The subject matter of the present invention is an improved stapling machine of the type adapted to drive relatively heavy strips, although in the broader aspects of the invention it is not limited in this respect. One object of the invention is realized in the provision of an efficient stapling machine characterized by a one piece frame having means for conveniently positioning the rear part of a staple supporting rail relative to the rear part of the frame for locating the rail transversely of the frame and including spaced sides having means for readily positioning and locking the forward part of the rail relative to the forward part of the frame for locating the rail longitudinally of the frame. The invention has as a further object the provision of a stapling machine in which the sides of the frame and rail include means for positioning and locking a housing relative to the frame for readily locating the rail vertically of the frame. The invention further comprehends as an object the provision of a stapling machine wherein the sides of the housing comprise means for readily positioning a sheath relative to the sides of the frame to locate the sheath transversely, vertically and longitudinally of the housing and wherein the sides of the sheath include means for readily interlocking with the housing to sustain the sheath in its located position.

The invention has as an additional object to provide an improved stapling machine wherein the sheath is in the form of a channel led member having means for locating the staple carrying rail centrally of the frame and wherein the locating means is integral with the channel member and serves an additional function of defining a part of a vertical staple raceway with the rear vertical and transverse face of the channelled member which in cooperation with the forward face of the rail forms the remainder of the vertical raceway which in turn is in communication with the staple ejecting gap constituting the forward part of the staple guide passageway formed by the frame and the located rail centrally disposed therein.

Other objects, advantages and features of the invention are in part obvious and in part herein after pointed out, however, the novel features characterizing the invention are more particularly set forth in the following description and defined in the appended claims although it is to be understood that the invention both as to its organization and the method of assembly and/or operation together with the objects, features, and advantages thereof will be best understood from the following description of the herein disclosed embodiment when read in the light of the accompanying drawings in which:

Fig. 1 is a side view of the improved stapling machine accorded to the invention shown partly broken away to illustrate the internal construction.

Fig. 2 is a vertical and longitudinal sectional view of Fig. 1.

Fig. 3 is a sectional view taken on the line 3-3 of Fig. 2.

Fig. 4 is a sectional view taken on the line 4-4 of Fig. 2.

Fig. 5 is a sectional view taken on the line 5-5 of Fig. 2.

Fig. 6 is a sectional view taken on the line 6-6 of Fig. 2.

Fig. 7 is an exploded view in perspective wherein the housing is detached from the frame, and the sheath or closure is detached from the housing.

Fig. 8 is a perspective view of a part of the ram or staple driving means.

Fig. 9 is a sectional view taken on the line 9-9 of Fig. 2.

Fig. 10 is a perspective view of the staple supporting rail.

Fig. 11 is a sectional view taken on the line 11-11 of Fig. 1 and Fig. 12 is a fragmentary perspective view of the rear end of the pivoted arm.

Illustrative of the embodiment disclosed, the improved stapling machine is generally designated 2 and includes a base 10 to which is pivoted a swingable arm having a one piece pivoted frame 11 in which an inverted U-shaped staple supporting rail 12 is centrally positioned in respect to the sides 13 of the frame and each of the sides of the frame includes an inwardly overhanging flange 14 spaced from the upper wall of the rail 12.

The pivoted frame 11 is a one piece member and is provided at its rear end with a boss 15 having transverse wall 16 which is integrally interconnected with the sides 13 of the frame 11.

Boss 15 is provided with a reinforced integrally connected ledge or seat 17 having a depending pin 18 surrounded by a compression spring 19 which has its lower end encircling upstanding pin 20 secured to base 10.

Integrally interconnected ledge 17 and the transverse wall 16 is a depending central lug 21 having a transversely disposed opening 22 disposed in alignment with the aligned openings 23 of the lugs or ears 24 depending from the sides 25 of the frame 11.
of the rail 12 which has its rear end seated on ledge 17 and closely straddles boss 15. In other words boss 15 and ledge 17 support the rear part of the rail but boss 15 prevents transverse movement of the rail relative to the frame and hence serves as positioning means to locate the rail transversely of the frame. In such relation, alined and spaced openings 23 of the rail are also alined in alignment with opening 22 of the depending lug 14 which is integral with transverse wall 16 and extends forwardly thereof.

