Dec. 8, 1936. H. T. SCOTT 2,063,345

STAPLING APPARATUS

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FIG. 18.

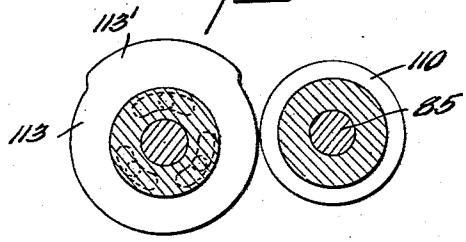

FIG. 1.

FIG. 17.

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STAPLING APPARATUS

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FIG. 1.

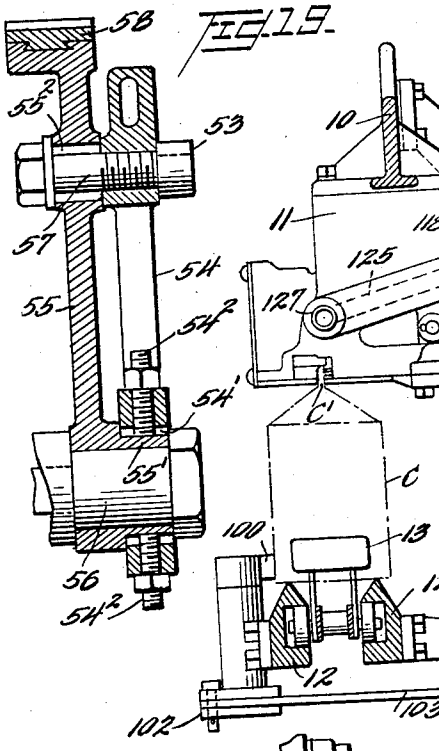


FIG. 2.

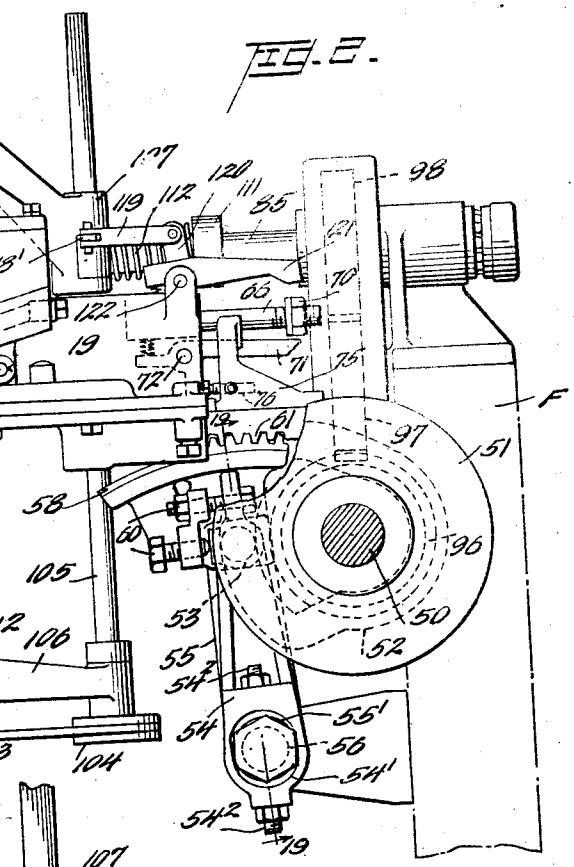
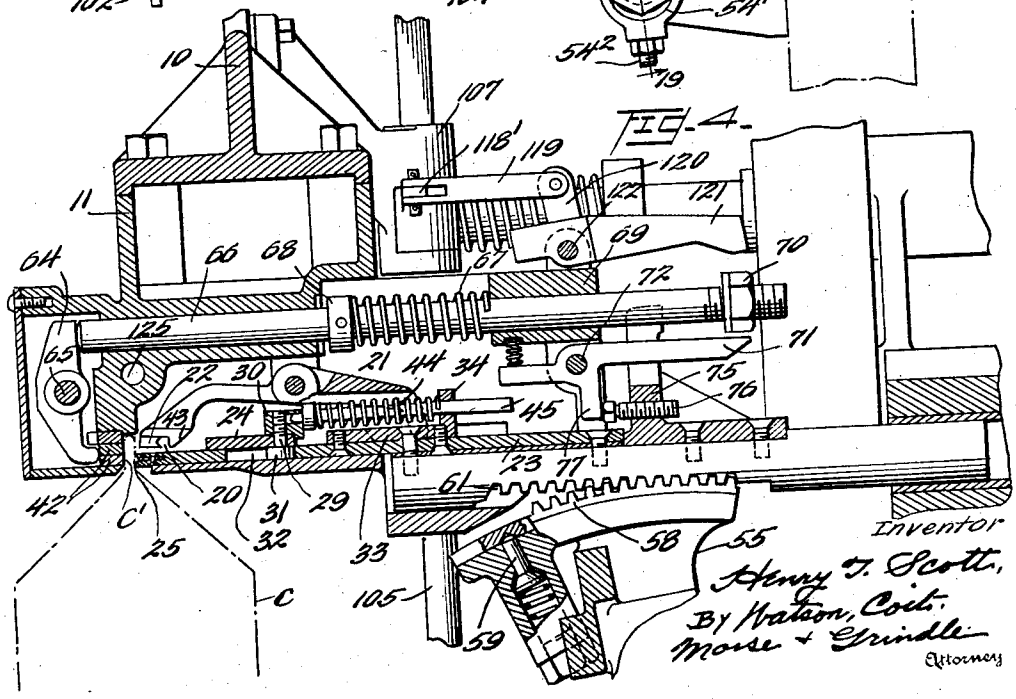


FIG. 4.



