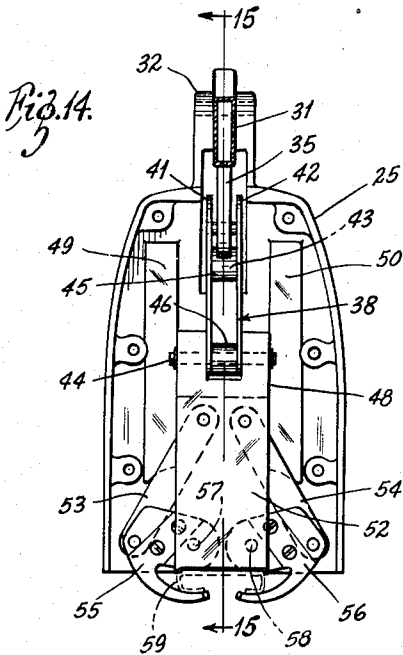
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3 Sheets-Sheet 3



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2,847,674

HAND OPERATED STAPLING MACHINE

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Application November 1, 1956, Serial No. 619,733

10 Claims. (Cl. 1—49)

This invention relates to improvements in stapling machines, and in particular is concerned with a hand operated stapling machine. As a special consequence of this invention, there has been provided a stapling machine which may be fully operated by only one hand of the operator.

In the past, various forms of stapling machines operated by hand have been designed. Such stapling machines may be conveniently used to fasten flaps of a carton with access to only one side through the use of retractible anvil mechanisms of the type shown in Patent No. 2,469,054 granted November 19, 1945 and assigned to applicant's assignee, International Staple & Machine Company of Herrin, Illinois. To insure efficient operation, the machines are best operated with both hands of the operator, one hand being placed on the machine to press it firmly against the carton or other work piece to be stapled and to steady it, while the other hand is employed to move the operating handle and effectuate the clinching of the staple. Thus, both hands of the operator have been, of necessity, required in the stapling operation.

In the instant invention, there has been provided a stapling machine which may be easily and efficiently operated by the operator with the requirement of using only one hand. This frees the other hand of the operator for other activities with obvious advantages. It has been found that one handed operation may be effectively employed in this invention since the handle is so designed that it may be forcefully actuated by the operator before the actual clinching takes place. This is accomplished by providing a preliminary lost motion mechanism whereby the handle may be moved to pick up speed and kinetic energy before it drives the staple operating mechanisms. Second, after this lost motion has been effected, the handle cooperates with an operating mechanism to cause preliminary piercing of the work piece by the retractible anvils and a breaking away of the staple from the staple stick. Finally, in the clinching of the staple against the anvils where the major force of the operating mechanism is required, the handle brings into operation a cam device which, through a high mechanical advantage, applies a great deal of force to the operating mechanisms in the interior of the stapling machine. All of this is accomplished without any additional force being required by the operator compared to conventional machines, and, as a matter of fact, less overall force is required.

The cooperating mechanisms between the operating handle and the linkages and cam structure in the stapling components are so designed that the operating handle is progressively lowered with respect to the stapling machines as the three force phases come into play. Thus, the lost motion phase comes, first of all, when the operating handle is at the top of the stroke and where, due to the structure of the machine, the greatest danger in upsetting it or tilting it with respect to the work piece occurs. In the next phase, the operating handle is relatively lowered with respect to the first phase and additional force is

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placed upon the operating handle to break apart the staple and effectuate the piercing of the anvils into the work piece. Here it will be noted that since the handle is lowered, the danger of upsetting is reduced. In the third and final phase, the handle is at the lowest stage and is comparatively close to the base of the machine so that the least likelihood of upsetting the machine is present during the operation cycle.

Thus, through this invention, there has been provided a stapling machine which may be operated by a single hand of an operator in a simple and efficient manner. The machine is light in weight, rugged in construction and made of standard components so that it may be easily broken apart for maintenance and repair.

Accordingly, it is a primary object of this invention to provide a stapling machine which may be easily and efficiently operated by one hand.