The forward part of rail 12 may also be quickly and accurately positioned relative to the sides of the frame for locating the rail longitudinally of the frame. In this connection it will be observed that each of the sides of the rail is provided with a laterally extending lug 25 adapted to be readily received in a recess 27 in each of the sides of the frame. Lugs 26 of the rail fit closely but removably with the walls of companion recesses 27 of adjacent sides of the frame and conveniently interlock therewith. By this arrangement the forward end of the rail may be readily positioned in respect to the frame and located longitudinally of the frame. With the rear part of the rail located transversely of the frame and the forward part of the rail located longitudinally of the frame alined openings 23 of the rail and opening 22 of the depending lug 21 are in alinement with the spaced alined opening 28 in the spaced sides 13 of the frame at their enlarged rear portions 29 thereof.

With the rear and front parts of the rail positioned and located in respect to the frame as described, the sides of the rail are in spaced relation relative to the sides of the frame and the top of the rail is spaced from the overhanging guide flanges 14 thus forming a passageway or channel 30 for slidably guiding the staples 31 of a staple strip longitudinally of the frame.

Extending upwardly from the sides of the frame and integral therewith are the spaced wings 32 which in turn are integrally interconnected by an arcuately shaped transverse closure wall 33 defining a chamber 34 with the front wall 35 of a rectangulally shaped and vertically disposed column 36 at the bottom of which lip 37 overhangs the front spaced faces 33 of the front side of the frame. It should be noted that lip 37 is integral with column 36 and the spaced flanges 14 and is provided with a longitudinally disposed relatively narrow channel 39 defining horizontally spaced shoulders 40 which form continuations of the undersurfaces of flanges 14, the channel 39 serving as relief for the crown of the staple during its advance under lip 37. Shoulders 40 of the overhanging lip 37 are spaced from the upper horizontal surface of the rail defining therewith a staple ejecting gap 42 which in effect is the forward part of the passageway 30. It should also be noted that the forward inverted U shaped and flat face 43 of the rail 12 is in the same plane as the front vertical face 41 of the overhanging lip 37 and constitutes a bearing for the driving blade of a displaceable ram or plunger hereinafter more particularly set forth.

Referring now to Fig. 7, it will be observed that the two wings 32 of the one piece frame extend laterally of the side 13 of column 36 although the latter is centrally disposed in respect to the frame at the forward end thereof, thus forming vertical shoulders 44 and the horizontal shoulders 45 extending laterally of the sides of column 36. Slidably guided by front and side walls of column 35 is a ram or plunger generally design-
the rear transverse vertical face of wall 72 of the housing serve as bearings for the driving blade 47 of the plunger 46. This driving blade is provided with a relatively shallow channel 77 defining corner shoulders 78 which cooperate with the rear face of a staple to drive the latter downwardly to be ejected out of the frame. The corner shoulders 78 of the driving blade also cooperate with the corners of a staple to prevent flowing of the corners of the staple towards the crown thereof during the driving displacement of the blade.

In the assemblage of the housing and frame, the forwardly projecting lugs 80 of the sides of the housing in cooperation with correspondingly shaped openings 81 in the U or channel shaped cover or sheath 82 constitute means for positioning this sheath in respect to the housing to locate the sheath transversely of the housing, that is, lugs 80 fitting into the spaced openings 81 also constitute means for interlocking the housing and sheath to prevent transverse displacement of the latter.

In locating the sheath on the housing, the spaced sides 83 are slightly spread apart to straddle the sides of the housing and moved in such fashion that lugs 80 enter into openings 81. Further movement of the sheath relative to the housing and projections 84 struck out of the sides of the sheath snap into openings 85 in the side walls of the housing. With pins 84 interlocked in openings 85, longitudinal movement of the sheath relative to the housing or rail is prevented and since rectangularly shaped lugs 80 closely but removably fit correspondingly shaped openings 81 in the sheath the latter is aligned or located vertically of the housing as well as transversely thereof.

