

[54] **SEWING APPARATUS FOR THE FORMATION OF EDGE-PIPING OPENINGS**

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[58] Field of Search 112/68, 66, 65, 76, 112/75, 74, 264

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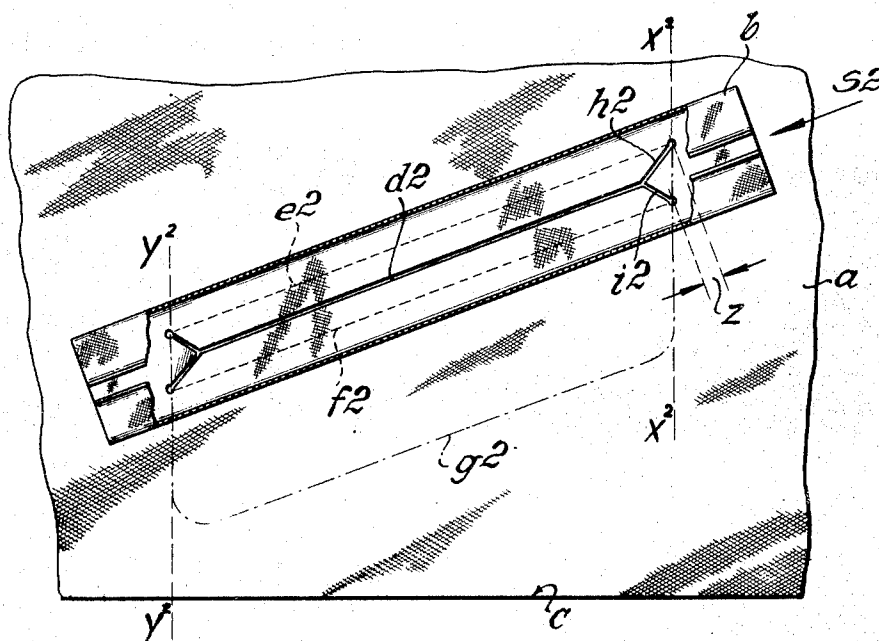
Primary Examiner—H. Hampton Hunter