It is a further object of this invention to provide a stapling machine in which the handle may be preliminarily operated without operating the internal stapling components.

Yet a further object of this invention is to provide a hand operated stapling machine in which the handle may be preliminarily operated to pick up speed and kinetic energy and then caused to operate stapling components to break apart the staple and cause the penetration of anvils into a work piece and then finally to cause to be brought into play components having a greater mechanical advantage to effectuate the clinching of the staple against the rotary anvils.

Still another object of this invention is to provide a hand operated stapling machine having an operating handle which can be preliminarily operated without doing substantial work to pick up driving speed and then subsequently to work through a linkage to cause initial movement of a staple driving blade and rotary anvils, and then finally to cooperate with a structure which increases the mechanical advantage and applies greater force from the handle to the staple driving blade and the rotary anvils to effectuate final clinching of the staple.

Yet another object of this invention is to provide a stapling machine which may be operated by a single hand of an operator, and which is light weight in construction, of rugged characteristics, and which may be simply and efficiently operated.

Further objects of this invention will appear in the detailed description which follows and will be further apparent to those skilled in the art.

There is shown, for the purpose of illustration, a preferred embodiment of this invention in the accompanying drawings. It is to be understood that these illustrations are for the purpose of example only and that the invention is not limited thereto. In the drawings:

Figure 1 is a view in side elevation of the stapling machine in unoperated position;

Figure 2 is a view in rear elevation of the stapling machine;

Figure 3 is a view in front elevation of the stapling machine with the rotary anvils and the connecting links being shown in dotted lines;

Figure 4 is a view in section taken on the line 4—4 of Figure 1;

Figure 5 is a view in section taken on the line 5—5 of Figure 1;

Figure 6 is a bottom plan view of the forward end and standard of the stapling machine;

Figure 7 is a view in rear elevation of the housing and standard of the stapling machine with the staple magazine removed;

Figure 8 is a view in front elevation of the top of the housing of the stapling machine with the cover removed showing the spring biasing means for the handle;

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Figure 9 is a view in rear elevation of the standard of the stapling machine showing the staple driving mechanism in non-operated position with the rear part of the housing being removed;

Figure 10 is a view in section taken on the line 10—10 of Figure 9 showing the handle in fully retracted position prior to the operation;

Figure 11 is a view taken similarly to Figure 10 showing the position of the handle and operating parts of the stapling machine just after the start of the operation;

Figure 12 is a view taken similarly to Figure 9 showing the location of the stapling machine operating components after the handle has been further lowered;

Figure 13 is a view in section taken on the line 13—13 of Figure 12;

Figure 14 is a view taken similarly to Figures 9 and 12, but showing the stapling machine operating components in a further position of operation after the handle has been further lowered;

Figure 15 is a view in section taken on the line 15—15 of Figure 14;

Figure 16 is a view taken similarly to Figures 9, 12 and 14 showing the stapling machine operating components in a final operating and clinching position after the handle has been fully lowered; and

Figure 17 is a view in section taken on the line 17—17 of Figure 16.

Referring now to Figure 1, a stapling machine is generally indicated by the numeral 20. Its main components are a housing 21, a handle 22 and a staple magazine 23. The magazine 23 receives a stick of staples 24 and forms no part of this invention.

The housing 21, as more particularly shown in Figures 3—10, is comprised of a standard 25, a rear plate 26, as shown in Figure 7, and cover plates 27 and 28 for the handle operating linkage, as shown in Figures 1, 2 and 3. All of the plates, 26, 27 and 28, are secured to the standard by bolts which are received in threaded openings in the standard.

The operating handle 22 has a flat shank 31 which is pivotally secured to a bifurcated support 32 extending upwardly from the standard. The handle is biased to the position shown in Figure 1 by a biasing spring 33 which is connected to the forward end of the handle and to a medial support 34 extending laterally in front of the standard.