Having located the sheath of the housing, it will be observed that the front inverted U shaped face 43 of the rail is properly located or positioned relative to the rear vertical and inner face 88 of the front wall 88 of sheath 82 so that the front face 43 of the rail is flush or in line with the vertical or front faces 87 of the spaced lips 88 struck out of the offset sides 89 of the sheath due to the limiting action of the Shirley curved or taper surfaced lips 90 of the lips or projections 88 (Figs. 2, 3 and 7). According to the invention lips 83 are formed by pressing or extruding the lower portion of offset walls 85 slightly inwardly, thus forming relatively small indentations 92 in the outside surface of the offset walls 89 of the sheath 82. By the present construction, sheath 82, a one piece member, is provided with a staple raceway 93 formed by the rear face 85 of the front wall 88 and the aligned vertical faces 87 of the lips 88 and hence during use it is apparent that since a one piece member defining a raceway is provided relative movement or spreading between the front and rear faces of the staple raceway 93 is prevented. Raceway 93 may be said to be the curve of the upper portion of the raceway 93 formed by the parallel faces 43 and 85 (Fig. 6). It is also apparent that the lips 92 of the sheath properly locate or centre the rail relative to the frame to take care of tolerances or other uncontrollable variations that might creep in during the process of stamping various parts of the arm when pins 84 during assembly interlock with the sides of the housing. These lips 84 also cooperate with the lower front corners of the rail to prevent the sides of the rail from spreading.

During displacement of the driving blade 47, the rear face of the front wall 72 of the housing together with the front vertical face 41 of the overhanging lip 37 serve as bearing surfaces for the parallel front and rear surfaces of the driving blade 47.

When the rail is positioned relative to the frame, the housing in respect to the latter, and the sheath in respect to the housing, provided of course spring 99 has been properly disposed in chamber 34 and the ram or plunger has been appropriately mounted on the column, aligned openings 94 of the spaced sides of the housing automatically line up with the transverse bore 95 of the rectangular column 93, the rectangularly shaped openings 96 in the spaced wings 73 of the housing line up with rectangularly shaped openings 97 of the wings 32 of the frame, opening 98 in one wing of the housing lines up with opening 10 which receives clamping set screw 96, opening 99 of the housing line up with aligned openings 102 in the sides of the frame and the aligned openings 101 of the housing line up with the aligned openings 103 in the spaced sides of the frame.

Continuing with the assembling steps, pin or stop 108 is inserted in the aligned openings 94 and bore 95 and upset to form rivet 99. Brace or bar 105 is inserted into openings 96 and 97 so that its projection or detent 106 which has been extruded or struck out therefrom is driven past an inner surface of an adjacent wing 73 of the housing. Detent 106 cooperates with the adjacent inner surface of the contiguous wing to prevent withdrawal of the brace. Brace 105 is provided with a notch 107, the walls of which serve as stop means for nose 108 which is associated with the staple follower block 67 to limit forward movement of the latter after the last staple of the staple strip has been expelled.

Clamping screws 108 are utilized to hold the housing in its located position in respect to the sides of the frame. In this connection the shank of a set screw 108 is passed through an opening 101 of the housing and connected to an associated threaded opening 103 of a contiguous side of the frame.

The shank 99 of the clamping set screw 68 is inserted in opening 98 in the housing and is clamped against the adjacent head of the adjustable arbor 62 having a slotted end accessible through opening 99 in an opposite wall of the housing.

When sheath 82 is snapped into position on the housing, openings 110 of the sides thereof are in alignment with the aligned openings 102 and 101 of the housing and 103 of the frame respectively. To sustain such position, set screws 111 are employed. Each of these have their threaded shanks passing into opening 110 of the sheath and cooperate with the companion threaded openings 102 and 101 of the housing and the frame to permit clamping of the sides of the sheath against the sides of the housing and the latter against the frame.