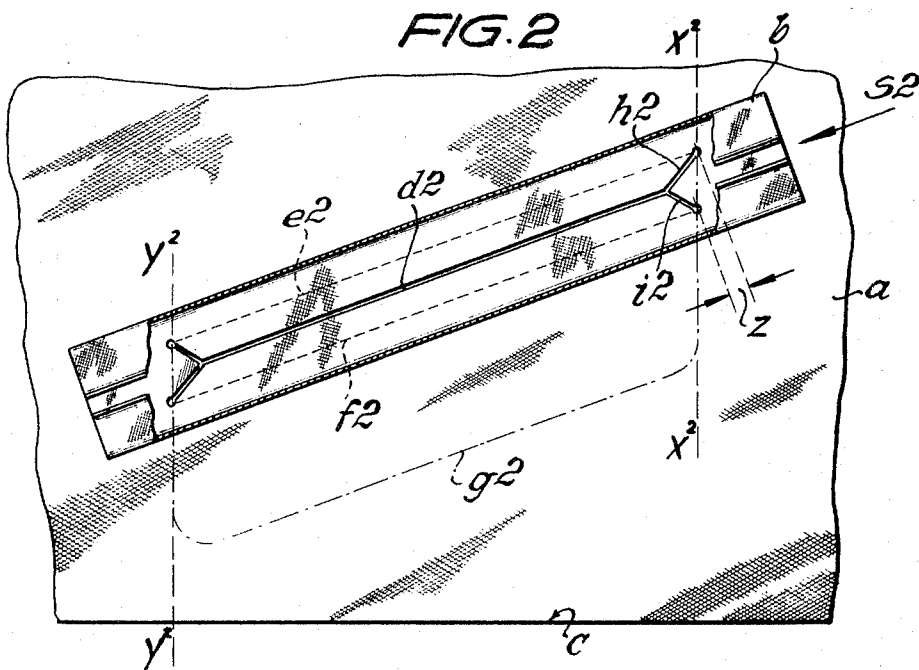
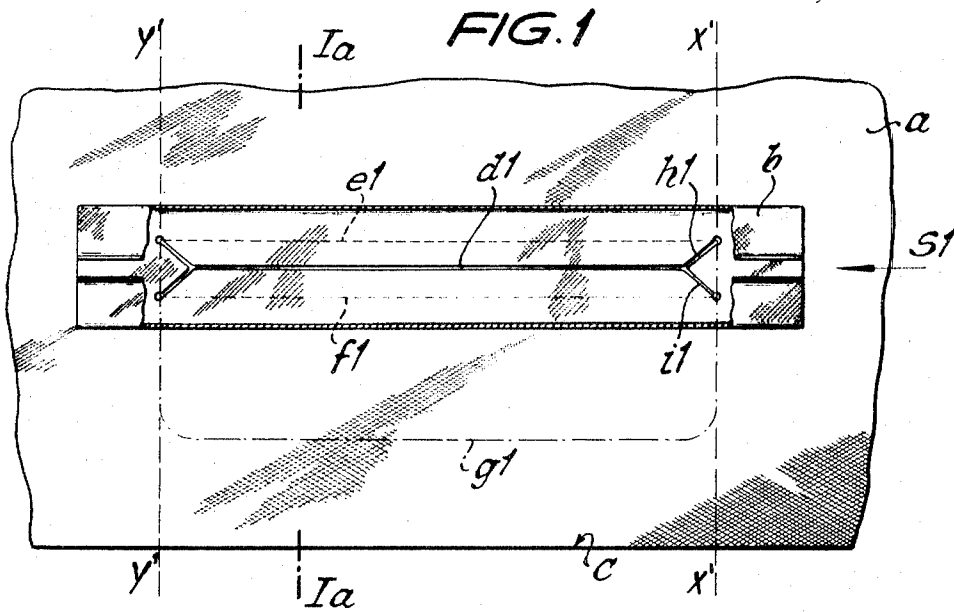
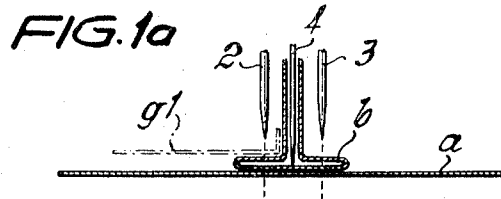
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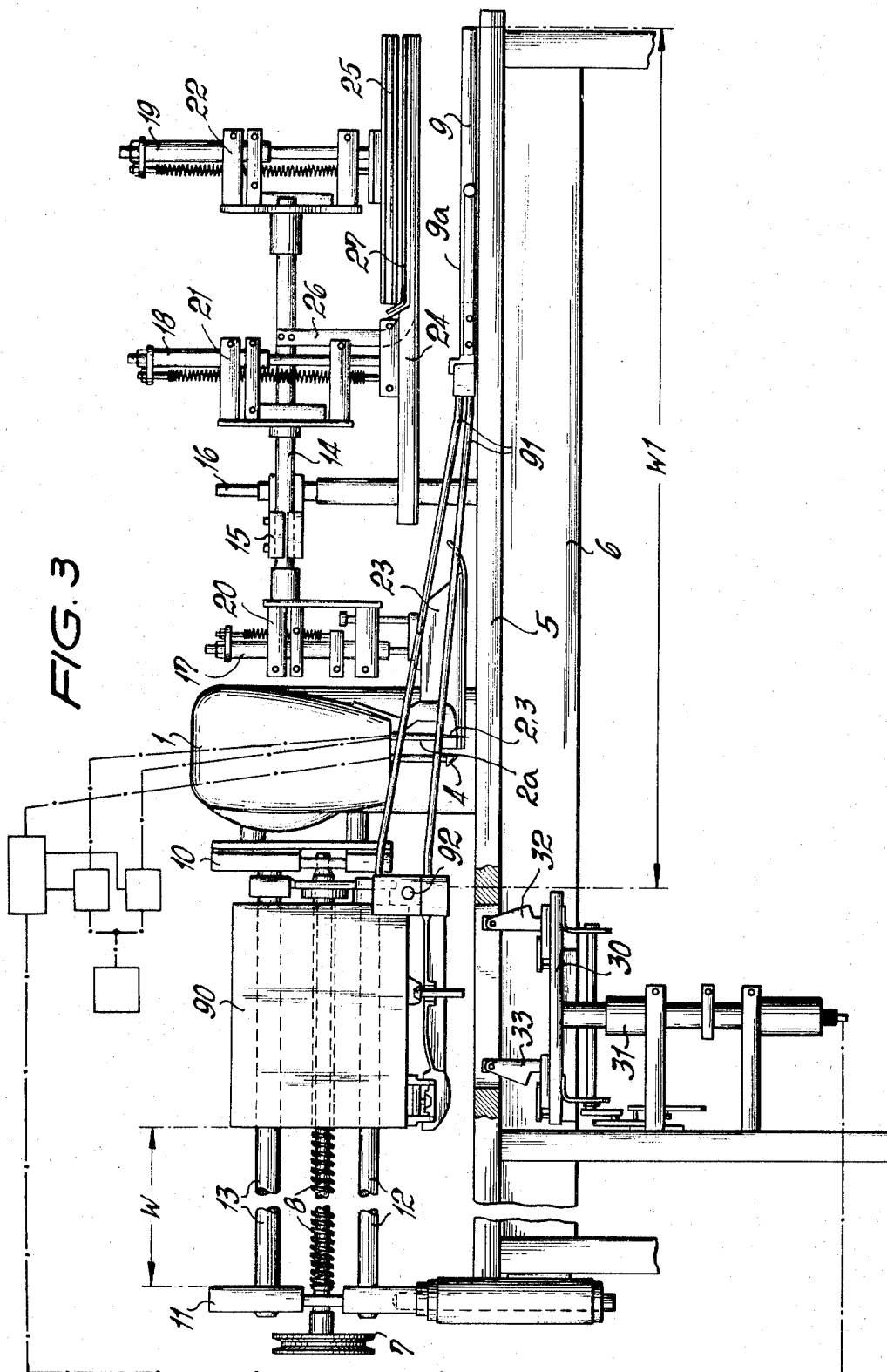
[57] **ABSTRACT**