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Dec. 8, 1936. H. T. SCOTT 2,063,345

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FIG. 3.

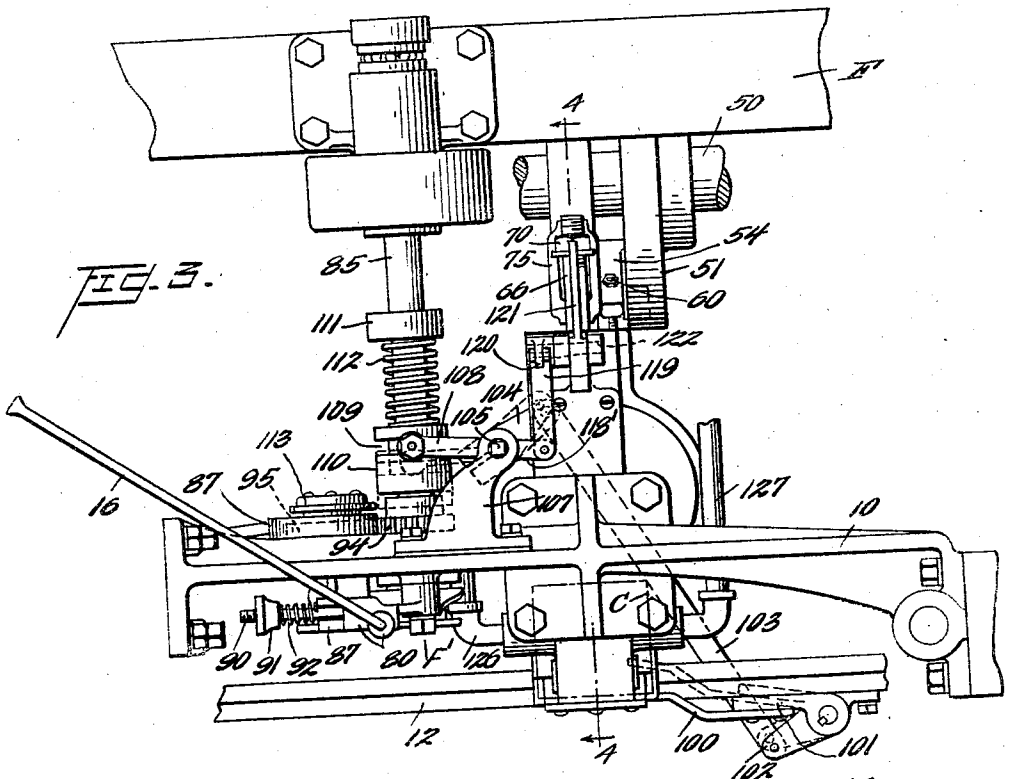


FIG. 13.

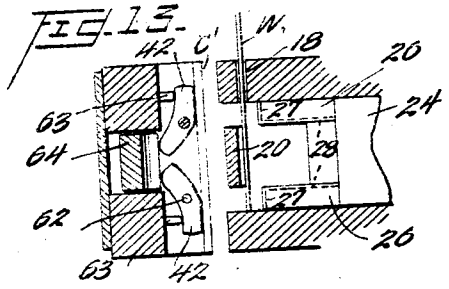


FIG. 14.

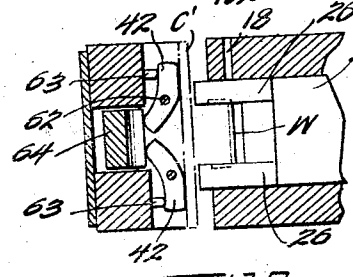


FIG. 15.

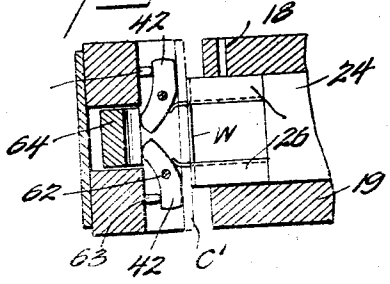
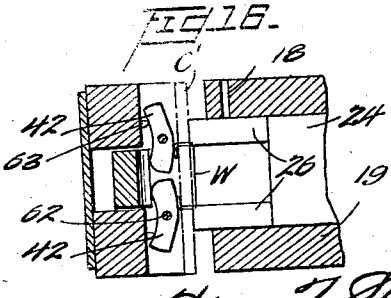


FIG. 16.



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STAPLING APPARATUS

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FIG. 5.

