Replacing the Feed-dogs: The Buttonhole Attachment

The buttonhole attachment is a more sophisticated zig-zag foot. This attachment is also a walking-foot with its own feed-dogs and, like the Singer zig-zag attachment, a cover-plate is needed to stop the sewing machine's feed-dogs being active on machines that cannot drop their feed-dogs.

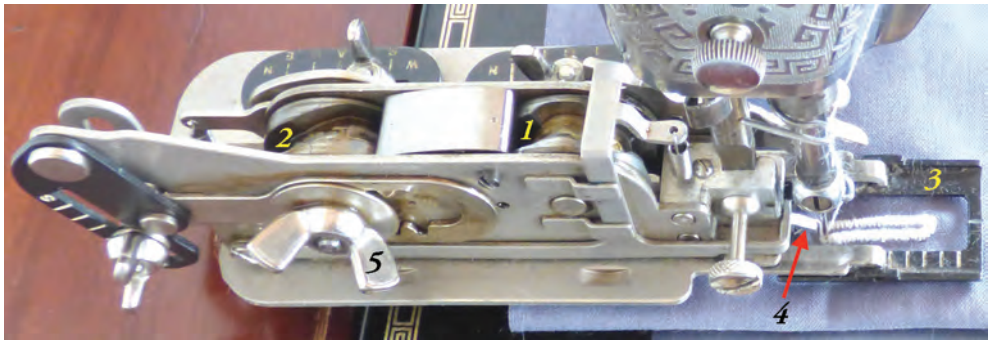


Figure 28

Figure 29

Figure 28 shows the left side of the attachment; it is complete except that its cover has been removed, and Figure 29 shows the left side of the attachment with the wing-nut ***5*** and the covering disk removed. The *zig-zag cam* ***1*** makes the small zig-zag stitches that form the buttonhole, and the *buttonhole cam* ***2*** moves the feed-dogs ***3*** to form the buttonhole. Because the gap in the feed-dogs is necessarily very large, an additional finger ***4*** is used to ensure the material does not move. The wing-nut ***5*** can be used to position the attachment before starting to sew.

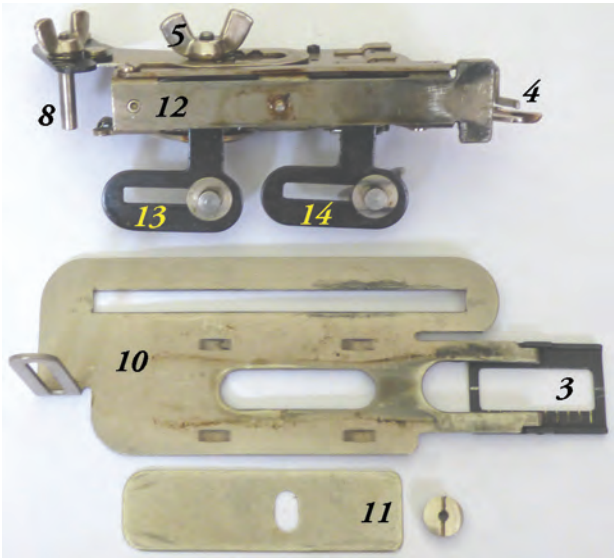


Figure 30

Under the wing-nut there is a three-tooth wheel ***6*** that rotates with the buttonhole cam ***2***. It moves the double-sided rack ***7*** which is linked to the buttonhole length adjustment ***8***.

The base plate ***10*** is loose, Figure 30. It is held in position by the plate and screw ***11***, by the fingers ***13*** and ***14*** and by the rod at ***8***. The slots in the base plate allow it to move backward and forward, and the wide slot allows it to move sideways.

As shown in Figure 31, the pieces ***7***, ***8*** and ***9*** (Figure 29) form a lever pivoted to the body ***12*** at the fulcrum ***9***. The movement of the base plate ***10*** can be adjusted by the wing-nut and rod ***8***, and so the length of ***9-8*** can be varied from short ***s*** to long ***l***, as shown in Figure 29.

Figure 31

Consequently the motion of the rack ***7*** will move the base plate ***10*** different amounts depending on the position of the wing-nut ***8*** and so form different lengths of buttonhole.

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*** (Figure 29) 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 attachment and cannot be exposed because the components of the body are riveted together; but see Figure 35.

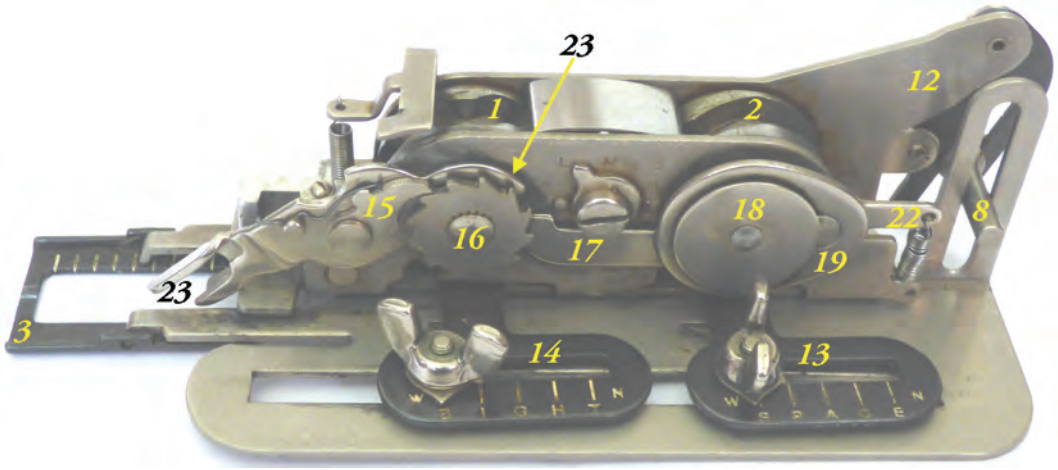


Figure 32

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 attachments. 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 buttonholer, ***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 attachment, 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 attachment 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 buttonholer.