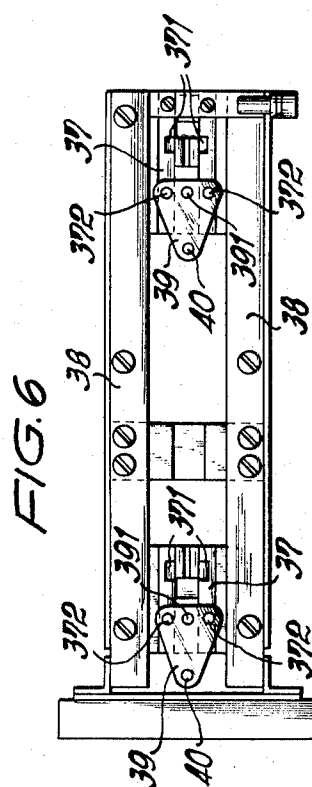
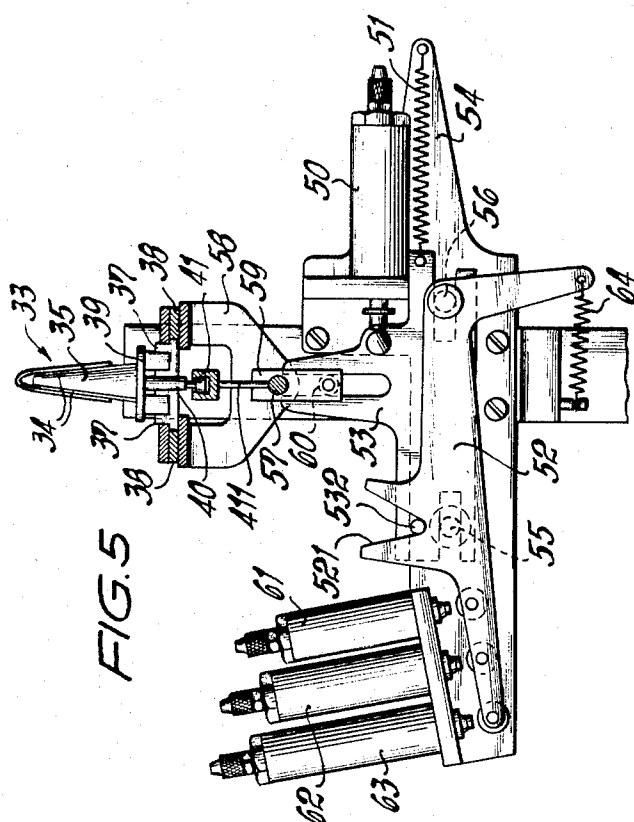
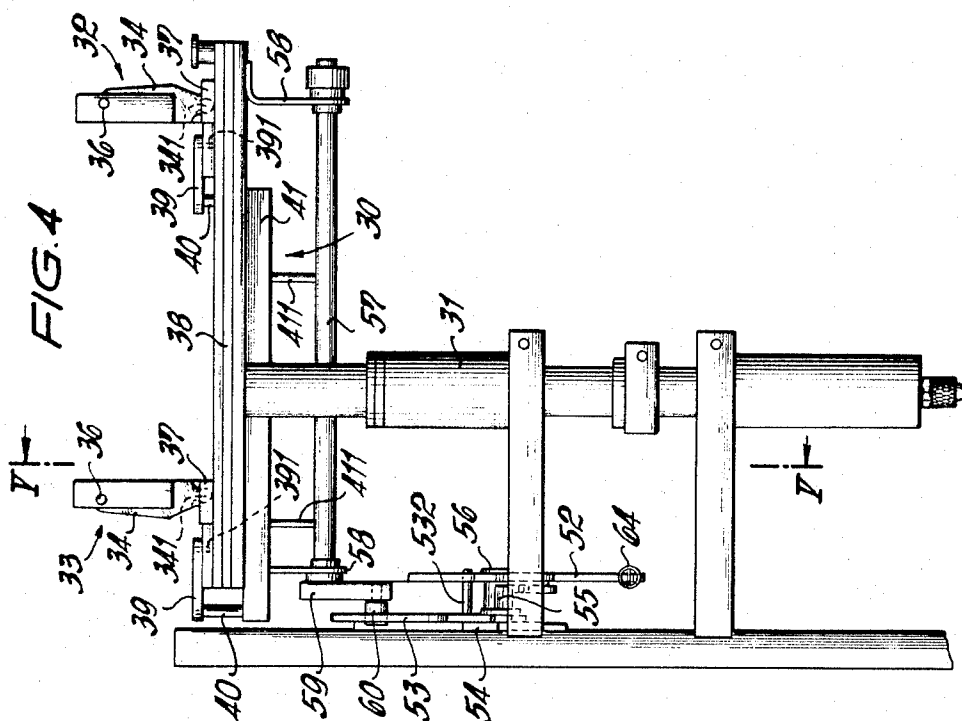
A sewing apparatus for stitching a piped-edge or welt border around an opening, e.g., a pocket slot or opening, in a garment fabric, in which the stitching is carried out with a double-needle sewing machine with adjustable interneedle spacing and cooperating with means forming the piping.