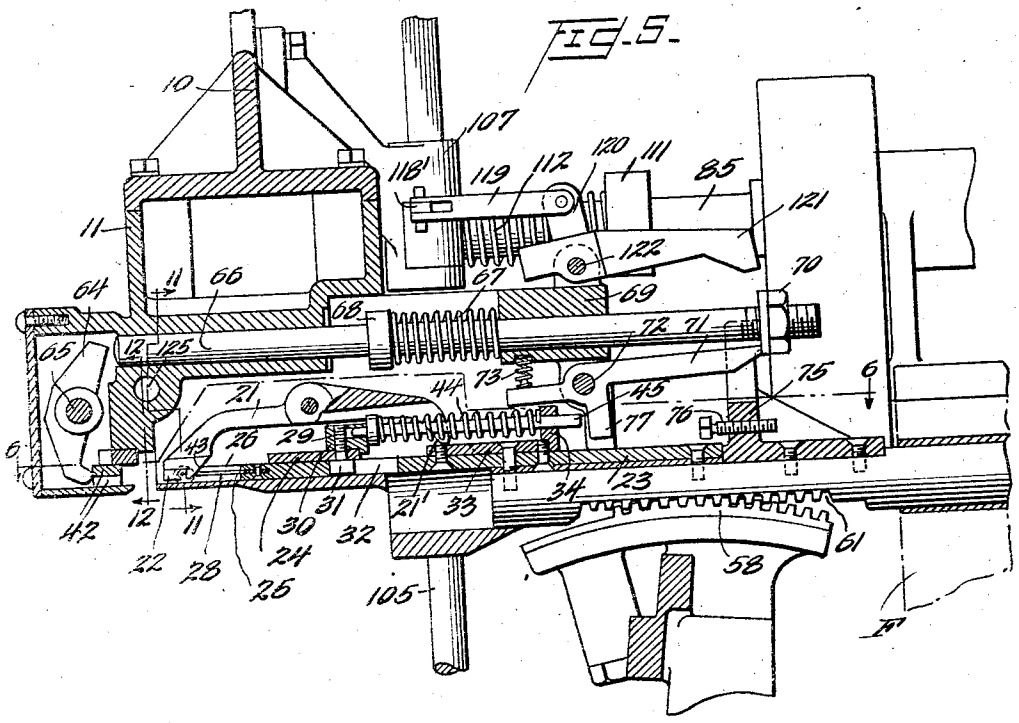

FIG. 6.

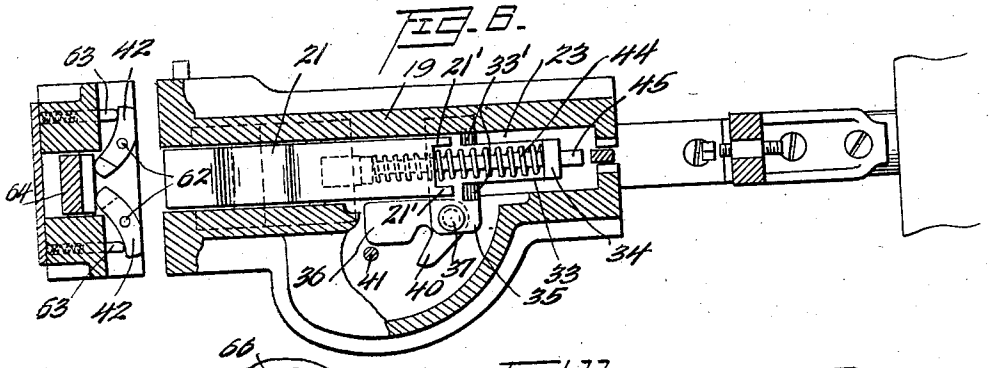

FIG. 11.

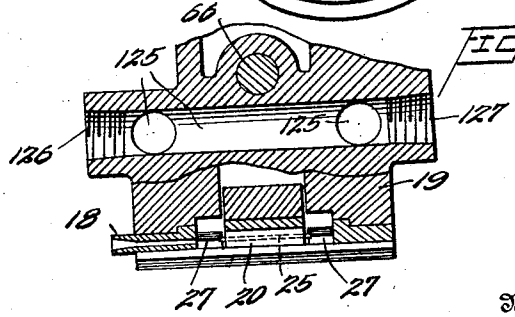

FIG. 12.

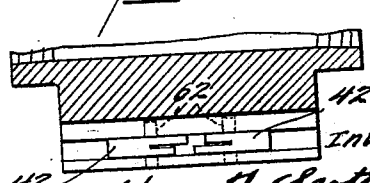

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FIG. 7.

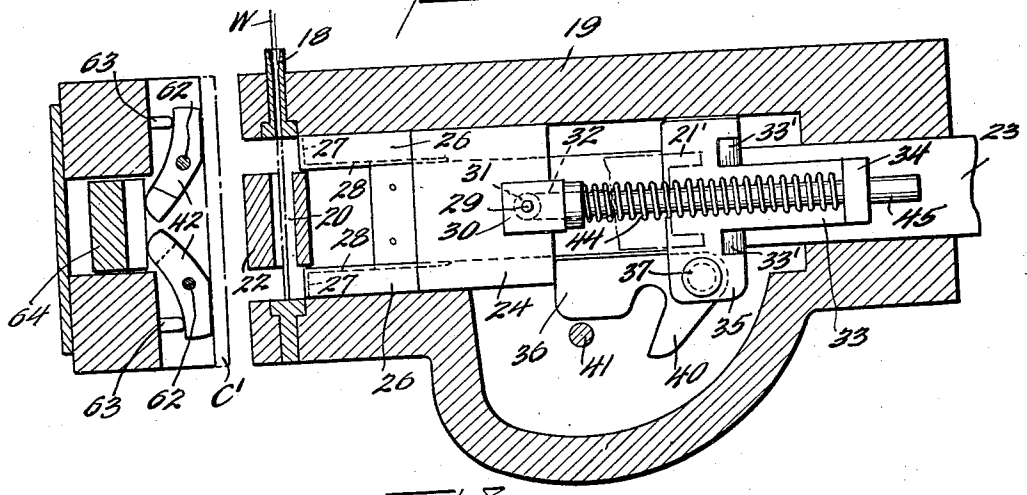

FIG. 8.