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

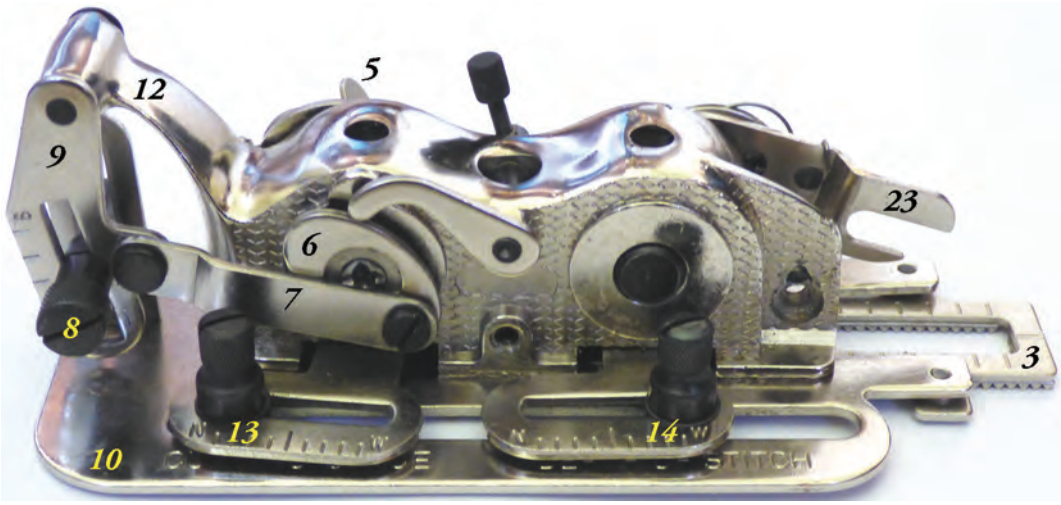


Figure 33

However on this attachment, Figure 34, the wing-nut ***5*** and the cover ***18*** can be removed. In both the Singer and YS attachments, 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.

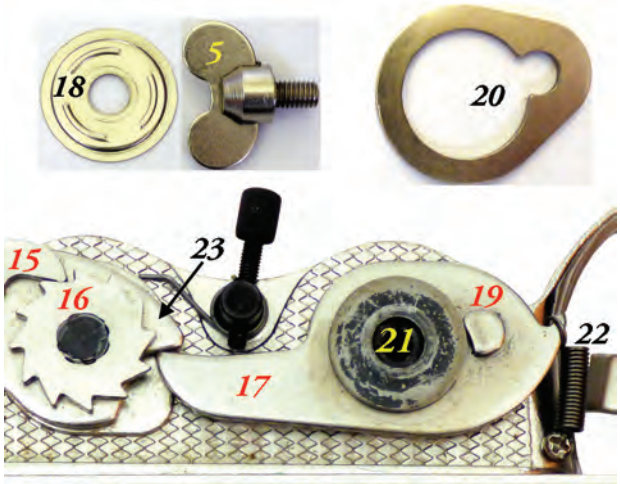


Figure 34

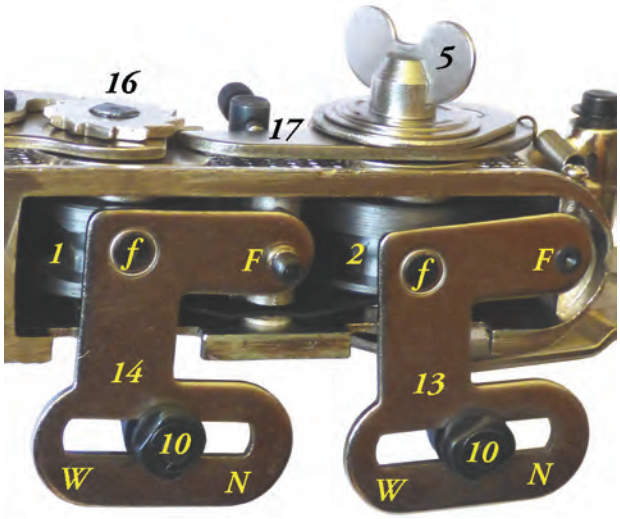


Figure 35

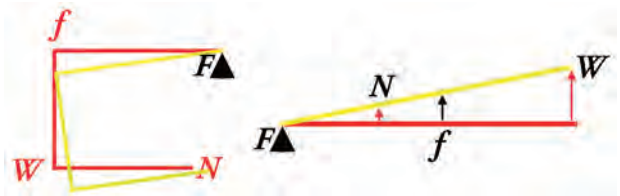


Figure 36

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 on it. Also, it might have been cheaper to buy zig-zag and buttonhole attachments 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 attachment, 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.

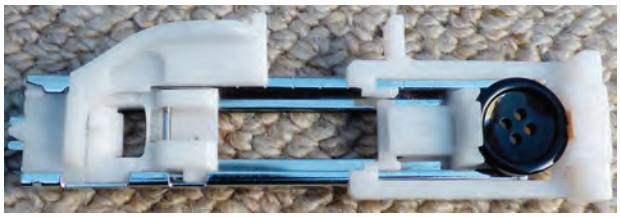


Figure 37

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

But none of these machines can fold material!

The secret of the Singer attachment sets (illustrated on page 4, page 5 and page 27 on) is that they contain attachments to enable material to be folded easily and in different ways. They contain:

A narrow hemming presser-foot, as in Figure 10 (page 7).

5 wide-hemmers mounted on a special presser-foot (4 bed mounted wide-hemmers in the style 14 box).

A binder

A tuck-marker

A ruffler

That is, 9 attachments explicitly designed to fold material.

Other than screwdrivers and other accessories, the style sets 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 attachments 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 attachment 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) foot, as in Figure 13 (page 8).

19 Singer Sewing Info, 2020a.

Consequently:

From before 1888 to now, the art of folding material has not changed.

Of all these material-folding attachments, the only complex one is the ruffler and it is not surprising that its design has changed over the years. Unfortunately there are very few sewing machine manuals before 1889, when Singer started to produce instructions for its attachment sets, and even fewer are dated. So the early development of attachments, and the ruffler in particular, is largely unknown.

