At the end of stitching one side of the buttonhole the finger under the buttonhole cam ***2*** moves sideways and moves the base plate to start the other side.

During this process the three-tooth wheel ***6*** fits into the end of the rack *7* and its teeth rotate while moving the base plate forward or backward a small amount until the teeth slot into the other side of the rack so that the zig-zag cam ***1*** can form the end of the buttonhole.

The pieces ***13*** and ***14***, Figure 32, are also levers, but the mechanism is hidden within the body of the Singer presser foot and cannot be exposed because the components of the body are riveted together; but see Figure 35.

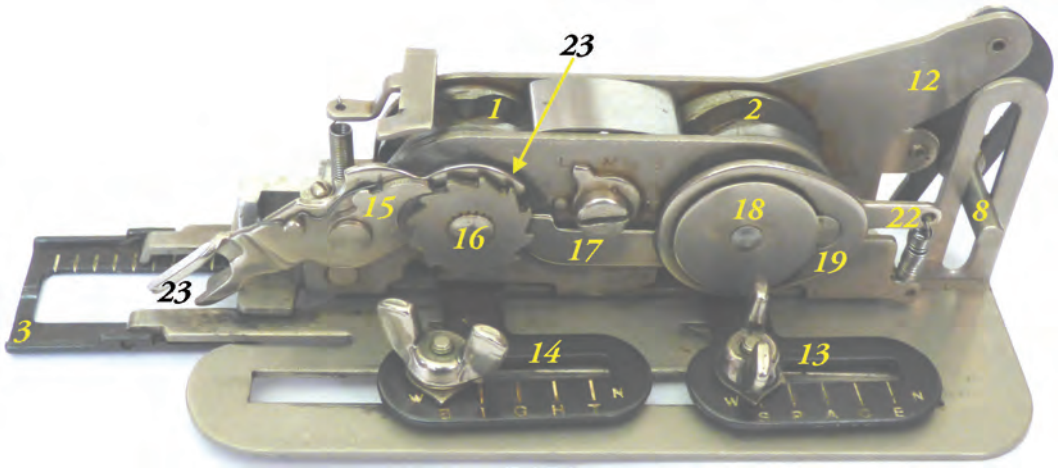


Figure 32

The lever ***13***, Figure 32, moves when the finger for the buttonhole cam ***2*** is pushed to one side or the other, and it moves the base plate sideways by varying amounts depending on the position of its wing-nut. This changes the space between the two rows of zig-zag stitches.

This happens twice for every rotation of the buttonhole cam and, as noted above, the base plate only moves forward or backward a small amount during this process.

The lever ***14*** is similar, but it responds to the position of the zig-zag cam ***1***. That cam is turned by the needle arm ***23*** via the spring-loaded pawl ***15*** that rotates the ratchet ***16***, as in zig-zag presser-feet. At every stitch the finger under the zig-zag cam moves the base plate sideways by an amount set by the wing-nut on ***14*** and this varies the width of the zig-zag stitches.

Thus the length, spacing and width of the zig-zag stitches that form the buttonhole can be adjusted.

Finally, how is the buttonhole cam ***2*** rotated?

The pawl ***15*** rotates the ratchet ***16*** and zig-zag cam ***1*** clockwise. The lever ***17***, and consequently the buttonhole cam ***2***, is rotated anti-clockwise by an extension of the needle arm ***23***. The cover plate on the Singer presser-foot, ***18*** in Figure 32, cannot be removed, and I assumed that the lever ***17*** was a pawl that rotated a ratchet. However, the mechanism is quite different and, although rather crude, it is effective.

Figures 33, 34 and 35 are of a YS-4455 industrial buttonhole presser-foot, made in China, that will not fit onto a domestic sewing machine. Although there are a few differences in layout, it is basically identical to the Singer buttonhole foot and uses the same methods.

Three obvious differences are:

(a) The three-tooth wheel and the rack (***6*** and *7*, Figure 29) are replaced by an oval cam and a bar linking the cam to the lever ***8***, ***9***, ***10***.

(b) The wing-nut (***5***, Figure 28) has been moved to the other side of the presser-foot.

(c) The two levers ***13*** and ***14*** are moved from the right side of the presser-foot to the left side.

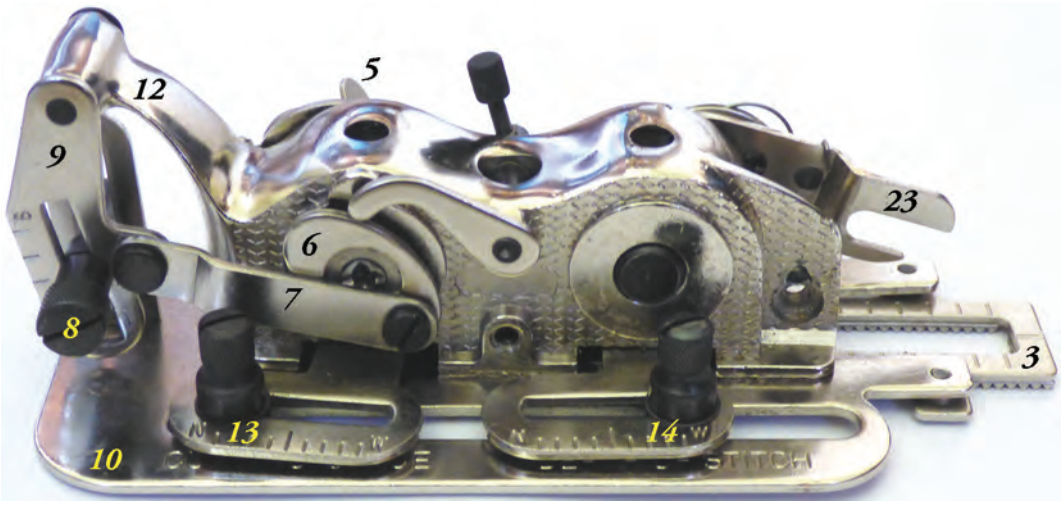


Figure 33

However on this presser-foot, Figure 34, the wing-nut ***5*** and the cover ***18*** can be removed. In both the Singer and YS presser-feet, the needle arm ***23*** rotates the lever ***17*** anti-clockwise on every stitch.

This lever is very loose and the hole in it is much larger that the pivot it surrounds! In addition, it has a boss ***19*** that is semi-circular but angled slightly so that only the top edge butts against the disk ***21***; that disk is fixed to the buttonhole cam ***2***.

The piece ***20*** fits tightly over the boss ***19*** and the disk ***21*** and, because of the boss, it prevents the lever ***17*** from moving sideways and it can only rotate.

When the lever ***17*** rotates anti-clockwise the boss has enough friction to rotate the disk ***21*** and the buttonhole cam. And when the needle arm ***23*** rotates anti-clockwise, freeing the lever ***17***, the spring ***22*** rotates the lever ***17*** clockwise and the boss ***19*** slides over the edge of the disk ***21*** without rotating it.

Finally, Figure 35 shows the two levers ***13*** and ***14*** that control the cutting space of the buttonhole and the width of the zig-zag stitches respectively, varying them from narrow ***N*** to wide ***W***.