Having assembled the arm, the enlarged rear portions 28 of the frame thereof are interposed between the spaced perforated upstanding lugs 112 of the base 15 taking up the lower portion of the base 15 of the frame 22 of the frame, rail and 76.
depending lug 21. Thereafter pin 113 is upset to form a rivet on which the frame is pivotally sustained. With the arm pivotally connected to the base, the plunger may be depressed to drive the staple in the staple vertical raceway previously ejected from the staple passageway. This vertical raceway is formed by the rear vertical face 85 of the front wall 86 of sheet 82, the opposing but parallel face 43 of the rail and front faces 67 of the lips 68 struck out of the sheath. When the staple strikes the shoulder 78 thereof abut the corners of the staple and the legs of the staple are driven against appropriate indentations of an anvil 114 to clinch or fasten the paper placed on the anvil in the customary fashion.

Briefly recapitulating several of the novel steps in the matter of assembling the several parts of the swingable staple carrying arm, it is appreciated, that the rail is first located transversely of the frame by slipping the rear end of the rail on the boss 15. Subsequently the rail is located longitudinally of the frame. In this instance lugs 26 of the rail are quickly moved into the interlocking recess 27. In such relation of the rail and frame, openings 23 of the rail are in alignment with openings 22 of depending lug 24 and openings 28 of the sides of the frame.

Pursuant to mounting the plunger 46 on the column 36 housing 71 is slipped on the forward part of the frame. Hence lugs 14 enter recesses 21 and abut fingers 25 of the rail. It follows that the forward part of the rail is thus prevented from being downwardly displaced. The rail is therefore located vertically relative to the frame. Consequently the rail is now aligned in three planes in respect to the frame. The shear is now moved over the lower forward end of the housing. Lugs 80 readily enter openings 81 in the sheath, hence locating the rail vertically and transversely of the housing. The projections 84 snap into openings 85 of the housing and the sheath is positioned longitudinally of the housing.

In the located position of the sheath, the depending sides of the rail are closely straddled by lips 88. These have the additional function of preventing the lower corners of the sides of the rail from spreading outwardly. Of course the front vertical faces 87 of the lips 88 are in alignment or flush with the front inverted U shaped face 43 of the rail and these faces are substantially parallel to the rear vertical face 85 of the front wall 86 of the sheath, thus forming a vertically disposed raceway 93 of the major portion of which is defined by the forward face of the rail and rear face 85 of the sheath. While the lower or complementary portion 89 of this raceway is formed by the front faces 87 and the lower portion of the rear face 85.

As many changes could be made in the herein disclosed embodiment and many widely different embodiments of this invention could be devised without departing from the scope thereof, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Claims:

1. In a stapling machine, a frame having spaced sides, a U shaped rail interposed between said sides longitudinally of said frame, means at the rear of the frame adapted to be straddled by said rail for positioning the latter in spaced relation in respect to said sides and transversely of said frame, interlocking means for positioning said rail longitudinally of said frame, and a housing mounted at the forward part of said frame and including means cooperating with said interlocking means for positioning said rail vertically of said frame.

2. In a stapling machine, a frame having spaced sides, means interconnecting the rear terminals of said sides comprising a boss, said sides at the sides thereof having recesses, a rail having a rear portion adapted to closely straddle said boss for positioning said rail transversely of said frame and in spaced relation to said sides, and laterally extending overlapping means carried by said rail and cooperating with said recesses to position said rail longitudinally of said frame.

3. In a stapling machine, a frame having spaced sides, a rail interposed between said sides and spaced therefrom to define a longitudinally disposed passageway, a member carried by said sides and having a rear face substantially parallel to the forward face of said rail to define therewith a vertically disposed raceway, and means projecting from said member and closely straddling the sides of said rail and having forward vertical faces spaced from said rear face and substantially in the same plane as said forward face of said rail.