Indeed, about 1888 Bacle produced machines with a tuck marker, other guides and a "new pleating machine", Figure 38.[20] And another simplistic method of ruffling that does not use the movement of the needle was used by the Victor sewing machine.[21]

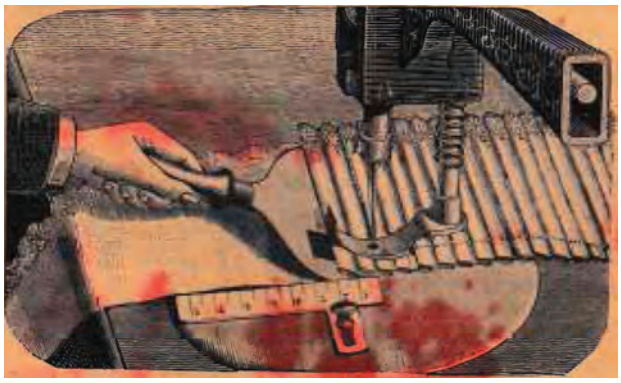


Figure 38

In addition, and most importantly, Alan Johnston of the Johnston Ruffler Company patented his ruffler in 1872,[22] and his design was used by a number of companies, including American Sewing Machine Company, Howe, New Home (1881), and Singer.[23] It is the earliest documented design that I know of.

The concept of a ruffler attachment is simple. In Figure 39 a lever ***C***, pivoted at ***1***, has the lever ***U*** attached to it by a pivot at ***2*** and ***U*** has the upper ruffler blade fixed to it; the two levers are used to change the direction of motion.

The body of the ruffler, that connects it to the presser-foot bar, is not shown. But the pivot ***1*** is part of the body and the lower ruffler blade ***L*** is attached to the body.

The separate needle arm ***A*** is also pivoted at ***1*** and has attached to it the two stops ***Sb*** and ***Sf***. In the diagram, ***Sb*** and ***Sf*** are at the ends of two levers ***l*** fixed to ***A***, but other arrangements are used.

As the needle arm rises, rotating it and the levers clockwise, the forward stop ***Sf*** pushes ***C*** and the upper ruffler blade ***U*** forward to the left to fold the material and form the ruffle.

As the needle arm drops, rotating anti-clockwise, the backward stop ***Sb*** pushes ***C*** and the ruffler blade ***U*** to the right, ready for the next ruffle.

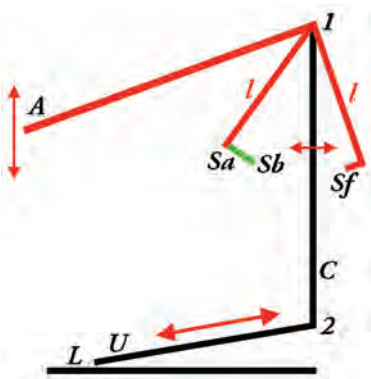


Figure 39

The distance of the forward stop ***Sf*** from ***C*** is fixed. This is necessary because it ensures that the material moves far enough to the right, but not too far, for the needle to catch the end of the fold when it forms the next stitch. The gap between ***Sf*** and ***C*** also ensures that the needle can rise out of the material before the upper blade ***U*** forms a ruffle.

The stop ***Sb*** can be adjusted by ***Sa*** (green). The size of the ruffle is determined by the position of the stop ***Sb*** relative to the lever ***C***, and how far the upper blade ***U*** moves to the right. If ***Sa*** is large and ***Sb*** is close to ***C*** most of the needle arm movement will be used to move the upper blade ***U***. And if ***Sa*** is small and ***Sb*** is further away from ***C*** more of the needle arm's movement is used to move ***Sb*** until it reaches ***C*** and consequently the upper blade ***U*** will move less. There are several forms of ***Sa*** by which the stop can be adjusted.

Because of the symmetry, one or both of the stops ***Sf*** and ***Sb*** can be attached to ***C*** to achieve the same effect.

20 Bacle, D, circa 1888.
21 Victor, circa 1880.
22 Johnston, 1873.
23 See Smithsonian Institution Libraries, 2001, and Smithsonian Institution Libraries, 2020.

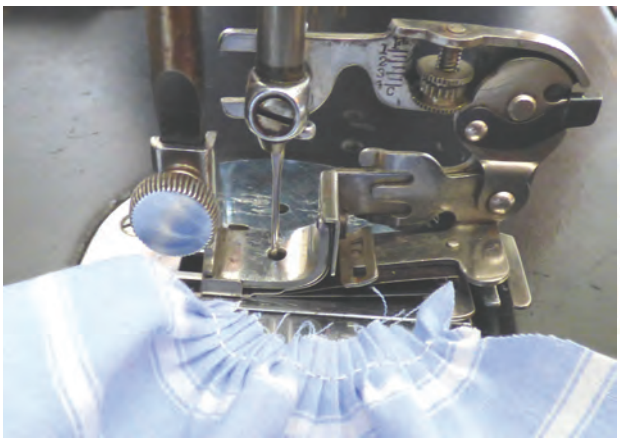


Figure 40a

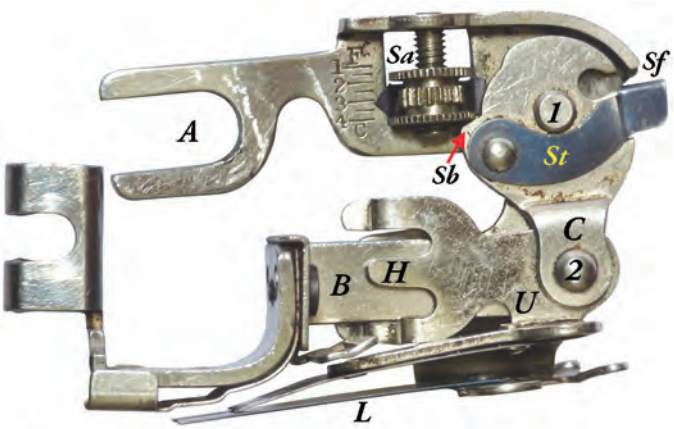


Figure 40b

Although out of date order, the Singer ruffler No. 26156 and what it produces, Figures 40a and 40b, is a good example of Figure 39.[24] The basic design was used from 1896 or earlier, and at least up until 1914.