10 Claims, 7 Drawing Figures









SEWING APPARATUS FOR THE FORMATION OF EDGE-PIPING OPENINGS

FIELD OF THE INVENTION

Our present invention relates to an apparatus for providing a piped or bound outline opening in a fabric and, more particularly, to a sewing machine for the outlining of pocket openings, buttonholes, slots, slits or like apertures in a fabric, especially for outer clothing.

BACKGROUND OF THE INVENTION

In the manufacture of outer garments, it has become a common practice to provide pockets and other slit-like openings in the fabric for various purposes. To prevent the edge of the fabric defining the opening from fraying and to allow the opening to be stretched or deformed within limits, it has become the practice to reinforce the edge portions of the fabric surrounding the opening with extra fabric layers added element having lesser tendency to fray and high wear resistance. It has especially been desired to provide a so-called piping along the outline of an opening of the character described and to attach the binder strip to the fabric by a row of stitches or the like which may also attach a flap-like but fully stitched member to the pocket.

In the mass production of outer garments with pocket-holes and like openings, it may be required to handle large webs of fabric which are to be provided at spaced-apart locations with the aforementioned openings and suitable binding or piping therefor. The web may then be subdivided according to the desired pattern. In addition, or alternatively, the web may be subdivided and the binder applied to a succession of pieces of the fabric.

Conventional sewing apparatus for producing piped openings for pockets of the fabric adapted to be made into garments generally have devices for feeding the binder strip onto the fabric in a direction generally parallel to a seam edge of the article. It is difficult, if not impossible, with such conventional apparatus to provide pocket slits which are inclined to the seam direction of the fabric piece and the direction of displacement thereof. The apparatus is thus of limited utility and it has been long desired, in the mass production of garments to improve the versatility of double-needle sewing machines capable of stitching the edges of a pocket-hole or the like to enable them to accept pocket-hole slits which are inclined to the seam direction.

OBJECTS OF THE INVENTION

It is the principal object of the present invention to provide an improved apparatus for stitching the borders of pocket-holes and like slitted openings in a fabric workpiece.

Another object is to provide a system for increasing the versatility of conventional double-needle sewing machines so as to enable them, for example, to stitch the borders of slit-like openings parallel to a seam of the piece fabric or at an inclination to this seam.

Yet another object of the invention is to provide a sewing-machine arrangement for the purposes described which will avoid the drawbacks set forth above.

SUMMARY OF THE INVENTION

These objects and others which will become apparent hereinafter are attained, in accordance with the present invention, by the use of a conventional sewing machine

having a pair of needles (double-needle sewing machine) with adjustable needle-penetration points, i.e., a variable interneedle spacing, and capable of generating two rows of stitches of equal length but offset from one another while remaining parallel and having variable termination and start points and varying intersection length of the stitching rows. Advantageously, the apparatus comprises a double-needle sewing machine with independently driven and actuatable needle bars and an adjustable device for the simultaneous or offset switching of these needle bars. The actuating systems for the needle bars, which establish the seam start and end points and the actuating means for adjusting the intersection length and angle of the stitched seams are so connected together, according to the invention, that they are synchronized by a single selector device.

According to a more specific feature of the invention, the apparatus for producing finished or piped (bound) pocket openings in a fabric, especially in the mass production of outer garments, comprises a sewing machine having independently actuatable needle bars, i.e., needle bars which can be actuated to commence a stitch seam and terminate a stitch seam independently of one another, a blade between the two needles and adapted to slit the fabric along the intended opening between the two stitch seams, and angle-cutting means operable to produce generally Y-shaped angle incisions at each end of the main incision, the angle incisions having shanks or portions reaching substantially from the main incision outwardly toward the respective stitch seam.