An operating arm 35, as best shown in Figure 10, is integrally connected with the handle and has a pin 36 extending therethrough, which is adapted to cooperate with a drive link, later to be described, for operating the stapling components. The operating arm 35 is further provided with a cammed surface 37, which is also adapted to cooperate with the drive link. In the operation of the stapling machine through the lowering of the handle, it will be seen, as more fully described below, that the pin 36 first moves through a lost motion phase, as phase 1, and then causes the operation of the drive link in phase 2, and then in the final clinching phase, the cammed surface 37 effectuates and brings into play a great mechanical advantage to complete the stapling operation.

The drive link generally mentioned above is best shown in Figures 1, 9 and 10, and is identified by the numeral 38. The drive link is comprised of two plates 41 and 42 connected together in spaced relation by pins 43 and 44, each of which are provided with spacing sleeves 45 and 46, respectively. The upper portions of the plates 41 and 42 are provided with slots 47 within which the pin 36 of the operating arm is interfitted. As best shown in Figures 10 and 11, it will be seen that the operating handle may be slightly lowered from the starting position with the pin 36 moving within the slot in a lost motion manner before the drive link is caused to be moved.

The lower end of the drive link 38 is pivotally connected by the pin 44 to a drive block 48 which is bifurcated at the top to receive the drive link. The drive

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block 48 moves vertically within the standard 25 between guide rails 49 and 50.

A staple driving blade 52 is secured to the rear face of the driving block. This driving blade is conventionally positioned over the endmost staple in the staple stick so that when the machine is operated, it will break the staple apart from the stick. The drive block 48 is further provided with a recess to receive the ends of the retractible anvil links 53 and 54 which are pivotally received in the recess. The bottom ends of these links are pivotally secured to the retractible rotary anvils 55 and 56. Each of the anvils is pivotally mounted on the standard 25 by pivot pins 57 and 58, respectively.

Operation

The stapling machine 20 is shown in rest position in Figures 1, 9 and 10. For convenience and description, a staple which is shown being driven by the stapling operation is depicted in dotted lines and indicated by the reference numeral 59. It will be noted that in the rest position, the pin 36 and the operating arm 35 of the handle, as appears in Figure 10, is at the top of the slot 47. Thus, when the stapling operation is commenced by the operator in the first lost motion phase, the handle can be lowered to the position shown in Figure 11, before the drive link is caused to be operated by the movement of the pin 36 to the bottom of the slot 47.

The stapling operation is adapted to be employed in conventional fashion by placement of the machine upon the work piece to be stapled, such as over the flaps of a carton. Then, after the handle has first been rapidly moved in the lost motion preliminary phase, the handle is subsequently lowered from the position shown in Figure 11 to the position shown in Figures 12 and 13. This further movement of the handle in the counterclockwise direction causes the movement of the drive link to the position shown together with the partial lowering of the drive block. This movement of the drive block in turn moves the staple driving blade and lowers the tops of the links 53 and 54 which causes the counter-rotation of anvils 55 and 56. In Figures 12 and 13, the staple driving blade has just contacted the top of the endmost staple 59 to cause it to be broken away from the staple stick. In addition, the partial counter-rotation of the anvils has been effectuated to start the piercing of the work piece. This action does not require much force, and the movement of the drive link by the pin is sufficient to effectuate this operation.

Subsequently, in the third and final clinching phase, as shown in Figures 14 and 15 and Figures 16 and 17, the further lowering of the handle causes the cam surface 37 of the operating arm to contact the sleeve 45 of the drive link. Sleeve 45 is rotatably mounted on the pin 43 which acts as a bearing to reduce friction. This first contacting action is shown in Figures 14 and 15, and it will be seen that a direct force is applied by the cammed surface of the operating arm from the handle through the drive link, and through the drive block to cause the complete piercing of the work piece by the rotary anvils and the forcing of the staple by the drive blade against the anvils. The greater mechanical advantage achieved through the relationship of the operating arm of the handle with the drive link brings into play a great amount of force to make this final phase successful. It will further be noted that, at the start of the clinching operation, as shown in Figures 14 and 15, the handle is relatively lowered with respect to the base of the stapling machine and is adjacent the magazine 23 at its juncture with the standard so that a great amount of stability in the application of the force to the operating arm is enjoyed by the operator.