The ruffler is attached to the presser-foot bar and the needle arm ***A***, pivoted at ***1***, is positioned around the needle clamp. The material is inserted between the two blued-steel blades at ***L;*** the upper blade attached to the arm ***U*** is shorter and has a serrated edge to grip the material.

When the needle rises after forming a stitch, the lever ***C***, also pivoted at ***1***, is rotated clockwise by the stop ***Sf*** and it moves the lever ***U***, pivoted at ***2***, forward and so moves the upper blade to the left; ***U*** can only move horizontally to the left because of its three-pronged fork ***H*** surrounding the body ***B*** of the ruffler. When the upper blade moves forward, to the left, it folds the material before the next stitch is made. Normally this movement clockwise cannot be varied because it is necessary that the upper blade moves the correct distance for the needle to go into the end of the fold.

However, when the needle arm ***A*** drops, the thumb-nut ***Sa***, mounted on ***A***, butts against ***Sb***, a ledge on ***C***, and rotates ***C*** anti-clockwise, moving the lever ***U*** and the upper blade back to the right. By changing the position of the thumb-nut, this motion can be varied to change the length of the ruffle.

It is no surprise that this ruffler will also fit onto a Janome Memory Craft 4000 computerised sewing machine circa 1997. And the reverse is also true; the Janome foot holder will fit on the Singer 201K and so Janome presser-feet attachments can be used with that machine.

The ruffler in Figure 40c is another version[25] and there are three differences in the design: the three-pronged fork ***H***, which is a part of ***U***, is replaced by a simpler wrap-around, a different style of thumb-nut, and the blued steel spacer, at ***St*** in Figure 40b, which is used for the different timings of vibrating shuttle and oscillating shuttle machines, is omitted.

There are at least 6 different designs of this ruffler: with or without the spacer, and varying ***H*** and the thumb-nut.[26] Also confusing is that 2 designs are given the same part number of 26156. (Unfortunately the 1896 book shows the same ruffler with and without the spacer.)

What is important is that this basic design had many variants, and so we must assume that other attachments had variants as well.

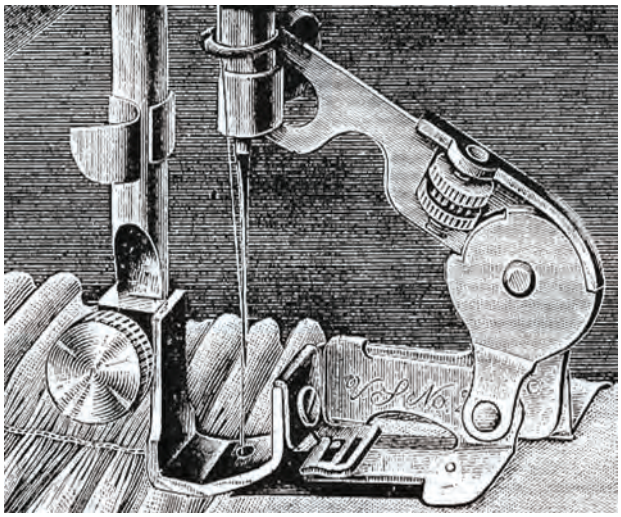


Figure 40c

24 Singer, 1908, page 17.
25 Singer 1896, page 8.
26 For example: Figure 40b; Singer 1908; Singer 1914; Singer 1896, page 3; Greist 1897; and Singer 1896, pages 8-9.

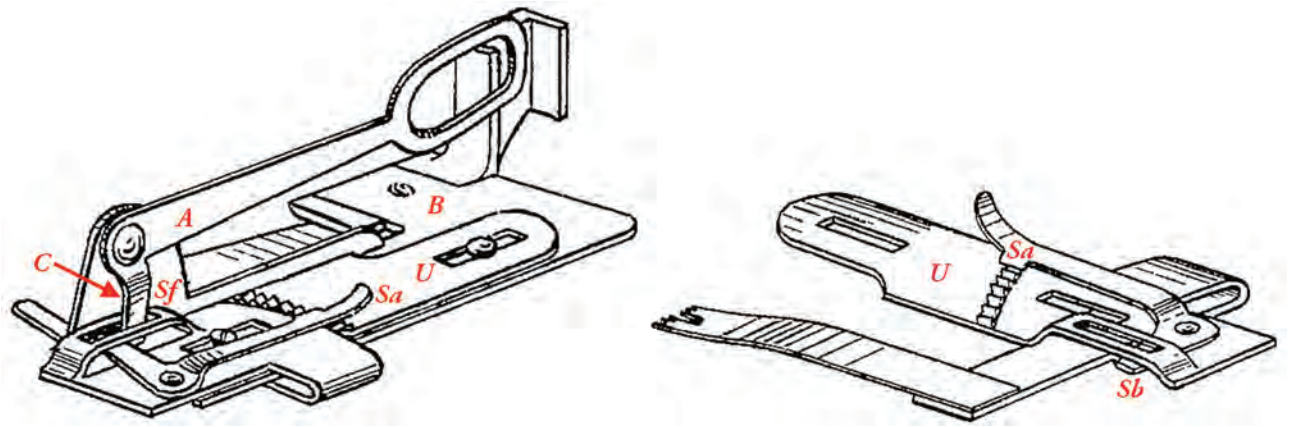


Figure 41a

As mentioned on page 19, the earliest documented ruffler is the Johnston ruffler in Figures 41a and 41b; the diagrams are from the patent.

The first point to note is that the needle arm ***A*** and the lever ***C*** are a single piece, and the consequence of this is that ***Sf*** and ***Sb*** are moved to ***U***, the carrier that holds the upper blade.

Figure 41b (John Stuart)

The lever ***C*** moves in a slot in ***U*** and ***Sf*** is the end of that slot, so when the needle rises ***C*** moves ***U*** and the attached upper blade forwards a constant distance. And when the needle drops, ***C*** meets ***Sb***, the end of the arm of ***Sa***, and moves ***U*** back by a varying amount depending on the position of ***Sa***.