The distance that the base plate moves depends upon the positions of the wing-nuts ***10***.

The distances of the fingers ***f*** from the fulcrums ***F*** are fixed, but the distances of the wing nuts varies from ***F-N*** up to ***F-W*** thus changing the distance the base plate moves.

Figure 36 shows the two positions of lever, folded as in Figure 35 and straightened out.

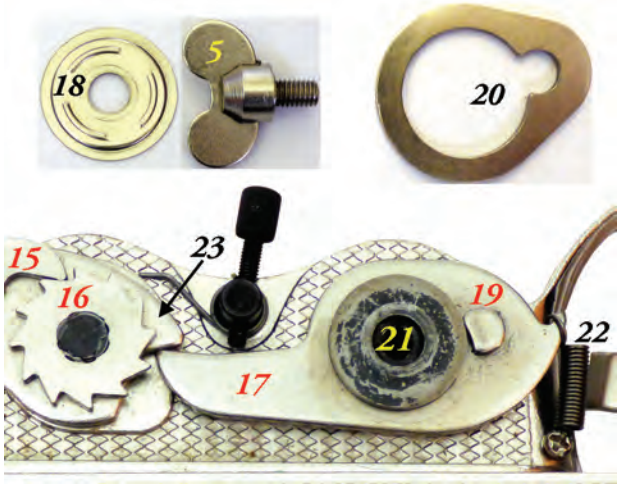


Figure 34

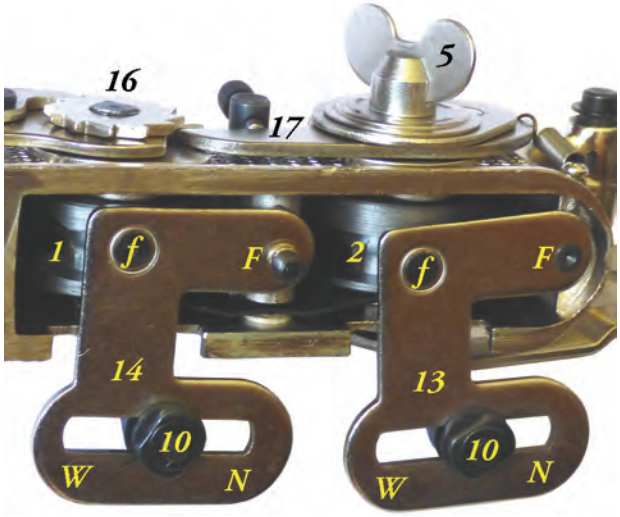


Figure 35

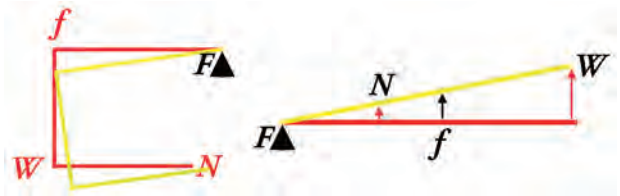


Figure 36

Singer Style Boxes

The following is all the information that I have at the time of writing:

(a) Singer manufactured two styles of machines. The vibrating shuttle (V.S. 2) has a bullet-shaped bobbin case and elongated bobbins. The improved family (I.F.) has an oscillating shuttle and a round bobbin. All the illustrations except for the Style 8 box are for vibrating shuttle machines, but there were corresponding boxes for both types of machines.

(b) Style 2: There is no doubt about the numbering of Style 1 and Style 3 boxes. Because of the method of clamping the hemmers this box must be before Style 3.

(c) Style boxes 4, 5, and 6 are missing. There is speculation that these may have been metal boxes, but I think that is unlikely; why would Singer switch back to wooden boxes?

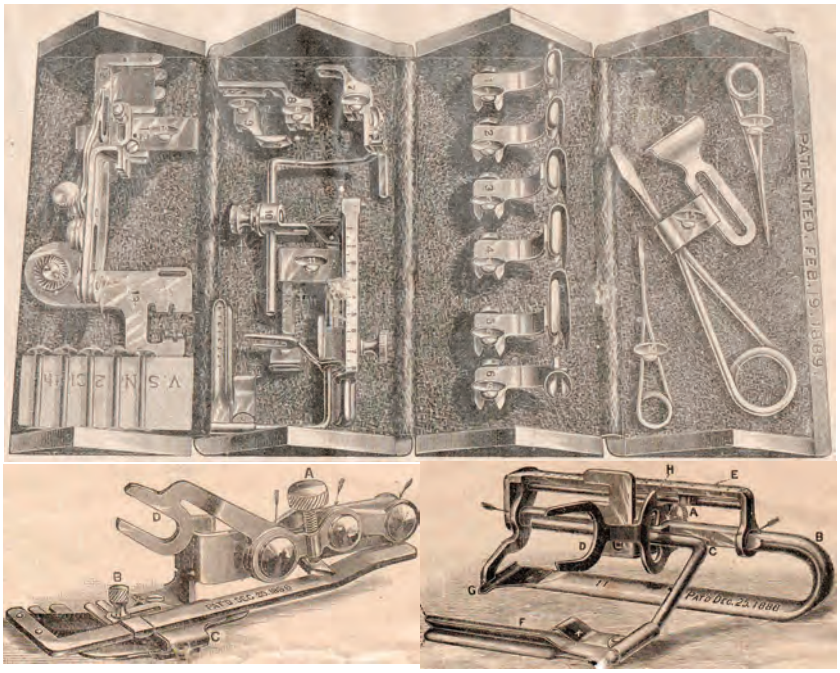
(d) Style box 10 is missing. Style box 12 is given that number because of the different arrangement of the screwdrivers; all style boxes before that have the screwdrivers in the top right.

(e) Style box 13 is strange and might not be a part of the series.

The source documents are listed on page 28.

Style 1: 1888. Improved Family or Vibrating Shuttle No. 2.

Back-clamped hemmers under thumb-screws, looped screwdrivers.

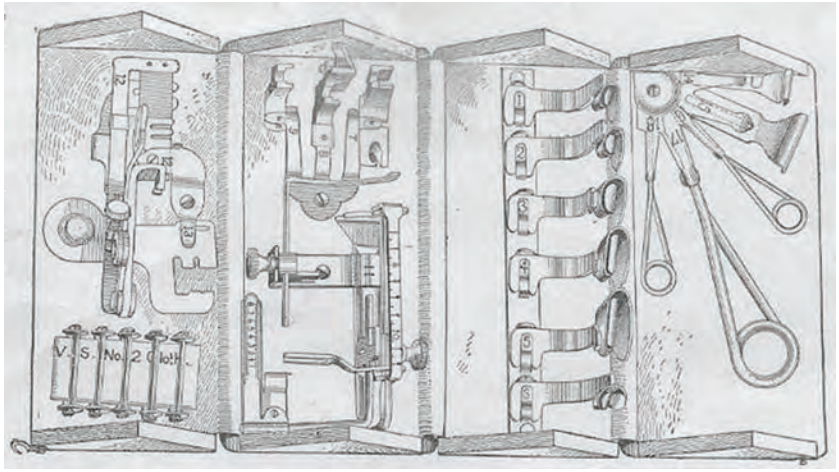


Style 2: 1889? Family shuttle.