The final clinching in the last phase, as shown in Figures 16 and 17, where it will be seen that the relationship of the operating arm and the cam surface with the drive link, is such that there is almost a straight line relationship. It will, however, be noted that the line

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of contact of the operating arm with the drive link through the line between the pins of the drive link and the contact point of the operating arm to the pivot point of the handle is not an exact straight line relationship, exactly, but just merely approaches it very closely. This aids in the return of the handle through the effect of the biasing spring and prevents hang up.

In the final phase, it will be noted that the force is applied through the operating arm cam surface against the sleeve 45 on the drive link. This takes the pressure off the link 36 which reduces likelihood of breakage of this operating component as well as wear on the slot and possible misalignment. It will be noted that in this operation between phases 2 and 3, the pin 36 actually moves from the contacting position with the operating arm at the bottom of the slot to a non-contacting position in phase 3, as shown in Figure 17.

The above-described sequence of operation takes place in less than a second so that the three phases of operation occur extremely rapidly. By means of the momentum and kinetic energy which is built up in the first or lost motion phase, the operating handle can be easily carried through the second phase which breaks apart the staple and preliminarily pierces the work piece by the anvils with build-up of resistance through the handle and then through the third and final phase for the final piercing of the work piece and the clinching of the staple against the anvil, which requires the greatest amount of force. It will be particularly noted that the build-up in resistance and force applied to the handle increases in the three phases and as the handle is relatively lowered, with respect to the machine. This provides for greater stability and makes possible the complete stapling operation by an operator through the use of only one hand without tilting or moving the stapling machine upon the work piece.

The return of the operating components and the handle of the stapling machine from the final position shown in Figures 16 and 17 to the original starting position, as shown in Figures 1, 9 and 10, is very simply effected. The force of the biasing spring after the handle is released from the final stapling operation will cause the handle to move counterclockwise around its pivot point and break apart from the contacting relationship of the cam surface with the bearing sleeve of the drive link. This independent movement of the handle and the operating arm with respect to the drive link continues without moving the stapling components until the pin 36 moves to the top of the slot 47 in the drive link. This permits a certain amount of lost motion and pick up of kinetic energy. This force generated by the biasing spring is sufficient to complete the return of the handle and the drive link together with the drive block and its attached driving blade and anvil links, to the original position shown in Figures 1, 9 and 10. Thus, the return movement is automatically effected in a very simple and expeditious manner by the mere releasing of the handle by the operator without the requirement of any manual effort.

Various changes and modifications may be made in the stapling machine of this invention, as will be apparent to those skilled in the art. Such changes and modifications are within the scope and teaching of this invention as defined by the claims appended hereto.

What is claimed is:

1. A stapling machine comprising a member adapted to be manually moved by an operator to perform a stapling operation, staple driving means for driving a staple through a work piece and clinching it, and force translating means cooperating with said member and the staple driving means for increasing the force applied to the staple driving means progressively as said member is moved, said force translating means including lost motion means connecting the member and the staple driving means for permitting initial movement of the member

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and build up of kinetic energy before resistance is encountered in the staple driving operation.

2. A stapling machine comprising a member adapted to be manually moved by an operator to perform a stapling operation, staple driving means for driving a staple through a work piece and clinching it, and force translating means cooperating with said member and the staple driving means for increasing the force applied to the staple driving means progressively as said member is moved, said force translating means including linking means of low mechanical advantage connecting said member and the staple driving means at an early stage of the stapling operation and comprising a rigid operating arm depending from said member and a link connected to said driving means, substantially direct driving means of relatively high mechanical advantage connecting said member and the staple driving means at a final clinching stage of the operation, said operating arm and said link being engageable with one another in a first bearing relationship at the early stage of operation and engageable with one another in a separate second bearing relationship at the final clinching stage of the operation.