The front of ***Sa*** is held by one of the teeth on ***U*** and if it is moved anti-clockwise (towards the needle) ***C*** will meet ***Sb*** later, the upper blade will be moved back a smaller distance and the folds will be smaller.

This design was modified over time; for example Figure 41b is different from the patent drawing.

The 1888 Singer ruffler, in the first attachment set,[27] Figure 42, appears to be different but it is basically the same design as Figure 39.

Because of the linear layout the lever ***C*** is split into two parts ***C-D***, hinged together at ***3,*** so that it can move ***U*** sideways. And the adjustment ***Sa*** is attached to ***C*** instead of ***A***.

When the needle arm ***A*** rises, the fixed stop ***Sf*** forces ***C*** down (clockwise in Figure 42 left) so that ***C-D*** is elongated and ***U*** moves the upper blade to the right to form a fold in the material.

When the needle arm drops, the pad ***Sb***, which is part of the needle arm ***A***, raises ***C*** anti-clockwise and ***D*** moves ***U*** to the left, ready for the next ruffle, by an amount that depends on the position of ***Sa***.

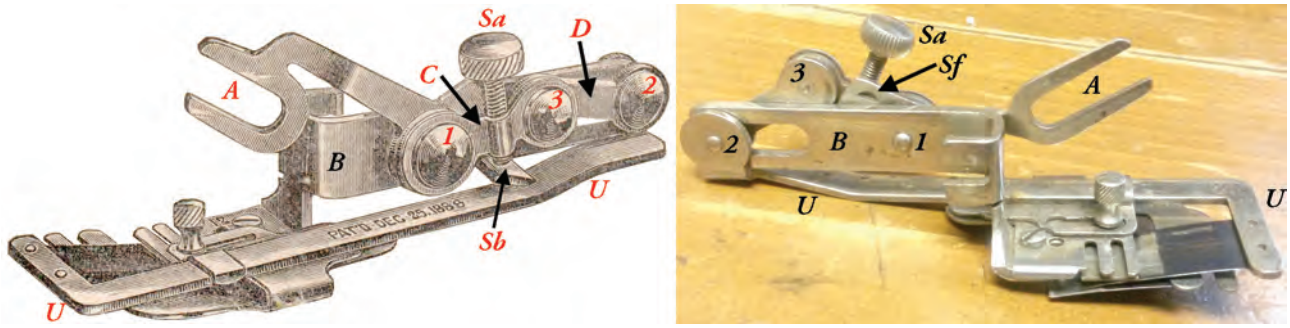


Figure 42

27 Singer, 1889a.

Contemporary with the previous ruffler is the back-clamped Wheeler & Wilson No. 9 ruffler, Figure 43.[28] It differs because it does not use the lever ***C***.

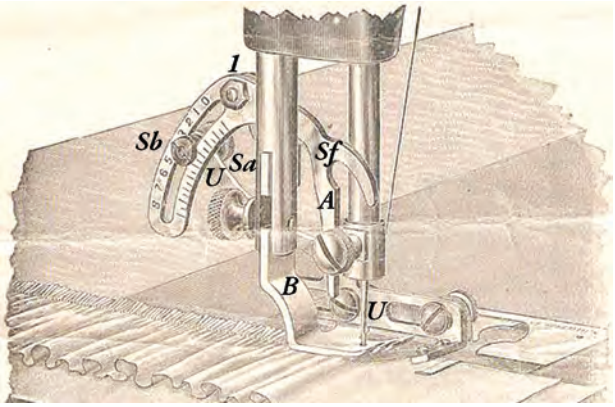


Figure 43

The needle arm ***A*** is pivoted at ***1*** and has ***Sb***, the scale for the adjustment thumb-screw ***Sa*** fixed to it. The hinged lever ***U-U***, extending from its pivot at ***Sb*** to in front of the needle, controls the motion of the upper ruffler blade. ***A-1-Sb*** forms a lever with its fulcrum at ***1***, and adjusting the length of ***1-Sb*** by the thumb-screw ***Sa*** changes the amount that the upper blade moves.

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 forward stop ***Sf***. At this point the needle arm is rotated by the needle clamp, anti-clockwise going up and clockwise going down.

When the needle rises, the arm ***A*** rotates anti-clockwise so that the needle clamp can fit into the stop ***Sf***. This motion moves ***Sb*** and ***U-U*** to the right, ready for the next ruffle. But this movement depends on the position of the stop ***Sb*** and so the motion of ***U-U*** varies. When the needle drops and moves away from the stop ***Sf***, ***A*** rotates clockwise, moving ***U-U*** to the left. The scale on ***Sb*** is an arc so that this movement is identical no matter where the stop ***Sb*** is placed.

A rather complex ruffler is that in Figure 44.[29]

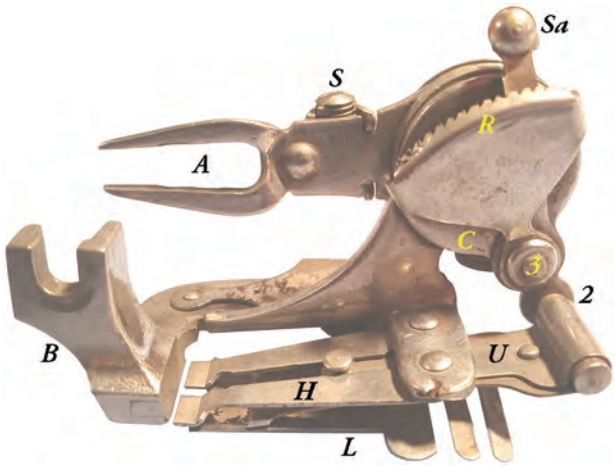


Figure 44a (Ericka Officer)

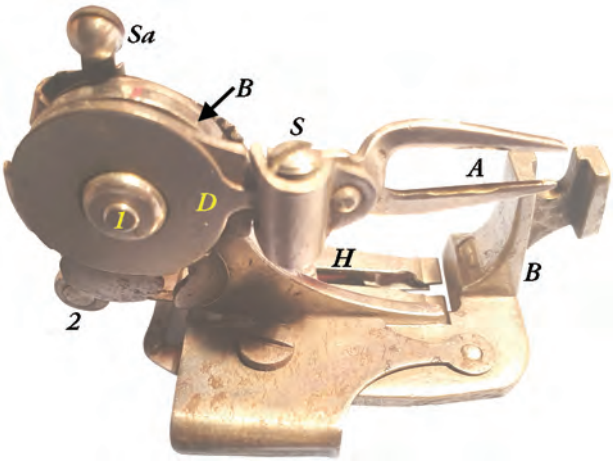


Figure 44b (Ericka Officer)

The lever ***C***, Figure 44a, is largely hidden by the ratchet ***R***, but it has a circular part around the common pivot point ***1*** and a linear part to the pivot ***2*** which attaches to the upper blade ***U***. Both ends of the ratchet ***R*** are folded over ***C*** so that they move together.