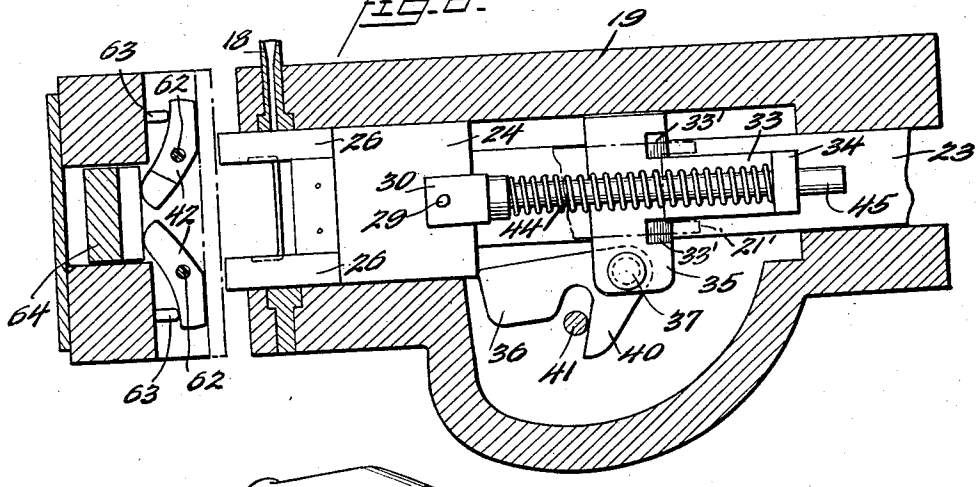

FIG. 9.

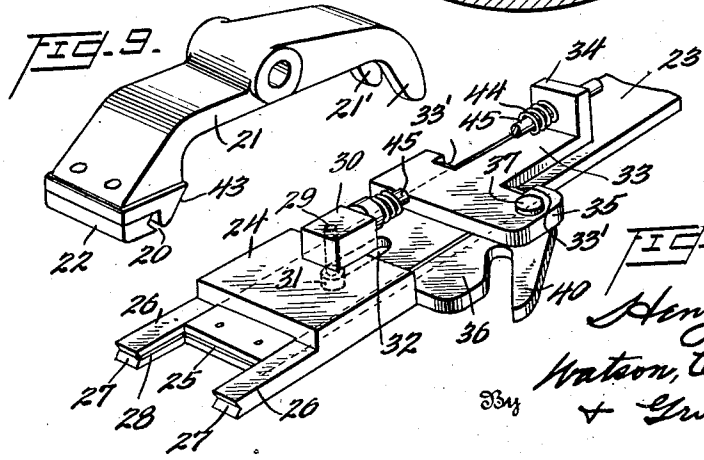

FIG. 10

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Patented Dec. 8, 1936

2,063,345

UNITED STATES PATENT OFFICE

2,063,345

STAPLING APPARATUS

Henry T. Scott, Toledo, Ohio, assignor to The American Paper Bottle Company, Toledo, Ohio, a corporation of Ohio

Application October 16, 1934, Serial No. 748,564

3 Claims. (Cl. 1—2)

The present invention relates to stapling machines and particularly to machines for fastening together by means of staples a plurality of plies of sheet material, such as paper.

The stapling machine which comprises subject matter of the present invention may, with minor changes in the design and arrangement of its component elements, be adapted for many different uses in the mechanical arts, but it has been primarily designed for the purpose of mechanically fastening together the several plies or sheets which, taken together, comprise the top closure rib of a paraffin coated paper bottle of the type for instance disclosed in my application Serial No. 686,300, filed August 22, 1933.

Paper bottles such as disclosed in the aforementioned application are fabricated of relatively stiff paper. The original blanks are first erected into tubular form, with both ends open, one end, i. e. the bottom end, is then closed, after which the container is coated with paraffin. After the paraffin has set or hardened, the container is charged with a liquid or solid substance to be dispensed and the foldable extension at the open end or top thereof is closed by folding or collapsing the same along certain score lines originally impressed in the blank, to form a central transverse rib disposed in a vertical plane. This rib includes a plurality of plies of paraffin impregnated paper and it is desirable that a staple be passed through these several plies to hold them securely together by mechanical means and to insure that the container will not open accidentally, but only by design.

The several elements comprising the stapling machine are therefore particularly designed for use in connection with paraffin impregnated fiber sheets and in addition, means is provided for heating all those portions of the stapling machine which lie adjacent to the container rib when it is presented to the machine for the purpose of stapling, this in order that any fragments or flakes of paraffin which may be detached from the container rib and pass on to the operating parts of the stapler shall not there solidify and "freeze" such parts. Heating of the stapling mechanism in the manner specified, also enables the stapler to perform its function in a superior manner upon a paraffin coated container, particularly one adapted to contain liquids. Thus, the stapling wire which is fed to the stapling machine and from which the staples are formed is heated to a temperature at or near the melting point of paraffin and hence, as the heated staple points pass through the container rib, the paraffin with which it comes in contact, is melted or rendered plastic and, at the conclusion of the stapling operation, makes a very close bond, upon cooling, with the staple itself. There is no tendency therefore for a liquid to escape from the container by flowing outwardly along the surfaces of the staple prongs.