Back-clamped hemmers under clips, looped screwdrivers, hook-and-eye catch.

Style 1 ruffler and tuck-marker.

Different arrangement of basic feet and the method of clamping hemmers might be different.

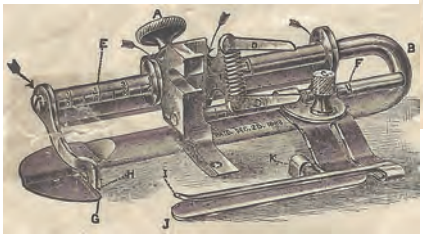


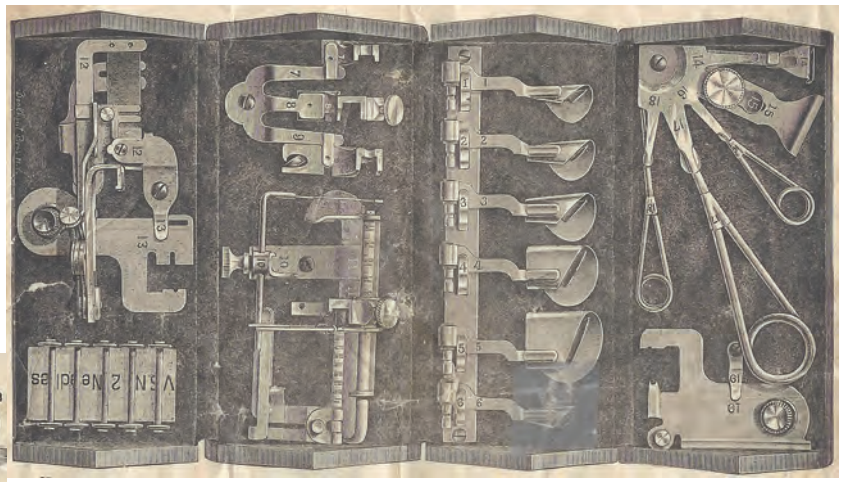
Style 3: 1890? I.F. or V.S. 2.

Rod-clamped hemmers, looped screwdrivers, hook-and-eye catch.

Style 1 ruffler and new tuck-marker.

Addition of under-braider and different arrangement of basic feet.



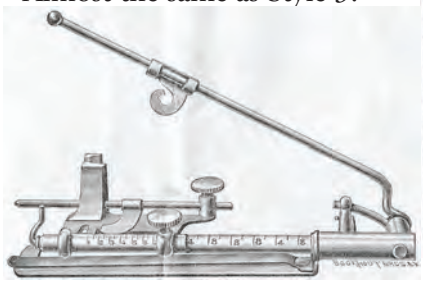


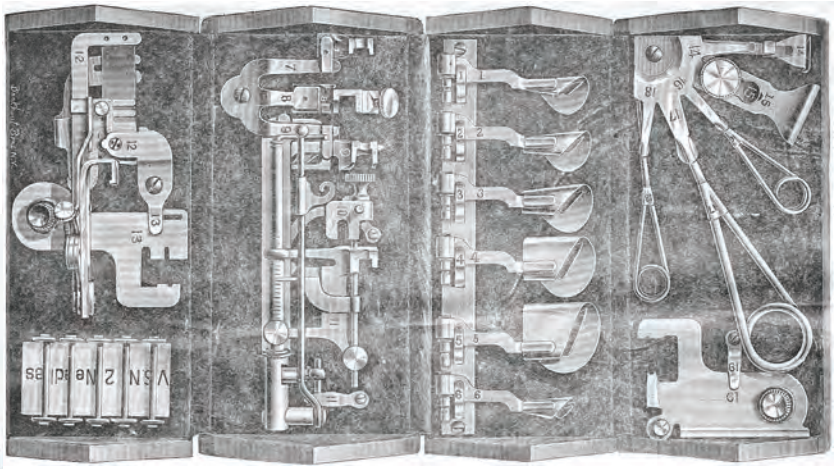
Style 7: 1891. I.F. or V.S. 2.

Rod-clamped hemmers and looped screwdrivers.

Style 1 ruffler and new tuck-marker.

Almost the same as Style 3.



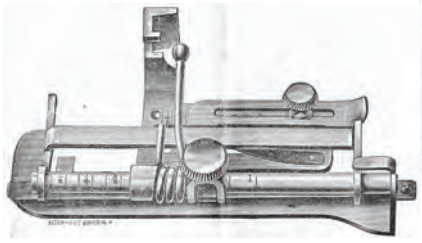


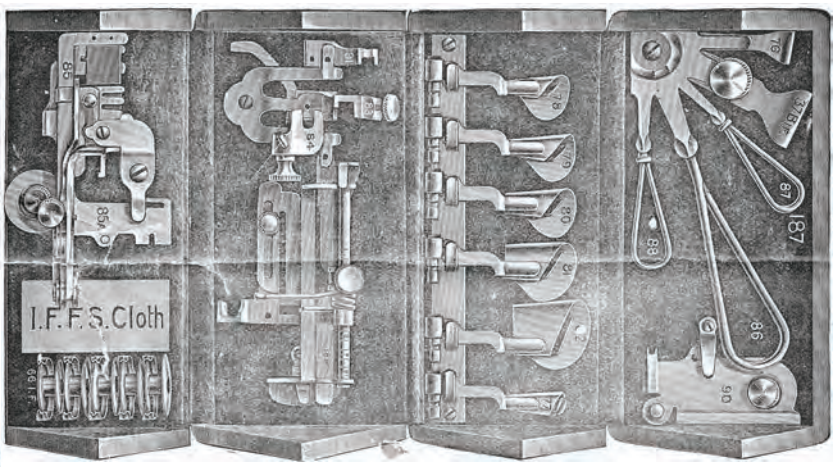
Style 8: 1893. I.F. or V.S. 2.

Rod-clamped hemmers and plain screwdrivers.

Style 1 ruffler and new tuck-marker.

Almost the same as Style 3.



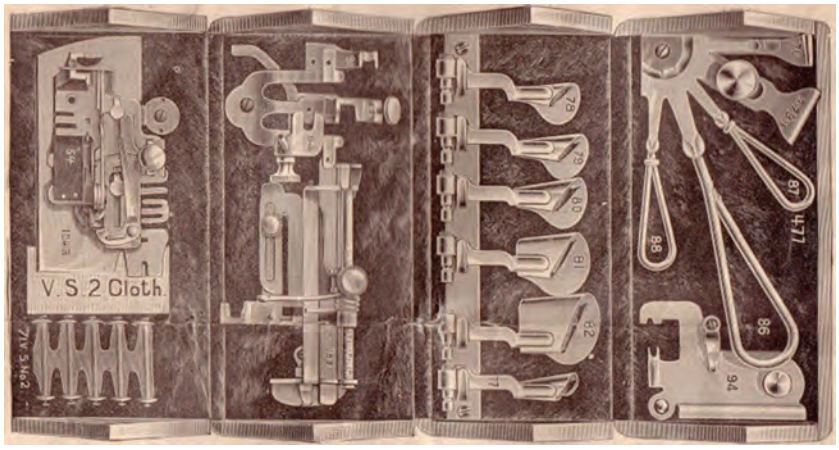


Style 9: 1895? I.F. or V.S. 2.