In Figure 44a, the adjustment ***Sa*** is a lever at the top of the ruffler and it can rotate about 70°. It is fixed to the pivot at ***3*** and held in a chosen position by the ratchet ***R***.

The pivot ***3*** goes from the lever ***Sa*** through to the other side of the ruffler and it has an oval cam fixed to it for the two stops ***Sf*** and ***Sb***, Figure 44c. So moving ***Sa*** rotates the cam. At ***Sf*** the oval cam is circular and the position of the lever in the ratchet does not affect it.

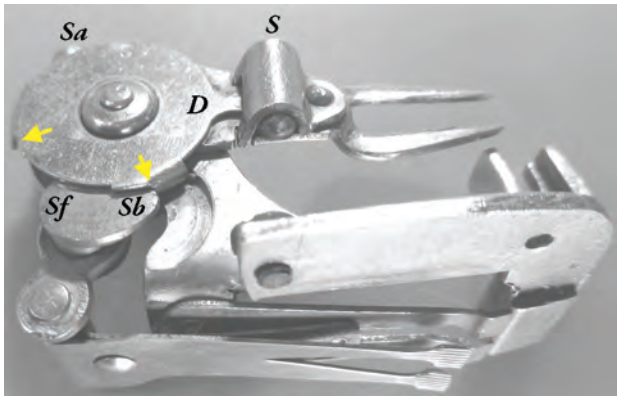


Figure 44c (Ericka Officer)

28 Wheeler & Wilson, ca 1888.
29 Singer, 1895a.

These stops are moved by the two pads on the disk ***D*** marked by the arrows, Figure 44c. The disk ***D*** is loose on the pivot ***1***, but held in place by a finger that goes to an adjusting screw ***S*** mounted on the needle arm ***A*** so that it rotates with the movement of the needle arm.

When the needle arm ***A*** rises, the left pad on ***D*** meets the oval cam at ***Sf*** and forces ***C*** and ***U*** to rotate anti-clockwise to move the upper blade forward the same distance irrespective of the position of the lever ***Sa***.

When the needle arm ***A*** drops, the right pad on ***D*** meets the oval cam at ***Sb*** and forces ***C*** and ***U*** to rotate clockwise to move the upper blade back. The distance that the upper blade moves back, and hence the size of the fold, depends on the position of the cam and what part of the oval face it meets.

The adjusting screw ***S***, Figure 44b, is fixed to the needle arm. It has threads top and bottom, but the middle part is cut out so that the finger on ***D*** fits into it. The adjusting screw is presumably used to ensure correct timing with the needle, like the blued steel spacer on the ruffler in Figure 40b (page 20).

Figure 45 is a much simpler way of using a ratchet ***R*** and a lever ***Sa*** mounted on ***C***.[30]

When the needle arm ***A*** rises, it butts against the end of the ratchet at ***Sf*** and moves the upper blade ***U*** forwards to the left. (The spring ***Su*** holds the upper blade ***U*** down in contact with the material.) This movement is always the same.

When the needle arm drops, ***Sb*** butts against the lever ***Sa*** and moves the upper blade back to the right. This movement varies, depending on the position of ***Sa.***

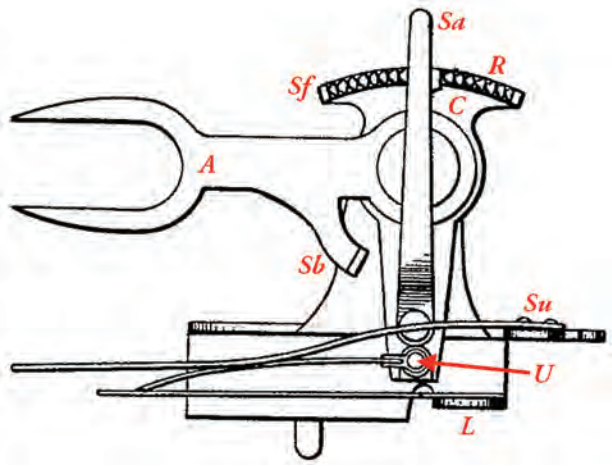


Figure 45

Although the illustration is poor, this design appears to have been used by the New Williams sewing machine.[31]

The Greist ruffler in Figure 46 is probably later.

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 levers ***l*** threaded onto it (they are shown in red in Figure 39, page 19), so that turning the dial moves the levers up and down, as in the inset photograph.

As the needle arm moves up and down, the levers ***l*** rock from side to side and move the lever ***C*** and hence ***U*** that is attached to the upper ruffler blade.

The distance that ***U*** moves depends on the vertical position of the levers.

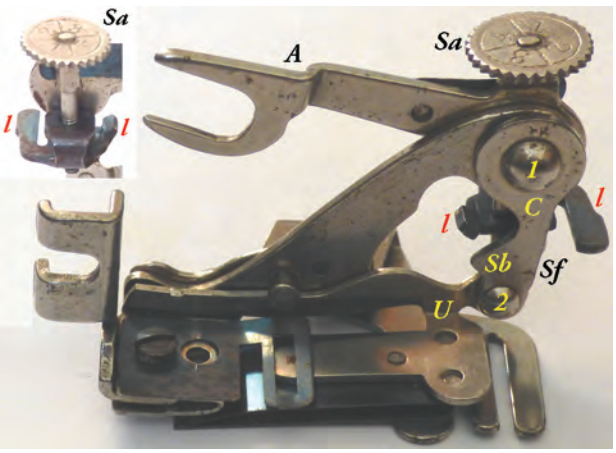


Figure 46

The stop ***Sf*** is the straight face of ***C*** and always moves ***U*** a fixed distance. However, the stop ***Sb*** is the other side of ***C*** that is shaped so that it will move ***U*** 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.