According to an important feature of the invention, the angle-cutting means for producing the angular incisions is adjustable for regulating the lengths of these incisions in accordance with the angle at which the pocket is cut in the garment. Thus, when the pocket is parallel to an edge of the fabric or an edge seam thereof, as described above, the two incisions constituting each angular slit may be of equal length, the fabric being advanced in a direction perpendicular to the plane of the needles. In this case, the needles may commence the respective stitch seams simultaneously. When, however, the fabric is advanced at an angle to the plane of the needles and is intended to be cut at a bias to the edge or edge seam, for an inclined pocket, a leading needle may commence its stitch seam in advance of the trailing needle. In this case, the incision of the angle slit at one end of the pocket may be longer than the incision and the opposite ends and the two incisions of each angle slit will be of unequal length.

Advantageously, the angle-cutting means and the blades thereof forming the incisions or synchronized with the needle-operating means to adjust the incision length to the stitch offset and therefore the angle of the pocket. This may be achieved in accordance with a feature of the invention by providing a common programming means for both the angle-cutting means and the stitch-forming means.

It has been found to be desirable to provide the or each angle-cutting means with a pair of blades which are pivotally mounted upon a common support and have eccentric cutting surfaces. Thus, each blade may be constituted as a lever which is swingable to adjust the actual incision length produced thereby in the fabric. The sewing machine may be of any conventional construction having means for offsetting the stitch seam, although it is preferred to provide a machine

having means for actuating one needle bar after the other, i.e., for actuating the needle bars with a time offset.

The apparatus, of course, may be provided with any suitable means synchronized with the sewing machine and the cutting devices for advancing the fabric and feeding a binder strip to the stitch seams and, if desired, means for applying a stitched flap to the sewing site. This means is provided with a mechanism for adjusting the fabric-feed angle.

DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a plan view showing the orientation of a pocket slot parallel to the seam;

FIG. 1A is a section taken generally along the line IA — IA of FIG. 1 and additionally showing the needle arrangement;

FIG. 2 is a view similar to FIG. 1 illustrating another orientation of the pocket opening according to the invention;

FIG. 3 is a simplified elevational view, according to the invention, taken from the side;

FIG. 4 is a side-elevational view of an angle-cutting arrangement for forming the pocket opening according to the present principles;

FIG. 5 is a section taken along the line V — V of FIG. 4; and

FIG. 6 is a plan view of the apparatus of FIG. 4.

SPECIFIC DESCRIPTION

In FIGS. 1, 1a and 2, we have shown a piece of the fabric onto which a piped or bound pocket opening is to be stitched by an automatic sewing machine. In these Figures, the piece of garment fabric is represented at *a*, the binding material or piping material at *b* and the seam line of the garment, represented for reference purposes, is shown at *c*. The pocket in FIG. 1 is, of course parallel to the seam line *c* while in FIG. 2 the pocket runs at an angle thereto. In making the pocket, the fabric is slit along the lines *d*¹ and *d*² which form the eventual pocket openings.

In the pocket of FIG. 1 and in the pocket of FIG. 2, the starting points and ending points of the rows of stitches *e*¹ and *f*¹ and the rows of stitches *e*² and *f*², attaching the binding or piping material to the fabric along the slits *d*¹ and *d*² respectively, lie along or define lines *x*¹ — *x*¹ and *y*¹ — *y*¹ and *x*² — *x*², *y*² — *y*² respectively. These lines lie perpendicular to the seam edge *c*. This arrangement of the stitching rows ensures a binding of the edges of the pocket openings in such manner that the corners of the opening are covered by the pocket flap material represented at *g*¹ and *g*² for the parallel and inclined pockets respectively. The pocket-flap material is represented in dot-dash lines in FIG. 1.

The fabric is advanced during sewing and slitting in the direction of the arrows S1 and S2, i.e. parallel to the seam *c* and at an inclination to the seam in FIGS. 1 and 2, respectively.

From these Figures, it will also be apparent that, when the pocket opening is parallel to the seam, the stitch start point and stitch end point of the two seams *e*¹ and *f*¹ are at the same level, i.e., the lines *x*¹ — *x*¹ and *y*¹ — *y*¹ lie perpendicular to the slot *d*¹ and there is no offset

in the direction of fabric feed S1. For the inclined pocket of FIG. 2, the stitch start point of the upper seam *e*² is ahead of the stitch start point of the lower seam *f*² by a distance *z* in the direction of feed of the fabric S2. Since the seam length *e*² and *f*² are identical, the lower seam *f*² terminates beyond the upper seam *e*² by a corresponding distance *z* in the direction of fabric feed. The distance *z* is, of course, a function of the angle of inclination. In particular, $z = d \sin \alpha$, where *d* is the spacing between the start points of the two stitch seams and α is the angle included between the direction of feed and the seam *c* or the straight (parallel) position of the pocket.