4. In a stapling machine, a frame having spaced sides, a rail interposed between said sides and spaced therefrom to define a longitudinally disposed passageway, a member carried by said sides and having a rear face substantially parallel to the forward face of said rail to define therewith a vertically disposed raceway, means projecting from said member and having forward transversely disposed vertical faces spaced from said rear face and substantially in the same plane as said forward face of said rail, said projecting means straddling and cooperating with spaced lower portions of said rail to prevent transverse displacement of said portions relative to said sides.

5. In a stapling machine, a one piece frame having at its forward end a vertically disposed column the additional function of preventing the lower corners of the sides of said column, driving means having a channel shaped element interposed between said housing and said column and slidably guided thereby, a blade carried by said driving means, a member mounted on said housing and having a surface spaced from the forward face of said lip and defined therewith bearing means to slidably guide said blade, and means cooperating with said element to limit displacement of said driving means relative to said frame.

6. In a stapling machine, a one piece frame having at its forward end a vertically disposed column and an overlapping lip, a housing mounted on said frame in spaced relation to said lip and said column, driving means including a channel shaped element interposed between said housing and said column and slidably guided thereby, a blade carried by said driving means, and a member mounted on said housing and having a surface spaced from the forward face of said lip and defined therewith bearing means to slidably guide said blade, transversely disposed means interconnecting said column and housing, means disposed in said column and cooperating with said driving means to hold the latter elevated, said
element having means cooperating with said stop means to limit vertical displacement of said blade relative to said column.

7. In a stapling machine, a frame having spaced sides, a rail spaced from said sides, a housing mounted on said frame and having forwardly disposed spaced lugs, and a sheath mounted on said housing and having means for receiving said lugs to locate said sheath relative to said housing.

8. In a stapling machine, a frame having spaced sides, a rail spaced from said sides, a housing straddling said frame, a sheath mounted on said housing, interlocking means for locating said sheath transversely of said housing, and detent and indent locking means for locating said sheath longitudinally of said housing.

9. In a stapling machine, a frame having spaced sides, a staple supporting rail spaced from said sides, a housing closely straddling said frame and including means adapted to interlock with said sides and the sides of said rail, said housing having forwardly extending lugs, a sheath mounted on said housing and having openings for removable interlocking with said lugs to prevent vertical and transverse displacement of said sheath relative to said housing, and means carried by said sheath adapted to interlock with said housing to prevent longitudinal displacement of said sheath relative to said housing.

10. In a stapling machine, a member having a wall, means integral therewith and extending from lower portions only of said wall to define a vertically disposed staple raceway, and a rail closely straddling by said means integral with said wall to prevent spreading of the sides of said rail.

11. In a stapling machine, a frame having spaced sides including alined recesses at the forward portions thereof, a staple supporting rail interposed between said sides, projecting means at the rear of said frame to position said rail in spaced relation to said sides, said rail having laterally extending lugs cooperating with said recesses to position said rail longitudinally of said frame, and a housing mounted at the forward part of said frame and including projecting means adapted to sustain said lugs for positioning said rail vertically of said frame.

12. In a stapling machine, a frame having spaced sides including alined recesses at the forward portions thereof, a staple supporting rail interposed between said sides, projecting means at the rear of said frame to position said rail in spaced relation to said sides, said rail having outwardly extending lugs cooperating with said recesses to position said rail longitudinally of said frame, and a housing mounted at the forward part of said frame and including inwardly extending projecting means adapted to sustain said lugs for positioning said rail vertically of said frame.

13. In a stapling machine, a frame having spaced sides including transversely alined recesses at the forward portions thereof, a U-shaped staple supporting rail interposed between said sides, means at the rear of said frame to position said rail in spaced relation to said sides, said rail having laterally extending lugs cooperating with said recesses to position said housing relative to said frame, said projecting means constituting means to support said lugs to prevent downward displacement of the forward part of said rail.

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