3. A stapling machine comprising a member adapted to be manually moved by an operator to perform a stapling operation, staple driving means for driving a staple through a work piece and clinching it, and force translating means cooperating with said member and the staple driving means for increasing the force applied to the staple driving means progressively as said member is moved, said force translating means including lost motion means connecting the member and the staple driving means for permitting initial movement of the member and build up of kinetic energy before resistance is encountered in the staple driving operation, linking means of low mechanical advantage connecting said member and the staple driving means at an early stage of the stapling operation, substantially direct driving means of relatively high mechanical advantage connecting said member and the staple driving means at a final clinching stage of the operation.

4. A stapling machine having a standard, staple driving blade, staple receiving means, means for operating said driving blade and performing a stapling operation, said means comprising an operating handle pivotally connected to said standard, force translating means for converting force applied by an operator to said handle to the staple driving blade, said force translating means including linking means of low mechanical advantage connecting said handle and the staple driving means at an early stage of the stapling operation, and substantially direct driving means of relatively high mechanical advantage connecting said handle and the staple driving means at a final clinching stage of the operation, said substantially direct driving means including a cam element integrally connected to said handle which is adapted to bear against a rigid link pivotally secured to a mounting block which supports the driving blade, said cam element being disengaged from the link at the early stage of the stapling operation.

5. A stapling machine having a standard, staple driving blade, staple receiving means, means for operating said driving blade and performing a stapling operation, said means comprising an operating handle pivotally connected to said standard, force translating means for converting force applied by an operator to said handle to the staple driving blade, said force translating means including lost motion means connecting the handle and the staple driving means for permitting initial movement of the handle and build up of kinetic energy before resistance is encountered in the staple driving operation, linking means of low mechanical advantage connecting said handle and the staple driving means at an early stage of the stapling operation, substantially direct driving means of relatively high mechanical advantage con-

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necting said handle and the staple driving means at a final clinching stage of the operation.

6. The stapling machine of claim 5 in which the lost motion means includes a pin on an integral portion of said handle, and a link forming part of the force translating means and having a slot cooperating with said pin.

7. The stapling machine of claim 5 in which the substantially direct driving means includes a cam element integrally connected to said handle which is adapted to bear against a rigid link pivotally secured to a mounting block which supports the driving blade.

8. A stapling machine having a standard, staple driving blade, retractible anvils, staple receiving means, means for operating said driving blade and performing a stapling operation, said means comprising an operating handle pivotally connected to said standard, force translating means for converting force applied by an operator to said handle to the staple driving blade in increasing ratio to the extent of movement of the operating handle from a starting position, said force translating means including lost motion means whereby the handle may be preliminarily moved prior to movement of the driving blade and the retractible anvils.

9. A stapling machine having a standard, staple driving blade, retractible anvils, staple receiving means, means for operating said driving blade and performing a stapling operation, said means comprising an operating handle pivotally connected to said standard, force translating means for converting force applied by an operator to said handle to the staple driving blade in increasing ratio to the extent of movement of the operating handle from a starting position, said force translating means including lost motion means whereby the handle may be

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preliminarily moved prior to movement of the driving blade and the retractible anvils, and linking means connecting the operating handle and the driving blade and retractible anvil to break apart a staple from a staple stick by the driving blade and at least partially pierce a work piece by the retractible anvils.

10. A stapling machine having a standard, staple driving blade, retractible anvils, staple receiving means, means for operating said driving blade and performing a stapling operation, said means comprising an operating handle pivotally connected to said standard, force translating means for converting force applied by an operator to said handle to the staple driving blade in increasing ratio to the extent of movement of the operating handle from a starting position, said force translating means including lost motion means whereby the handle may be preliminarily moved prior to movement of the driving blade and the retractible anvils, and linking means connecting the operating handle and the driving blade and retractible anvil to break a staple apart from a staple stick by the driving blade, and at least partially pierce a work piece by the retractible anvils, and substantially direct driving means of increased mechanical advantage connecting said handle and the staple driving blade and the retractible anvils at the final clinching stage of the stapling operation.

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