One form of stapling mechanism constructed in accordance with the present invention is set forth by way of example in the following description and is illustrated in detail in the accompanying drawings, in which

Figure 1 is an end elevation of the entire mechanism;

Figure 2 is a side elevation of portion of the same;

Figure 3 is a plan view;

Figure 4 is a section on line 4—4 of Figure 3 to a somewhat larger scale;

Figure 5 is a view similar to Figure 4 but showing certain of the operating parts in different positions;

Figure 6 is a section on line 6—6 of Figure 5;

Figures 7 and 8 are views generally similar to Figure 6 but showing certain of the operating parts in different positions;

Figures 9 and 10 are perspective views, respectively, of portions of the staple forming and applying mechanism;

Figures 11 and 12 are sections on line 11—11 and 12—12 of Figure 5 respectively;

Figures 13 to 16 inclusive are similar sections through the wire engaging portions of the stapling mechanism, these portions being illustrated in various positions in the several views in order to bring out the sequence of operations which must necessarily follow in applying a staple;

Figure 17 is a section on line 17—17 of Figure 1;

Figure 18 is a section on line 18—18 of Figure 17; and

Figure 19 is a section on line 19—19 of Figure 2.

A paper bottle or container of the type which the stapling mechanism is particularly suited to act upon is illustrated in chain lines in Figures 1, 2, and 3, being indicated at C in these views. It comprises essentially a tubular member of paper, square in horizontal section, and having a top portion in the nature of a gable roof, which terminates at its top in a transversely extending vertically disposed central rib C'. This rib comprises five or six plies of stiff paper lying in parallel planes and by means of the improved stapler, these several plies are secured together. First referring to the rather diagrammatic Figures 13

to 16 inclusive, the functions of the stapling mechanism may be understood. Thus, in Figure 13 the rib C' of the container is shown in chain lines and is positioned between a mechanism for forming and advancing the staple and a mechanism for clinching the ends thereof. In these figures that portion of the mechanism which lies to the right of the rib C' comprises the means for shearing a length of wire W from the end of a much longer piece, forming this short length of wire into the U-shaped staple indicated in dotted lines in Figure 14 and forcing the ends of this U-shaped piece through the rib C', as shown in Figure 15. That portion of the mechanism which lies to the left of the rib C' in these figures comprises the clinching or heading over mechanism by means of which the free ends of the staple wire which are projected through the rib are headed over or clinched. The resulting article is illustrated in Figure 16, the staple having been completely applied and its ends clinched and the container C being ready for removal from the stapling machine, which removal may be effected after the staple applying mechanism has been retracted.

The greater portion of the stapling mechanism is supported upon a bridging member or frame 10, the ends of which are rigidly connected to substantial portions of a larger frame, for instance, the frame of a complete automatic container fabricating, filling, closing and sealing machine, parts of this frame being indicated at F. The housing in which the staple applying parts are enclosed is indicated at 11, and as shown is suspended from the bridging member 10. Beneath the housing 11 are located the parallel container supporting rails 12 upon which the bottoms of the containers C rest as they are moved successively into and out of position to be acted upon by the stapler, these containers C being gripped between gripping members 13 which members are in turn mounted upon a conveyor chain which is supported by and intermediate the parallel rails 12 and is driven with a step by step advancing movement by mechanism which is not illustrated. It will be appreciated that it is a function of the container supporting and conveying mechanism just described to place a container C with its central upper rib between the jaws of the stapling machine, to maintain it in this position while the stapling operation is carried out and to thereafter remove the stapled container and substitute an unstapled container. The rails 12 together with the conveyor chain are vertically adjustable so that containers of various heights and capacities may be presented to the stapling jaws.

A coil of wire from which suitable lengths may be fed into the stapling machine for the formation of the staples is indicated at 15, the free end of this wire being passed through the guide 16 thence downwardly through the wire feeding mechanism generally indicated at F, thence through the guide 17 and finally through an aperture 18 formed in the side wall of the housing 19 which encloses the active stapling mechanism, the feeding mechanism supplying such length of wire for each operation of the stapler that the end thereof extends transversely across this last mentioned housing, the end contacting with the inner wall of the housing directly opposite the aperture 18, as shown in Figure 13. In passing transversely through the interior of housing 19 the wire end W likewise passes through a notch 20 formed in the end of a rocker member 21 lying in close proximity to the notched face of a hardened steel block 22 which I designate an anvil member since it is the function of this member to support the central portion of the wire W while its ends are being turned forwardly in the formation of a staple. The rocker member 21 is shown in Figure 5 to occupy the position to which it must necessarily move to assist in the formation of a staple.

When so positioned, the driver 23 and the shearing and shaping block 24 mounted thereon are caused to move forwardly toward the wire. Driver 23 comprises an elongated plate like member having the wire receiving groove 25 in its forward end and the block 24 is superposed upon the driver and adapted to have a limited sliding movement longitudinally thereof. Block 24 has downwardly extending side portions embracing the sides of the driver and forwardly extending parallel arms 26 with notched end surfaces 27 and interior mutually facing wire receiving grooves 28. Upon the top of block 24 is secured, by means of a screw 29, a spring abutment block 30 and the head 31 of this screw lies within an elongated slot 32 formed in the driver, the relative longitudinal movements of block and driver being therefore limited to the distance which screw head 31 may travel in slot 32.