Because of this difference in position of the stitch-start and stitch-end points, which correspond to the corners of the piped edges of the opening, the fabric must be slit or cut unsymmetrically at the ends of the main pocket opening (compare FIG. 2 with FIG. 1). With the parallel pocket (FIG. 1), both portions *h*¹ and *i*¹ of the angle cut at each end of the main or linear slit *d*¹ or equal length and the angle of each cut, as included with the slit *d*¹ is equal to the other. With the inclined pocket of FIG. 2, however, the portions *h*² and *i*² of the angle cuts, referred to as shanks, are of different length, the shanks including different angles with the main opening slit *d*². The offset of the stitch-start and stitch-end points, the variation of the length of the shank slits and the cutting angle of the angle-cutting device are proportional to the angle setting of the pocket slit *d*², i.e. the angle included between the direction S2 and the reference seam *c*.

The piped or bound pocket of the present invention may thus consist of a region of the fabric, preferably a piece of an outer garment, which is provided with a linear main slit flanked by a pair of stitch seams which may be offset from one another in accordance with the angle of inclination of the pocket opening to the fabric edge or each seam. At each end of the main slit, there are provided V-shaped angle slits whose individual incisions have been designated at *h*¹, *i*¹ and *h*², *i*², respectively. The stitch seam secures a binder strip to the fabric and, if desired, a stitched pocket, as represented at *g*¹ or *g*².

The apparatus for forming the pocket configurations illustrated in FIGS. 1 and 2, comprises a two-needle sewing machine 1 which may be of conventional construction and is provided with needles 2 and 3 on respective needle bars generally represented at 2a. The needle bars are individually actuable by, for example, clutches C₁ and C₂ between the machine drive represented diagrammatically at D, the clutches being mechanically, hydraulically, pneumatically or electrically controlled from the programming mechanism represented at P. In this construction, the needle bars are actuated with a relative time lag, i.e., one clutch is energized before the other, to achieve the offset in the stitch rows. It is also possible, and included within the present invention, to provide a sewing machine wherein the plane of the needles may be altered so as to remain perpendicular to the main slit, i.e., wherein the needle bars may be offset with respect to one another or from their normal positions. In the illustrated system, the second needle bar is actuated only after the first has performed several stitching operations. A typical sewing machine of this type is the DURKOPP machine 274-1* (*see U.S. Pat. No. 2,871,810). Between the needles 2 and 3, there is arranged a main cutting means in the form

of a blade 4 (see FIGS. 1a and 3), for cutting the main slit d^1 or d^2 between and parallel to the stitch seams e^1 , f^1 or e^2 , f^2 . The sewing machine 1 is mounted upon a sewing table or stitch plate 5 upon a support 6 and is driven by an electric motor (not shown, but diagrammatically represented at D) via the usual clutch arrangements which may be the clutches C_1 and C_2 . The motor is connected by a V-belt to the V-pulley 7 which is mounted upon a threaded spindle or lead screw 8, the latter forming part of the fabric-feed means, the feed mechanism being designated generally at 9.

The spindle 8 is journaled at one end in a bearing plate 10 affixed to the sewing machine 1 (FIG. 3) and at its opposite end in a bearing plate 11 mounted upon the support 6. The space between the two bearing plates 10 and 11 is spanned by two rails 12 and 13 which extend parallel to the spindle 8 and carry a slide 90 to the left and right under the control of the spindle 8. The slide 90 is connected by arms 91 with the fabric-feed structure 9.

The spindle 8 and the rails 12 and 13 are shown foreshortened or broken in FIG. 3, although it will be understood that their free lengths (corresponding to the normal displacement of the carriage or slide) may be of a value W which is at least equal to the stroke $W1$ of the feed device 9 during its normal operation. In the working direction, ahead of the sewing machine 1, there is provided a shaft 4 parallel to the table 5 and thereabove, the shaft being carried by an arm 15 vertically adjustable on a post 16 of the support 6. This shaft 14 carries three pneumatic cylinders 17, 18 and 19 via respective brackets 20, 21 and 22 forming a binder-feed arrangement adapted to deposit the binder material in the configuration of an inverted T (i.e., a configuration). Bracket 20 and the associated pneumatic cylinder 17 is provided immediately ahead of the sewing machine 1 and is formed with a folding rail also of inverted T configuration for folding the binder strip and feeding the same to the stitching site parallel to the stitch seams. The intermediate bracket 21 and its pneumatic cylinder 18 is located in the region of the stitch table or plate and is located above the garment piece which may be deposited thereon, while being provided with another inverted-T folding guide. The bracket 22 and the pneumatic cylinder 19 most distal from the sewing machine, is provided with a retaining clamp 25 co-operating with guide 27, for holding the binder step which will be advanced during the following steps of the cycle. The shaft 14 also carries, via a bent bar 26, the plate 27 forming part of the fabric hold-down mechanism and the binder clamp. The feed device may have the construction and operating modes described and illustrated in our commonly assigned concurrently filed application Ser. No. 244,780, entitled *Sewing Machine With Improved Binder-Feed Mechanism*.