Rod-clamped hemmers and plain screwdrivers.

New ruffler and Style 8 tuck-marker.

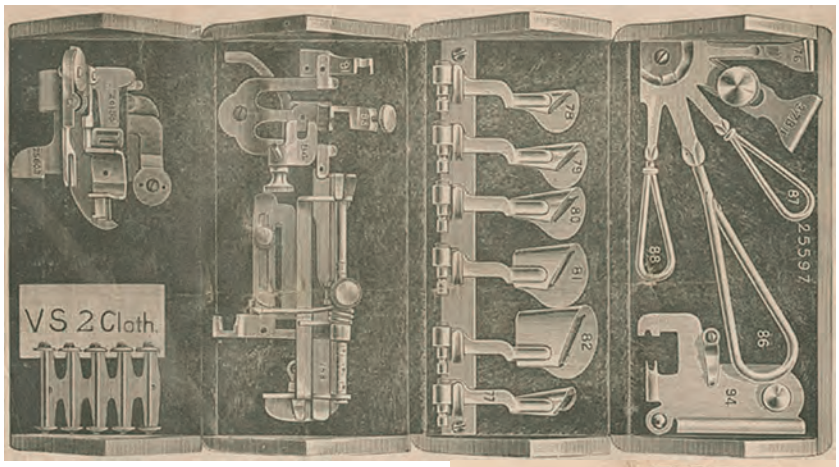
Almost the same as Style 3.

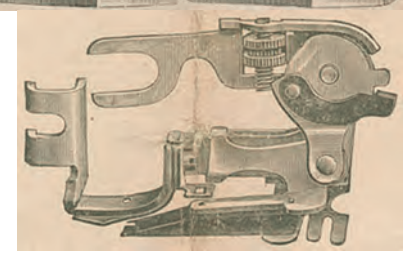


Style 11: 1899 and 1901. No 27.

Rod-clamped hemmers and plain screwdrivers.

New ruffler and Style 8 tuck-marker.





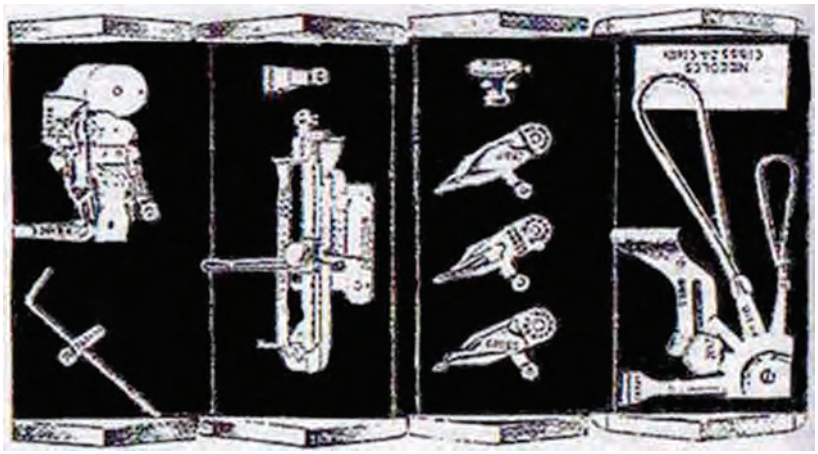
Style 12?: circa 1905? I.F. or V.S. 2.?

Rod-clamped hemmers, and plain screwdrivers, box catch.

Style 11 ruffler and new tuck-marker.

Changed arrangement of screwdrivers. (The large screwdriver is the wrong type.)

Style 13?: circa 1910? No 24. (Chain stitch machine.)



"Folding Attachment Case. Attachments for use on No. 24 sewing machines."

Probably Style 11 ruffler and new tuck-marker.

"The general advantages of this type of machine for family sewing comprise greatest ease and quietness of operation, simplicity of construction, and the elasticity of the single-thread seam. When needle is threaded the machine is ready, the stitch requiring neither bobbin nor shuttle. The thread is taken from one spool, and is so interwoven and twisted that seams cannot rip unless the finished end be unlocked. When this is done the entire length of thread can be quickly withdrawn without injury to the fabric. Guaranteed to be in every point the best single thread chain-stitch machine on the market."

Style 14: 1913. Nos 27, 28, 127 and 128.

Metal box.

Style 11 ruffler and new tuck-marker.

The Art of Folding

Zig-zag sewing machines are old, but apparently the first domestic zig-zag machine was the Singer 206 made between 1936 and 1953.[19] It might be possible, but very difficult, to make a buttonhole by hand manipulation of the direction of stitching. Also, it might have been cheaper to buy zig-zag and buttonhole presser-feet for a straight stitch machine than to pay for a model 206, especially as these two tasks are relatively infrequent.

Modern sewing machines, like the Janome Memory Craft 7700 computerised sewing machine that was made about 2010, have in-built the ability to sew zig-zag stitches and to sew forward or backward under computer control. So the buttonhole presser-foot, Figure 37, is reduced to a simple guide that will make a buttonhole according to the machine's settings and the size of the button.

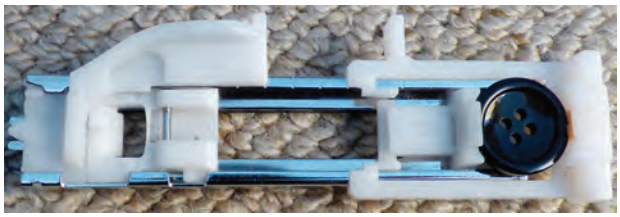


Figure 37

Consequently, the zig-zag and buttonhole presser-feet described previously are unnecessary.

But none of these machines can fold material!

The secret of the Singer style boxes is that they contain presser-feet to enable material to be folded easily and in different ways. They contain:

A narrow hemming presser-foot, as in Figure 5 (page 5).

5 wide hemmers (4 in the style 14 box).

A binder

A tuck-marker

A ruffler

That is, 9 presser-feet explicitly designed to fold material.

Other than screwdrivers and other accessories, the style boxes only contain 2 attachments that do not fold material, the quilting guide and the under-braider.

In contrast, the Janome sewing machine has special presser-feet for:

A narrow hemming foot called a rolled-hem foot.

7 wide hemmers.

A binder

A ruffler

That is, 10 presser-feet explicitly designed to fold material.

There is no tuck-marker and wide tucking is done by hand with a marker and an iron. There is a pintuck presser-foot for making very narrow tucks, but it is simply a guide to regularly space the pintucks. Also it uses two needles and so is not relevant.

Another similarity is that the Janome sewing machine has a separate walking (even feed) presser-foot, as in Figure 11 (page 8).

Consequently:

From 1888 to 2010 the art of folding material has not changed.

19 Singer Sewing Info, 2020.

Of all these material-folding presser-feet, the only complex one is the ruffler and it is not surprising that its design has changed over the years.