Secured to the top of the driver is a plate 33 having an upstanding flange 34 and a lateral projection 35 to which the latch 36 is pivotally connected at 37. With the latch 36 positioned as shown in Figures 7 and 10, forward movement of the driver results in simultaneous forward movement of block 24 and this simultaneous movement of driver and block is continued, in the ordinary operation of the device, until the cam arm 40 of latch 36 contacts the stationary stud 41 secured to the housing. The mechanism is so designed, and the stud so positioned, that driver 23 and block 24 will move simultaneously forward or toward the wire W until the wire has been severed by the operation of that arm 26 of the shaping block 24 which moves over the inner end of the wire entry port 18 and will be further continued until the forward ends of arms 26 are in contact with the rib C' as shown in Figure 14, the anvil 22 of the rocker 21 during this time remaining in the position in which it is shown in Figure 13 so that the ends of wire W are turned forwardly by the action of arms 26 and are caused to lie in grooves 28 formed in these arms.

At this point the latch 36 is swung laterally by contact of its camming arm 40 with the stud 41 so that movement of the driver 23 no longer necessarily results in forward movement of the shaping block 24. As the ends 27 of the arms of the shaping block are in contact with the rib, the block will then remain stationary while the driver continues its forward movement, passing from the position in which it is shown in Figure 14 to the position in which it is shown in Figure 15, the parallel ends of the staple being driven through the rib C' and being slightly deflected upon the far side of the rib by the clinching elements 42, as shown in Figure 15. Soon after the driver commences its independent forward movement, propelling the formed staple before it, its forward upper edge contacts with the inclined rearwardly facing cam surface 43 of the rocker 21, lifting the rocker out of its path of movement. During this time, also, the screw head 31 is approaching the rear end of slot 32 and the spring 44, the ends of which abut, respectively, against the block 30 on shaping block 24 and the flange 34 movable with the driver, is being compressed. Spring 44

encircles a rod 45 the forward end of which is mounted in block 30 and the rear end of which slidably extends through flange 34.

Eventually screw head 31 contacts with the rear end of slot 32 and driver and forming block 24 are again positively connected for forward movement, so acting together as to bear, as a unit, against the entire central portion of the rib of the container and to exert a final pressure. After insertion of the staple, the driver 23 will be retracted and in its retracting movement the forming block will remain stationary until the end of slot 32 contacts with screw head 31, spring 44 expanding meanwhile, and the parts again assuming the relative positions in which they are shown in Figure 10. During the rearward movement of the driver the inclined cam surfaces 33' formed on bracket 33 contact with the ends 21' of rocker 21, thus moving this rocker in a counterclockwise direction and resetting the rocker in the position in which it is shown in Figure 5. During this rearward movement of the driver also, the latch 36, the lower face of which frictionally engages the floor of the housing, turns into its locking position, as shown in Fig. 7, the cam arm 40 having disengaged the lug 41. The grooves 28 formed in arms 26 within which the forwardly extending arms of the staple lie naturally support these arms as the staple is forced through the paper rib C' and crumpling of the staple thereby prevented.

Power for effecting reciprocatory movements of the driver is derived from uniformly rotating shaft 50 suitably supported in bearings mounted upon the frame F. Upon this shaft is mounted a cam 51 having a cam path 52. Lying within this cam path is a roller 53 mounted upon an arm 54. Arm 54 is parallel to and lies immediately in front of (Figure 2) an arm 55, the lower end of which is rotatably supported upon a fixed stud 56, a sleeve like projection 55' from this arm, encircling the stud, projecting into a longitudinally elongated aperture 54' formed in the lower end of arm 54. The outer diameter of sleeve 55' is approximately the same as the width of slot 54', the arm and sleeve therefor having no relative movement horizontally (Figure 19) the arm 54 being adjustable vertically through a distance determined by the length of slot 54'. By means of adjusting screws 54^2 the arm 54 may be positioned as desired relatively to sleeve 55' within the limits of slot 54'. At its upper end, arm 55 is provided with a cylindrical aperture 55^2, through which extends the stud 57 secured to arm 54 and which supports roller 53. Upon the upper end of arm 55 is formed a circular undercut groove within which is slidably retained the circular rack 58, this rack being normally retained in fixed position in the slot by means of spring pressed detent 59. This detent will be automatically depressed to inoperative position should the stapling mechanism become jammed from any cause, thus breaking the driving connection between this mechanism and drive shaft 50.

The diameter of aperture 55^2 is at least sufficiently great to provide as much space for adjustment of stud 57 therein as there is room for adjustment of arm 54 relatively to sleeve 55', as determined by the length of slot 54'. There may be also lateral adjustment of arm 55 with respect to stud 57 and arm 54. The teeth of rack 58 mesh with those of rack 61 slidably mounted in the stapler housing and to which the driver 23 is secured.

By the means just described, it is possible to vary the travel of rack 61, lowering of the lever 54 resulting in increased rack travel and raising of this lever causing decreased rack travel, as will be obvious. Adjusting screws 60 may be manipulated to rock arm 55, relatively to arm 54, about the axis of stud 56, and to maintain these arms in desired angular relationship. By such manipulation of screws 60 the position of rack 61 and driver 23 may be adjusted relatively to cam roller 53 and hence to the stapler housing and other parts.