The parts 24, 25 and 27 thus form a binder positioning and feeding mechanism co-operating with the main fabric-feed arrangement and operated in synchronism therewith. The binder strip for a subsequent stitching operation is disposed upon the plate 27 during a previous working cycle and pneumatic cylinder 19 is operated to clamp this strip in place via a clamping shoe 25. During the previous working cycle, the next piece of fabric, e.g. a portion of a sack coat, is disposed beneath the plate 27 on the cable 5 and is oriented manually or automatically via optical markings upon the cloth in accordance with conventional practice.

At the end of the previous working cycle, the fabric-feed mechanism 9 is lifted by withdrawal of the slide 20 to release the previously stitched fabric. Thereafter, the carriage 90 is shifted to the position illustrated in FIG. 3 and the feed mechanism 9 lowered onto the next fabric. Clamp 25 is simultaneously lowered to position the binder strip b upon the surface 9a of the fabric-feed shoe. The latter comprises two longitudinally extending spaced-apart parallel rails, each of which is connected by three links represented at 91 to the carriage 90 for swinging movement about the pivot 92.

As the fabric and binder, constituting the workpiece, are advanced to the left beneath the needles of the sewing machine, the folding guide 24 and the folding guide 23 are lowered to maintain the inverted-teeth configuration of the binder strip b during the stitching operation (see FIG. 1a). The two-part construction of these folding guides allows the guide portion proximal to the sewing machine to maintain the orientation of the binder strip during one sewing cycle while the other portion is used to orient the next binder strip for a subsequent cycle. The lengths of the foldings guides 23 and 24 are so arranged that guide 24 is free of the previous binder strip and can be raised while the stitching cycle is in progress to allow the new binder strip to be inserted.

As already noted, the sewing machine is energized to stitch two rows in parallel spaced-apart relationship with mutual offset depending upon the angle of the pocket slit. The stitch rows are thus formed while the blade 4 cuts the main or pocket slit d^1 or d^2 of a length which is less than the length of the stitch rows flanking same. The blade 4 is thereby actuated by the programmer P after the stitching operation commences and is deactivated before the end of the stitching operation.

The angle-slitting means, for producing the incisions h^1 , i^1 or h^2 , i^2 , which are to extend between the end of the slit d^1 or d^2 and the ends of the stitch seams to form a clean binding, are produced by blades 32 and 33. The angle-cutting device thus comprises an elevatable carrier 30 vertically shiftable by a pneumatic cylinder 31 to the plane of the table or somewhat thereabove so that the blades 32 and 33 can incise the workpiece.

As has been explained earlier, the effective length of the incisions produced by the blades 32 and 33 will vary depending upon the angle of the main or pocket-opening slit d^1 and d^2 , although the angle included between these incisions will generally remain at 90° . For this purpose, each of the angle cutters 32 and 33 comprises a wedge-shaped pin 35 carrying a pair of blades 34 swingably about an axis 36 close to the tip of the supporting pin 34. The blades are thus eccentric and cut the fabric to a length depending upon the angle at which the blades are tilted.

At its foot, each of the blades 34 is provided with a rounded formation 341 in corresponding recesses 371 of a slide 37 guided in a rail 38. Each of the slides of each angle cutter 32 and 33 is pivotally connected at 372 with a triangular lever 39 rotatable about a pin 391 and engaging via a downwardly extending ball stud 40 in a U-section rails 41. The angle cutters 32 and 33, which in construction and operation are identical, operate inversely or reciprocally since they are turned outwardly in opposite directions.

When the rail 41 is shifted to the left or to the right via an actuating mechanism to be described in greater detail hereinafter, the triangular lever 39 is swung

about its axis 391 and via a slide 37 and the linkage 372 causes the blade members 34 to swing about their axis 36 in opposite directions with respect to one another, thereby varying the cutting depth and the length of the incisions formed in the fabric. The rail 41 ensures proper reciprocity between the angle cutters at opposite ends of their carriers 30.

The lateral shifting of the rail 41 is achieved by a pneumatic cylinder 50 against the force of a spring 51. The cylinder 50 and the spring 51 are supported on a slide 53 shiftable on a plate 54 and guided by pins 55 and 56. The rail 41 is rigidly connected by two bars 411 with a shaft 57 which is rotatable in the angle member 58. The angle members 58 are connected to the rails 38.

At one end, the shaft 57 carries a crank arm 59 (bell-crank lever) having a pin 60 received between the arms and within a slit 531 of a bifurcated portion of the slide 53. Upon displacement of the slide 53, therefore, the shaft 57 is rotated and the control rail 41 connected therewith shifted to the left or to the right.