The concept of a ruffler presser-foot (as shown in Figure 17, page 11) is simple. In Figure 38 a lever ***E***, pivoted at ***1***, has the lever ***D*** attached to it by a pivot at ***2*** and ***D*** has the upper ruffler blade fixed to it; the two levers are used to change the direction of motion. The separate needle arm ***A*** is also pivoted at ***1*** and has attached to it the two stops ***Sl*** and ***Sr***.

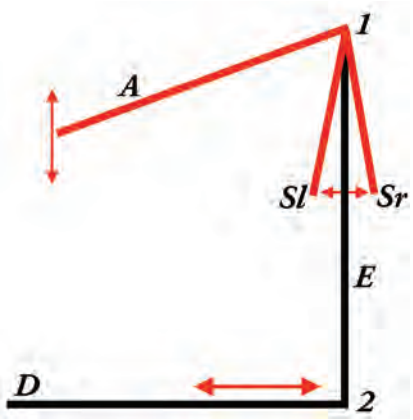


Figure 38

As the needle arm rises, the right stop ***Sr*** pushes ***E*** and the lever ***D*** to the left to fold the material and form the ruffle.

As the needle arm drops, the left stop ***Sl*** pushes ***E*** and the ruffler blade to the right ready for the next ruffle.

The distance of the right stop ***Sr*** from ***E*** is fixed. This is necessary because it ensures that the material moves far enough to the right for the needle to catch the end of the fold when it forms the next stitch. The gap between ***Sr*** and ***E*** also ensures that the needle can rise out of the material before the upper blade ***D*** forms a ruffle.

The size of the ruffle is determined by the position of the left stop ***Sl*** relative to the lever ***E***, and how far the upper blade ***D*** moves to the right. If the left stop ***Sl*** is close to ***E*** most of the needle arm movement will be used to move the upper blade ***D***. And if ***Sl*** is further away from ***E*** more of the needle arm's movement is used to move ***Sl*** until it reaches ***E*** and consequently ***D*** will move less. This can be done by moving ***Sl***, changing the shape of ***E*** or having an adjusting screw ***Sa***.

Although out of date order, the Greist ruffler in Figure 39 is a good example. The needle arm ***A***, pivoted at ***1,*** has the dial ***Sa*** attached to it, and the dial is the head of a screw that has the two stops ***Sl*** and ***Sr*** threaded onto it, so that turning the dial moves the stops up and down, as in the inset photograph. As the needle arm moves up and down, the stops rock from side to side and move the lever ***D*** that is attached to the upper ruffler blade.

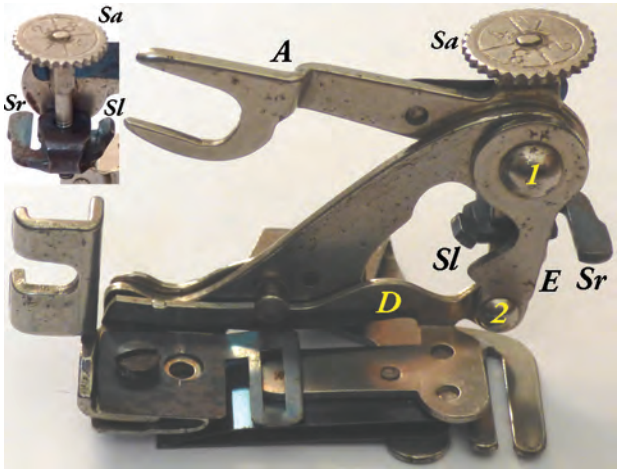


Figure 39

The distance that ***D*** moves depends on the vertical position of the stops. The stop ***Sr*** butts against the straight face of ***E*** and always moves ***D*** a fixed distance. However, the other side of ***E*** is shaped so that the stop ***Sl*** will move ***D*** back by varying amounts depending on the position of the dial ***Sa***.

The numbers on the dial are meaningless decoration! Several turns of the screw are necessary to make any difference and the effect has to be determined by practice. But the numbers do have some meaning in that turning the dial in the direction of increasing numbers increases the size of the ruffle.

The ruffler in Figure 17, reproduced in Figure 40, is different in that ***Sr*** and ***Sl*** are separate, and ***Sa*** is the thumb-nut, the equivalent of the dial in the Greist ruffler.

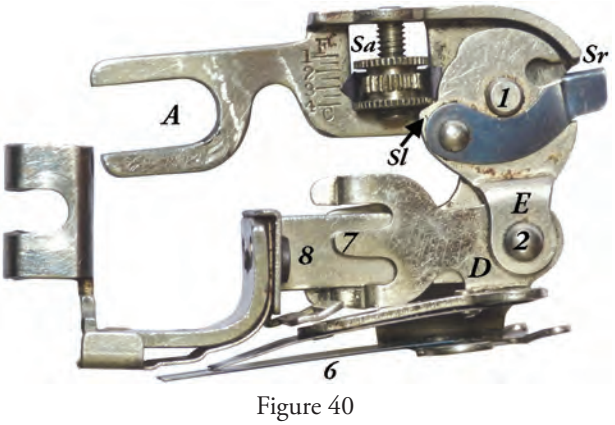


Figure 40

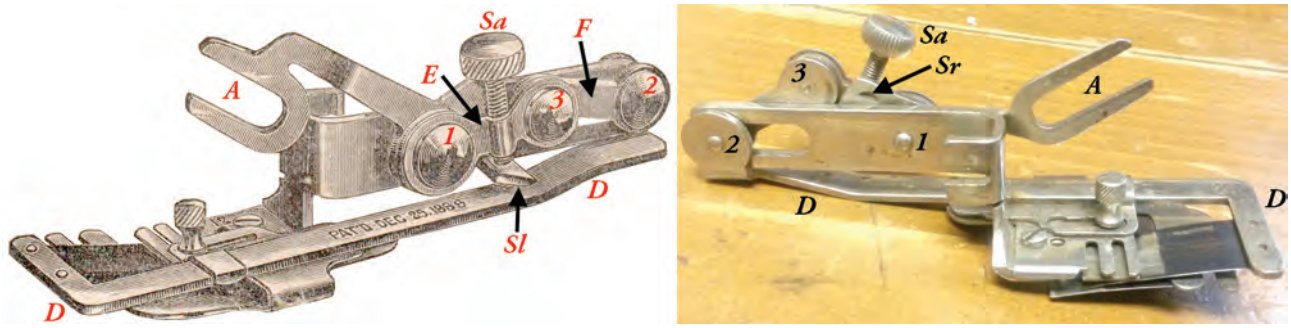


Figure 41

The 1888 Singer ruffler, in the first style box,[20] appears to be different but is basically the same design, Figure 41. (The drawing in Figure 41 left has some errors in the detail.) Because of the linear layout the lever ***E*** is split into two parts ***E-F***, hinged together at ***3,*** so that it can move ***D*** sideways. When the needle arm ***A*** rises, the fixed stop ***Sr*** forces ***E*** down (clockwise) so that ***E-F*** is elongated and ***D*** moves the upper blade to the right to form a fold in the material. The movement of the left stop ***Sl*** can be varied by the thumb-screw ***Sa***. When the needle arm drops, the pad ***Sl*** under the screw, which is part of the needle arm ***A***, turns ***E*** anti-clockwise and ***F*** moves ***D*** to the left, ready for the next ruffle.