30 Johnston, A., 1886
31 Williams, nd.

Some sewing machine manuals that illustrate rufflers are available.[32] Of these the Florence Family Rotary, top-clamped, is the same as Figure 40c. The Howe (1867-1886) and the New Home (1881) are the same as Fig 41. The Domestic, Mason, Standard Paragon and Minnesota, all top-clamped, are variants of the Greist ruffler in Figure 46. In 1903 the Mason ruffler cost $1.00, about a day's toil for an unskilled worker.

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.

Figures 47 and 48 are photographs of a Singer No. 120290 "1-star-5" ruffler. The needle arm ***A***, pivoted at ***1***, runs from the fork for the needle clamp to its finger ***F***. The 12-tooth ratchet ***R*** is loose, but is prevented from rotating clockwise (in Figure 47) by a spring. The bottoms of two diametrically opposite teeth on ***R*** are much deeper than the rest.

The pawl ***P***, mounted on the needle arm ***A*** above the fork, consists of a spring-loaded lever pivoted at ***Pp*** and going to the flattened, slotted section where the finger ***F*** can fit into one of the slots. A small part of ***P*** is bent down at ***Pr*** so that it can meet the forward stop ***Sf***, which is a cut-out part of the lever ***C***, and the ratchet ***R***. The pawl ***P*** can be moved to three different positions. At positions "1" and "5" it has slots for the finger ***F*** on ***A***. At the "star" position there is a slight depression under it to ensure the arm of the pawl cannot accidentally be moved.

In position "1" the pawl ***Pr*** has rotated sideways away from the ratchet teeth ***R*** and it drops under the pressure of its spring so that ***Pr*** will meet the fixed forward stop ***Sf***. When the needle arm rises, ***Pr*** meets the stop ***Sf*** and causes ***U*** and the upper ruffler blade to move and fold the material. When the needle moves down, the face of the adjustment screw ***Sa*** meets the back stop ***Sb***, which is an arm on ***C***, and returns ***U*** and the top ruffler blade back as far as is needed for the size of the folds. So the material is folded at every stitch and the ratchet does not rotate.

In position "5" the pawl has been rotated sideways so that ***Pr*** lifts up and 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 level of the forward stop ***Sf*** and consequently it does not move the lever ***C*** and no folding takes place. That is, the ratchet rotates anti-clockwise (in figure 47) by one tooth and a normal stitch is made.

However, after the ratchet ***R*** has rotated 5 teeth and 5 stitches have been made, the pawl meets a deeply cut tooth on the ratchet that allows ***Pr*** to drop so that it meets the forward stop ***Sf*** and a fold occurs; the behaviour then is exactly the same as for the position "1". Because in position "5" there are 5 ordinary stitches between each ruffle, the position should be numbered "6" for ruffling every 6th stitch.

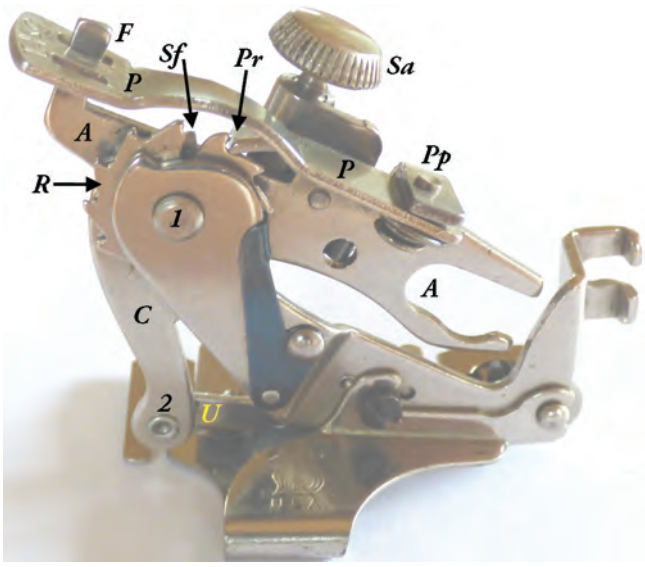


Figure 47

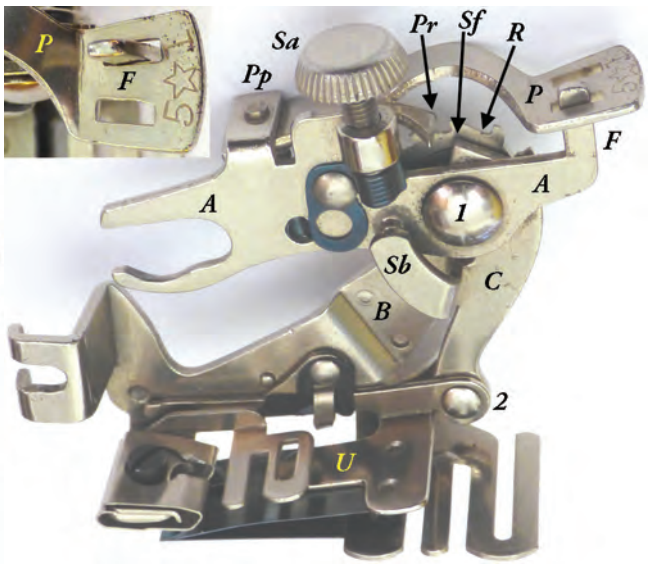


Figure 48

32 Victorian Sweatshop Forum, 2020a.

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

Figures 49 and 50 show a Simanco "1-6-12-star" ruffler.[33] The operation of it is basically the same as the "1-star-5" ruffler, except that it has two 12-tooth ratchets ***R*** that are fixed together. When the pawl is rotated to the "6" position ***Pr*** acts on only the inner ratchet which has the bottoms of two diametrically opposite teeth cut much deeper than the rest, and there are 5 ordinary stitches between each ruffle. However, in the "12" position the pawl ***Pr*** 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 there are 11 ordinary stitches between each ruffle. It also has a timing spacer ***St***.