The clinching members 42 are shaped as shown in Figures 6, 12, and 13 to 16. There are hardened steel elements, pivotally mounted to rock about parallel axes 62 and normally urged to the positions in which they are shown in Figure 6 by spring pressed plungers 63 so that the inner ends of these clinching elements are in contact with the lower end of a rocker 64 pivotally mounted upon a horizontally extending arbor 65. The upper end of rocker 64 lies in the path of movement of the forward end of a plunger or ram 66, slidably supported in the housing and extending in a direction parallel to the path of movement of the driver 23. Normally this plunger or ram 66 is urged forwardly so as to strike rocker 64, by means of a spring 67, one end of which rests against a collar 68 secured to the plunger and the opposite end of which rests against a stationary part 69 of the housing. At its rear end, plunger 66 is provided with a nut 70. Nut 70 is adapted to be engaged by the extreme rear end of a latching member 71 pivotally mounted at 72 upon the housing and which is normally urged in a counterclockwise direction (Figure 6) by a compression spring 73 so as to move into locking engagement with nut 70 whenever nut 70 is moved beyond the end of locking lever 71. Rearward movement of plunger 66 against the action of spring 67 is brought about by the driver operating mechanism, the bracket 75 secured to rack 61 having spaced upstanding portions which pass upwardly on opposite sides of locking lever 71 and plunger 66 and into position to engage the forward end of nut 70. It will be readily seen that movement of the rack 61 and driver 23 to the right (Figure 5) will cause engagement of bracket 75 with nut 70 hence, of simultaneous movement of plunger 66 in the same direction or until nut 70 has passed beyond the end of locking lever 71 and the lever 71 has been operated by the spring 73 to engage the nut.

Release of plunger 66 can only be effected by withdrawal of locking lever 71 from contact with nut 70 and this is effected, at the proper time in the forward movement of the driver (which is after the staple has been driven through the rib C' as shown in Figure 15) by the engagement of the head of screw 76 with the depending arm 77 of the rocking lever. As soon as this engagement occurs, the locking lever is rotated in a clockwise direction, nut 70 is disengaged and the plunger 66 is allowed to move suddenly forward under the influence of spring 67 to strike the upper end of the rocker 64 and to cause this to rock suddenly in a counterclockwise direction and to cause the two clinching members 42 to rock about their pivotal axes from the position in which they are shown in Figure 15 to the positions in which they are in Figure 16, thus clinching over the protruding ends of the staple. Plunger 66 will remain in this position until nut 70 is engaged by bracket 75 upon the returning movement of the driver 23 and rack 61. By manipulating the screw 76 the time of release of the

plunger 66 may be varied with relationship to the operations of the staple applying mechanism.

The wire feeding mechanism is designed and constructed to feed, into the stapling mechanism, the proper amount of wire and at the proper times. Wire passing through the guide tube 16 and through a boss 80 rigid with the frame passes vertically downwardly, after issuing from the bottom of the boss and along the vertically disposed face of a hardened steel guiding member 81. Positioned opposite guide 81 is a toothed locking pawl 82 normally urged by a spring into the position shown in Figure 1 in which position its serrated end engages the wire and prevents upward or return movement of the wire while at the same time freely permitting downward movement. Positioned adjacent the lower end of the guiding member 81 and just above the upper end of the guide tube 17 are the rotatable wire feeding disks 83 and 84, these disks being disposed in the same vertical plane (which also includes the wire) and being mounted to rotate about parallel axes. Each of the disks includes a peripheral raised portion, these portions being indicated at 83' and 84' and it is the cylindrical edge surfaces of the raised portions 83' and 84' which engage the opposite sides of the wire as the disks are rotated in the directions of the arrows (Figure 1), the wire being pinched between such surfaces and fed downwardly so long as both surfaces are in contact therewith and the disks are rotating. The wire engaging surface of either portion 83' or 84', or both, may be roughened to ensure against slippage. The disks 83 and 84 are driven at the same angular velocities and normally cooperate in feeding equal lengths of wire forwardly for each complete revolution thereof. Disk 84 is fixed on its supporting shaft 85 but disk 83 is so mounted upon shaft 86 that its angular position on the shaft may be varied as desired. By varying the angular position of disk 83 upon its shaft the length of the raised portion 83' thereof which cooperates with the raised portion 84' of disk 84 may be varied as desired and hence the amount of wire fed for each operation of the disks in conjunction regulated.

Shaft 85 is mounted in frame 10 and shaft 86 is mounted in a rocking bracket or frame 87 which is pivotally supported by stud 88, which extends through its lower end, so as to be rockable in a plane parallel to the plane of the feeding disks 83 and 84. At its upper end the rocking frame 87 is apertured and through this aperture extends a threaded stud 90 having a nut 91 thereon which comprises the outer abutment for a coiled compression spring 92 by means of which the upper end of the rocking frame is normally maintained in contact with a portion of the stationary frame. Shafts 86 and 85 have fixed thereon respectively driving gears 94 and 95, it being the function of these gears to transmit the rotary motion of shaft 85 to shaft 86. Shaft 85 is driven at uniform angular velocity by power derived from the main drive shaft 50, gearing including a spiral gear 96 fixed on shaft 50, intermediate spiral gear 97 and spiral gear 98 fixed on shaft 85, transmitting this rotary motion. It will be obvious that so long as shaft 50 is rotating, the feeding disks 83 and 84 will function to feed equal lengths of wire to the stapling mechanism.