Contemporary with the previous ruffler is the back-clamped Wheeler & Wilson No. 9 ruffler, Figure 42.[21] It differs because it does not use the lever ***E***.

The needle arm ***A*** (which has a bend in it so that it can reach the needle clamp on the other side of the needle rod) is pivoted at ***1*** and extends to the adjustment scale ***Sa***. The lever ***D-D***, extending from its pivot at ***Sl*** to in front of the needle, controls the motion of the upper ruffler blade. ***A-1-Sl*** forms a lever with its fulcrum at ***1***, and adjusting the length of ***1-Sl*** by the thumb-screw for ***Sa*** changes the amount that the upper blade moves.

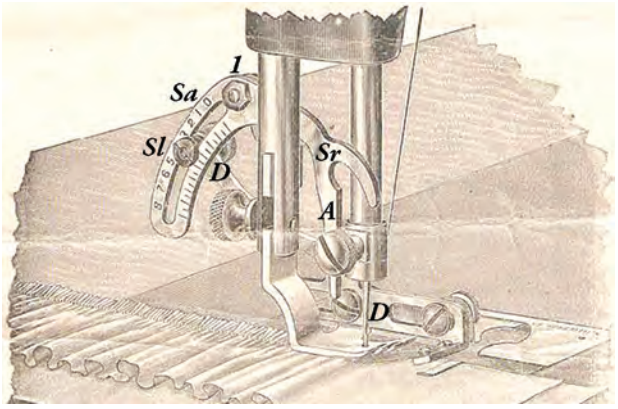


Figure 42

Most of the needle arm is vertical and the only part of it that interacts with the needle clamp is the very top, at the stop ***Sr***. At this point the needle arm is rotated by the clamp, anti-clockwise going up and clockwise going down.

When the needle rises, the arm ***A-Sa*** rotates anti-clockwise so that the needle clamp can fit into the stop ***Sr***. This motion moves ***Sl*** and ***D-D*** to the right, ready for the next ruffle. But this movement depends on the position of the stop ***Sl*** and so the motion of ***D-D*** varies.

When the needle drops and moves away from the stop ***Sr***, ***A-Sa*** rotates clockwise, moving ***D-D*** to the left. The scale ***Sa*** is an arc so that this movement is identical no matter where the stop ***Sl*** is placed (similar to the motion of ***E*** in Figure 39).

Some sewing machine manuals are available.[22] Of these:

(a) The Florence Family Rotary, bottom clamped, is the same as Figure 40.

(b) The Mason, Standard Paragon and Minnesota, all bottom clamped, are the same as the Greist ruffler in Figure 39. (The Standard Paragon manual is confusing because it shows two different rufflers. The other appears to be a modification of Figure 40.) In 1903 the Mason ruffler cost $1.00, about $208.00 today.

20 Singer, 1889.
21 Wheeler & Wilson, ca 1888.
22 Victorian Sweatshop Forum, 2020.

The preceding rufflers have one thing in common; the folding of the material occurs at every stitch.

The following rufflers allow for a number of stitches between the ruffles. They all rely on ratchets and pawls to modify the stitching; two other designs using ratchets and pawls, Elgin and Rotary (both bottom clamped),[23] are not discussed here.

Figures 43 and 44 are photographs of a Singer No. 120290 "1-star-5" ruffler.

The 12-tooth ratchet ***R*** is loose, held in place by a spring, and the bottoms of two diametrically opposite teeth are much deeper than the rest. The pawl ***P***, mounted on the needle arm ***A***, can be moved to three different positions. At positions "1" and "5" it has slots for a finger on ***A***. At the "star" position there is a slight depression to ensure the arm of the pawl cannot accidentally be moved.

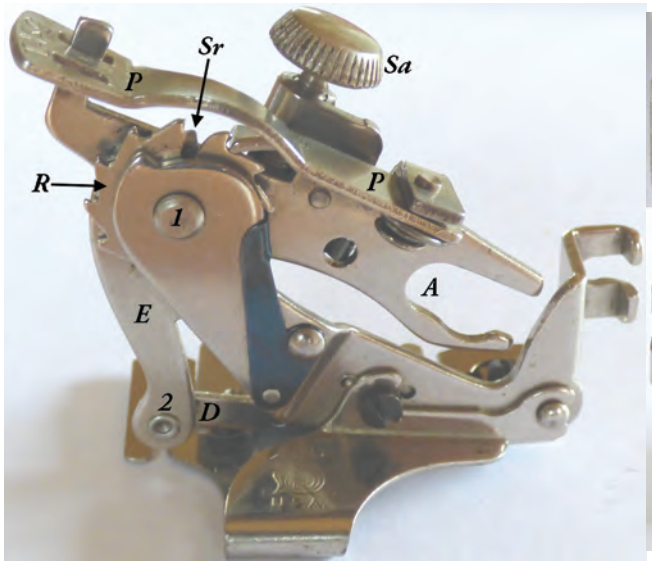


Figure 43

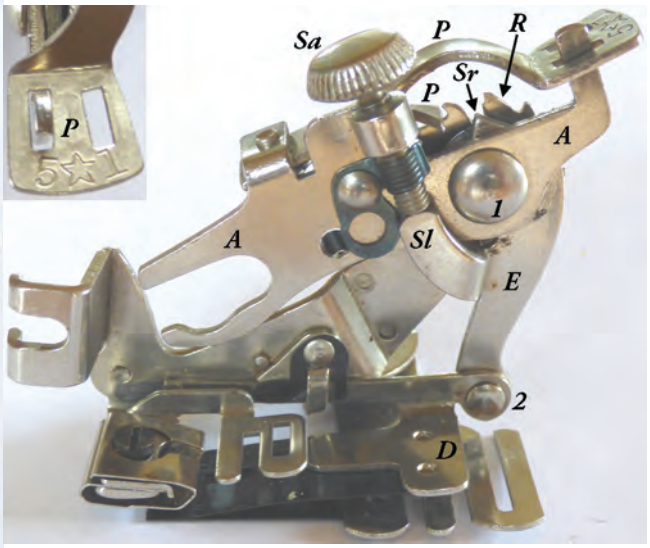


Figure 44

In position "1" the pawl is rotated away from the ratchet teeth ***R***. And so, on every upward movement of the needle arm the pawl meets the fixed right stop ***Sr***, which is a part of the lever ***E***, and causes ***D*** and the top ruffler blade to fold the material.

When the needle moves down, the face of the adjustment screw ***Sa*** meets the left stop ***Sl***, which is an arm on ***E***, and returns ***D*** and the top ruffler blade as far as is needed for the size of the ruffles.

In position "5" the pawl has been rotated sideways so that it meets the ratchet teeth ***R***. When the needle rises, the normally cut teeth of the ratchet hold the pawl up so that it is above the right stop ***Sr*** and consequently it does not move the lever ***E*** and no folding takes place.

Because ***E*** has not moved the left stop ***Sl*** has not moved, so when the needle drops, the adjustment screw ***Sa*** butts against the left stop and doesn't move it. That is, the ratchet rotates one tooth and a normal stitch is made.