The pin 56 also carries a double arm lever 52 coupled with the slide 53 and having a displacement which is proportional to the desired angle of the pocket slit. The stroke is controlled by a selected one of the three pneumatic cylinders 61, 62 or 63 in which, for example, actuation of cylinder 61 corresponds to a pocket angle of 8°, actuation of cylinder 62 corresponds to a pocket angle of 16° and actuation of cylinder 63 correspond to a pocket angle of 24°. The lever 52 is displaced by the cylinders against the force of a spring 64. A triangular recess 521 of the lever 52 receives a pin 532 of the slide 53. In FIG. 5, we have illustrated the positions of these elements corresponding to a zero angle of the pocket, i.e., a pocket parallel to the edge or edge seam of the garment. However, when the pocket is to be orinated at an angle as described earlier, the corresponding pneumatic cylinder is actuated by the programmer P in accordance with the intended angle. The fabric is fed, stitched and slit as already indicated, whereupon the selector 31 is triggered to operate the angle cutters.

Of course, additional pneumatic cylinders may be provided along the array 61, 62, 63, so that other pocket angles may be accommodated. Furthermore, a stepless adjustability may be provided by replacing the pneumatic cylinders with an eccentric, cam and the like. Each selected position of the lever 52 is suitable for left-hand and right-hand pockets and thus it is possible by actuation of pneumatic cylinder 62 and the pneumatic cylinder 50 to form the right-hand pocket whereupon the left-hand pocket can be produced by de-energizing pneumatic cylinder 50 to provide pocket angles of 16°. The positioning of the fabric can be done by hand or automatically for the oppositely oriented pockets. The programmer P, of course, may also operate such selector means and in any event provides a single selector arrangement with considerable precision for the angle cutters, stitch-row length, offset and main-slit length.

The improvement described and illustrated is believed to admit of many modifications within the ability of persons skilled in the art, all such modifications being considered within the spirit and scope of the invention except as limited by the appended claims.

We claim:

1. A sewing apparatus for forming a piped-edge slit in a fabric, comprising:

a double-needle sewing machine having a pair of spaced-apart needles adapted to form respective stitch rows in a fabric workpiece;

means connected with said sewing machine for offsetting said stitch rows relative to one another in the longitudinal direction;

first cutting means for slitting said fabric work-piece between said stitch rows to form a main slit therein of lesser length than said stitch rows;

means for feeding said fabric workpiece and a binding strip past said needles and said first cutting means;

second cutting means operable for forming Y-shaped slits at each end of said main slit and including respective incisions reaching from the end of the main slit to the end of a respective stitch row; and means for adjusting the lengths of said incisions.

2. The apparatus defined in claim 1 wherein said means for feeding said workpiece and said binder past said needles and said first cutting means includes a fabric-fed mechanism adapted to shift the fabric work-piece selectively parallel to an edge thereof and at an angle to said edge to form parallel and inclined pocket openings respectively, said lengths of said incisions being determined by the angle of the pocket opening.

3. The apparatus defined in claim 2 wherein said second cutting means includes a pair of angle cutters each provided with adjustable blades, means for simultaneously displacing said angle cutters toward and away from said fabric workpiece, and common programming means for adjusting the longitudinal offset of said stitch rows and the positions of said blades in accordance with the angle included between said main slit and said edge.

4. The apparatus defined in claim 3 wherein said means for offsetting said stitch rows includes means for actuating said needles in time-delayed relationship.

5. The apparatus defined in claim 3 wherein said angle cutters each comprise a wedge-shaped pin, a support carrying said pin, said blades being pivotally connected to said pins at angles to one another and means for swinging said blades about respective pivot axes on said pins through angles determined by the angle included between said main slit and said edge.

6. The apparatus defined in claim 5, further comprising a pair of slides each connected with the blades of the respective angle cutter, respective triangular lever connected with each slide for displacing same and swingable about a respective axis, and common means for displacing said triangular levers.

7. The apparatus defined in claim 6 wherein said common means includes a pair of rails flanking said triangular levers and means for shifting said rails.

8. The apparatus defined in claim 7 wherein said means for shifting said rails includes a pneumatic cylinder and adjustable abutment means for limiting the displacement of said rails by said pneumatic cylinder.

9. The apparatus defined in claim 3 wherein said means for feeding said workpiece past said needles and said first cutting means includes a binder guide subdivided into a plurality of successive sections for feeding said binder onto said workpiece and toward said needles, said sections being so constructed and arranged as to permit a section proximal to said needles to continue to guide a previous length of binder while a section from said needles is operable to receive a subsequent length of binder.

10. The apparatus defined in claim 3 wherein said first cutting means is a blade mounted between said needles.

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