As it sometimes occurs during the operation of the automatic machine of which this mechanism comprises a portion, that no bottle is properly presented to the stapling mechanism, while at the same time the stapling mechanism continues to be driven, it is desirable to provide means for preventing the feeding of wire, and for preventing the operation of the clinching mechanism, whenever the conveyor fails to present a container to be stapled, to avoid clogging of the stapler mechanism with wire and injury to the clinching elements 42. This safety mechanism includes a bottle detecting finger 100 mounted upon a bell crank lever 101, which lever is pivotally supported upon a bracket connected to the outer conveyor rail 12 so that it may rock in a horizontal plane. The finger 100 is engaged by a bottle moving into position to be stapled and is moved outwardly thereby to the position in which it is shown in full lines in Figure 3. When no bottle is presented, it occupies the position in which it is shown in dotted lines in this figure. To the outer arm 102 of the bell crank lever is pivotally connected one end of a link 103 which extends rearwardly of the machine in a diagonal direction and has its opposite end pivotally connected to an arm 104 fixed upon the lower end of a shaft 105. Shaft 105 is suitably supported in a bracket 106 at its lower end and a bracket 107 at its upper end, bracket 106 being connected to the inner conveyor rail 12, and bracket 107 to the frame 10.

The upper end of shaft 105 is squared and passes through a squared opening in an operating lever 108. The left hand end of this operating lever (Figure 3) is bifurcated and the spaced ends of the arms thereof carry rollers which lie within an annular slot 109 formed in a sleeve 110 mounted upon shaft 85 in such manner as to be freely slidable longitudinally thereof. A collar fixed on shaft 85 is indicated at 111 and a coiled spring 112 interposed between fixed collar 111 and sleeve 110 normally urges this sleeve from the position in which it is shown in full lines in Figure 3 to the position in which it is shown in dotted lines.

When sleeve 110 occupies the dotted line position just referred to, its forward end lies in the path of movement of a cam member 113 fixed on gear 94 and hence will be engaged by the raised portion 113' of this cam (Figure 18) when gear 94 reaches a certain predetermined point in its rotation. Naturally the engagement of the cam portion 113' with sleeve 110 will cause rocking motion of the rocking frame about its pivot 88 and against the action of spring 92, thus separating the wire feeding disks 83 and 84 so that these disks cannot cooperate with each other during the time that cam portion 113' is in contact with sleeve 110. As normally the spring 112 tends to move sleeve 110 into the position to effect separation of the wire feeding disks, and to also move through the linkage described, the detector finger 100 to its dotted line position (Figure 3) the wire feeding mechanism may be said to be normally inoperative. It is only when the detector finger 100 is moved outwardly due to the presence of a container properly positioned with respect to the stapling mechanism that the sleeve 110 is positively moved rearwardly against the action of spring 112 and out of the path of cam 113, the wire feeding mechanism being operative only so long as this condition exists.

The presence or absence of a container likewise is determinative of the operation of the plunger 66. It will be seen in Figure 3 that the arm 108 has an extension 118' on the opposite side of the shaft 105 from sleeve 110. To this arm is connected by means of a link 119 the upwardly extending arm 120 of a latching member 121 pivot-

ally mounted upon a stud 122 rotatably supported in the frame. The extreme end of latching member 121 is adapted to fall into the path of movement of nut 70 of plunger 66, when the plunger and nut are at their rearmost positions. As a matter of fact, this is the normal position of latch 121 and hence the plunger 66 may not move forwardly unless this latch, as well as latch 71, has been moved to releasing position. By means of the bottle detecting mechanism previously referred to, which operates shaft 105 and lever 108 when the bottle is present, the latch 121 is lifted and the plunger allowed to operate whenever a container is present.

A steam conduit is indicated at 125 and inlet and outlet conduits therefor at 126 and 127. By passing steam through these conduits while the mechanism is functioning, all of the parts are maintained at a temperature equal to or higher than that at which paraffin melts. The wire staple itself is raised to such a temperature prior to the time that it is forced into the paper rib of the container. Hence, any paraffin which is scraped off or which breaks off of the container rib and which passes on to the operating parts of the machine cannot solidify and clog the machine but on the other hand will remain liquid and will eventually escape. Furthermore, the action of the heated parts upon the container rib itself is beneficial, the paraffin being caused to flow under pressure and to occupy all cracks or apertures for the possible escape of liquid from the container. The staple, after having been inserted, firmly holds the several plys of the rib together and during the hardening of the paraffin after the stapled container has been removed from the stapling unit.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A stapling mechanism comprising in combination, wire feeding means, staple forming and advancing means, staple end clinching means and mechanism for rendering the clinching means inoperative in the absence of an article to be stapled intermediate the staple forming and advancing means and the clinching means without modifying the action of the staple forming and advancing means.

2. A stapling mechanism comprising in combination, driving means, wire feeding means, staple forming and advancing means, staple end clinching means and mechanism for rendering both the wire feeding and clinching means inoperative in the absence of an article to be stapled intermediate the staple forming and advancing means and the clinching means without interrupting the operation of the driving means.

3. The method of securing the multi-ply closure rib of a container fabricated of paraffin coated paper in the fabrication of a leak proof package for liquids, which comprises heating a staple to or above the temperature at which paraffin melts, passing the staple into said rib while so heated, and thereafter permitting the same to cool and the paraffin melted thereby to solidify around the staple, thus effecting a leak proof seal between paper and staple.

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