However, after 5 stitches the pawl meets a deeply cut tooth that allows the pawl to drop so that it meets the right stop ***Sr*** and a fold occurs. The behaviour is exactly the same as for the position "1".

In position "star" the pawl is held above the ratchet ***R*** and the movement of the needle arm ***A*** has no effect, so no ruffles are made and the sewing machine behaves normally as a straight-stitch machine.

As in position "5" there are 5 ordinary stitches between each ruffle, the position should be numbered "6" for ruffling every 6th stitch.

23 Victorian Sweatshop Forum, 2020.

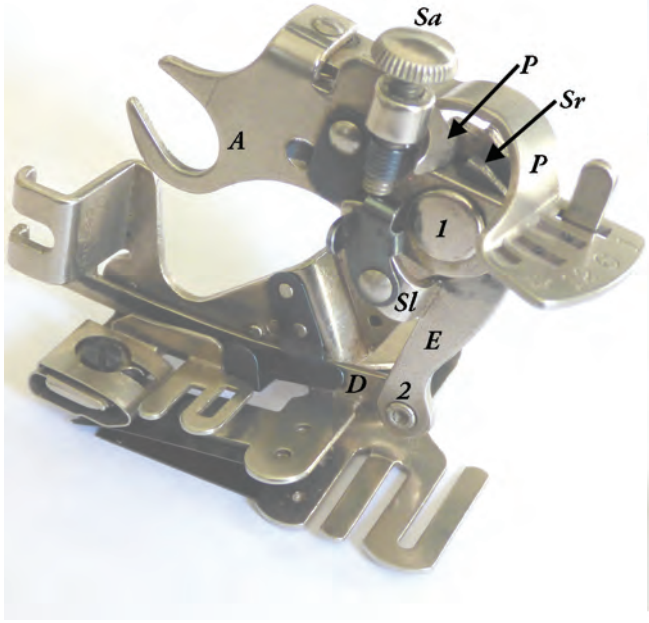


Figure 45

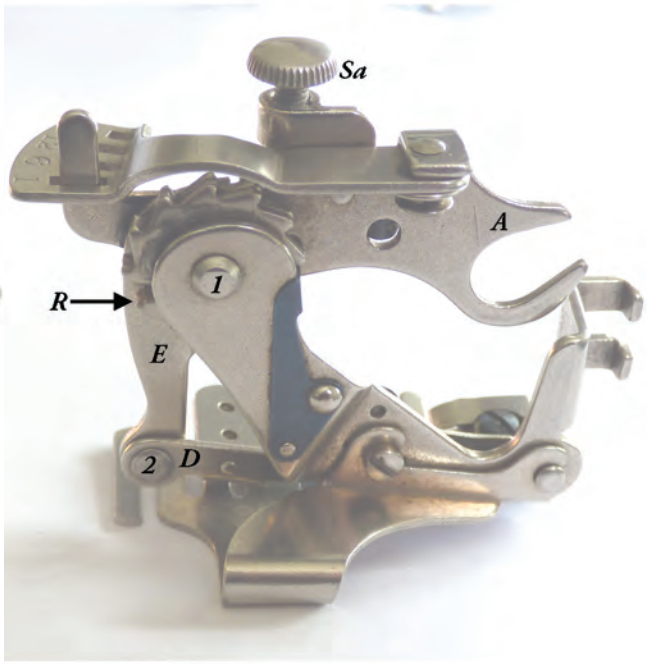


Figure 46

Figures 45 and 46 show a Simanco "1-6-12-star" ruffler.[24] The operation of it is basically the same as the "1-star-5" ruffler, except that it has two 12-tooth ratchets ***R*** and a correspondingly wider pawl ***P***.

When the pawl is rotated to the "6" position it acts on only the inner ratchet with the bottoms of two diametrically opposite teeth are much deeper than the rest, and there are 5 ordinary stitches between each ruffle.

However, in the "12" position the pawl acts on both ratchets and the outer ratchet has only one deeper tooth corresponding to one of the deeper teeth on the inner ratchet. So only this tooth causes a fold and the are 11 ordinary stitches between each ruffle.

The ruffler presser-foot in Figures 47 and 48 is a little more sophisticated. (It is numbered 55404, but that is not a Singer number.)

First, the outer ratchet in the Simanco ruffler above is replaced by a disk ***3*** that is shaped to block off one of the deep teeth when the pawl is rotated to position "12".

Second, the method of adjusting the left stop ***Sl*** is by rotating the cam ***4***. First, note that in Figures 44 and 45 the left stop ***Sl*** is part of the lever ***E*** and the adjusting screw is on the needle arm ***A***. However, in Figure 48 the positions have been reversed, with ***Sl*** now a part of the needle arm ***A***.

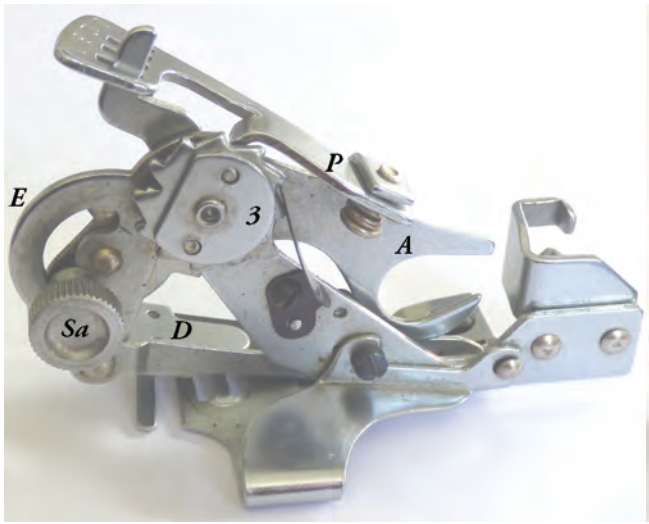


Figure 47

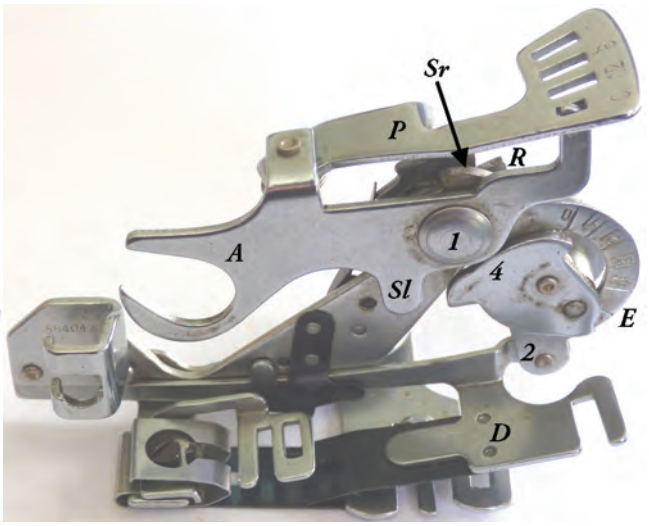


Figure 48

24 Singer, 1951.

There is a semi-circular scale that is part of the lever ***E*** and an adjusting thumb screw ***Sa*** to lock the cam ***4*** in position. Rotating the cam ***4***, as in Figure 49, changes the gap between ***Sl*** and the acting face of ***4***, indicated by the arrow. Consequently the rotation of the lever ***E*** by the needle arm ***A*** when the needle drops changes.

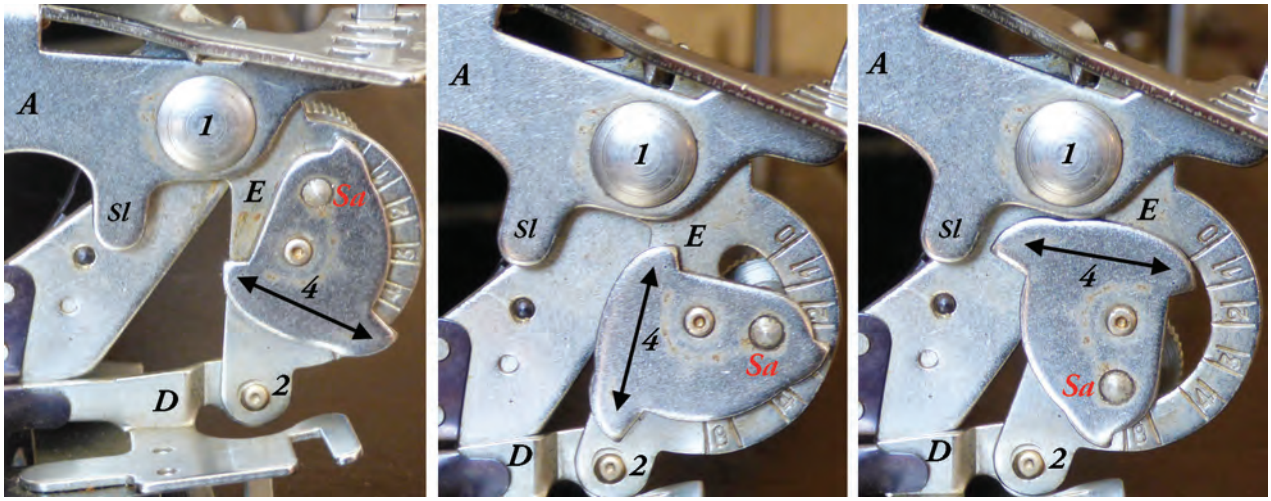


Figure 49

This appears to be the final design for a ruffler and, at the time of writing, it is used by Singer and the Bernina "old style" rufflers.

Bernina, Brother, Elna, Husqvarna, Janome, Pfaff and Singer produce rufflers with a disk or segment of a disk ***3*** replacing the second ratchet, but all these use a screw to adjust the left stop ***Sl***. Two, made by Husqvarna and Pfaff, have ***Sl*** being a part of the lever ***E*** and the adjustment screw is on the top, as in Figure 45. The remaining rufflers have ***Sl*** being part of the arm ***A***, as in Figure 48, which moves the screw to the front of the ruffler.

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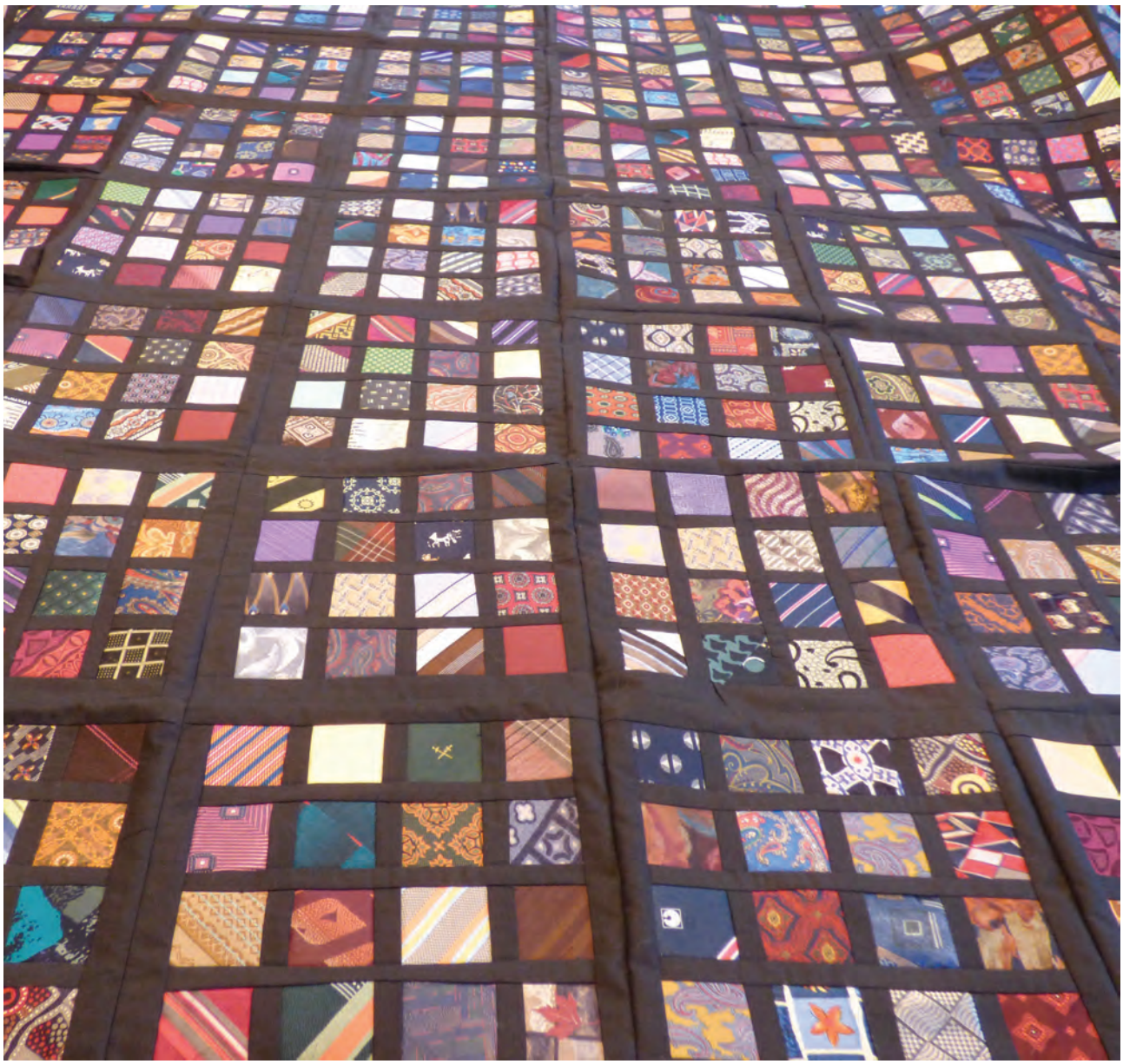

Part of an un-ironed window hanging made from men's ties. There are 9 x 8 large squares comprised of 1,152 small squares cut from different ties. It is meant for the light of the Sun to shine through it.