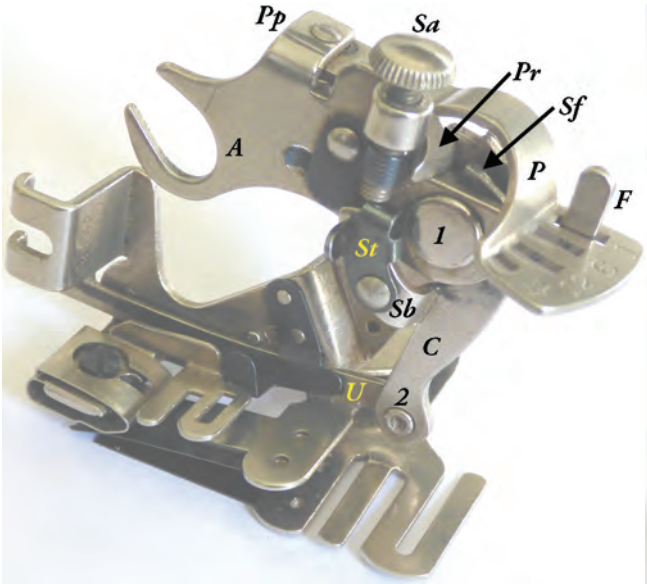


Figure 49

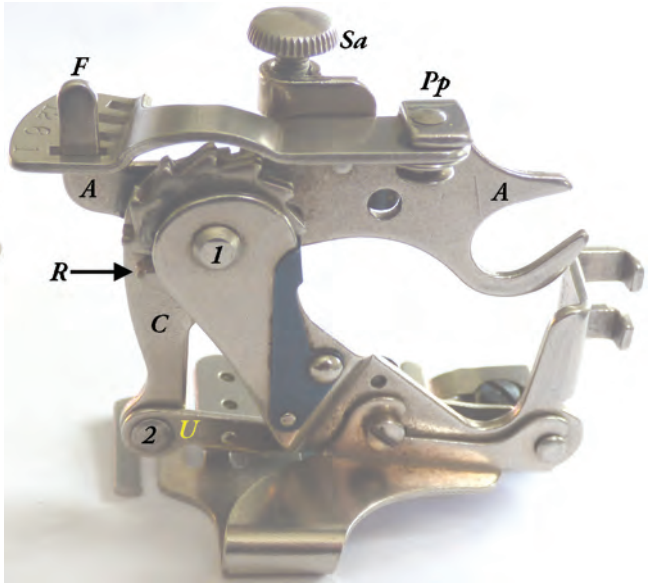


Figure 50

The ruffler attachment in Figures 51 and 52 is a little more sophisticated.

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 back stop ***Sb*** is by changing the shape of ***C*** by rotating the cam ***4*** which is part of the adjustment ***Sa***. First, note that in Figures 47 to 50 the back stop ***Sb*** is part of the lever ***C*** and the adjusting screw is on the needle arm ***A***. However, in Figure 52 the positions have been reversed, with ***Sb*** now a part of the needle arm ***A***.

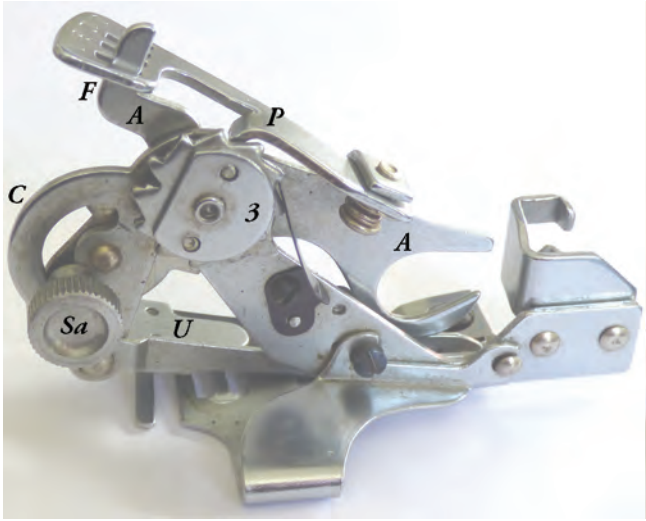


Figure 51

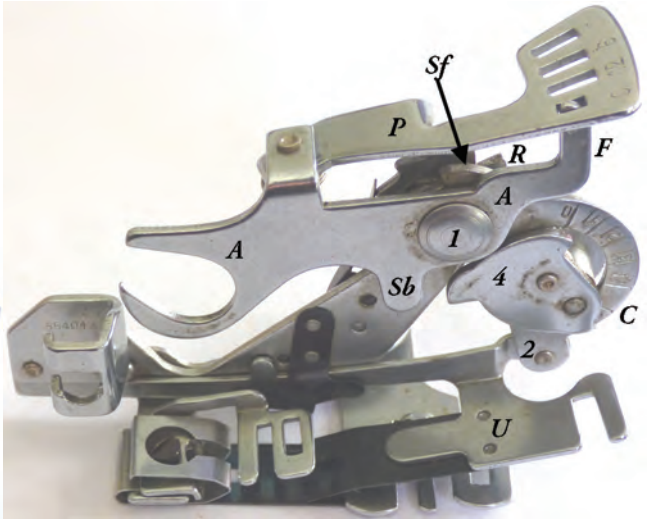


Figure 52

33 Singer, 1951.

There is a semi-circular scale that is part of the lever ***C*** and an adjusting thumb-screw ***Sa*** to lock the cam ***4*** in position. Rotating the cam ***4***, as in Figure 53, changes the gap between ***Sb*** and the acting face of ***Sa***, indicated by the arrow. Consequently the rotation of the lever ***C*** by the needle arm ***A*** when the needle drops changes.

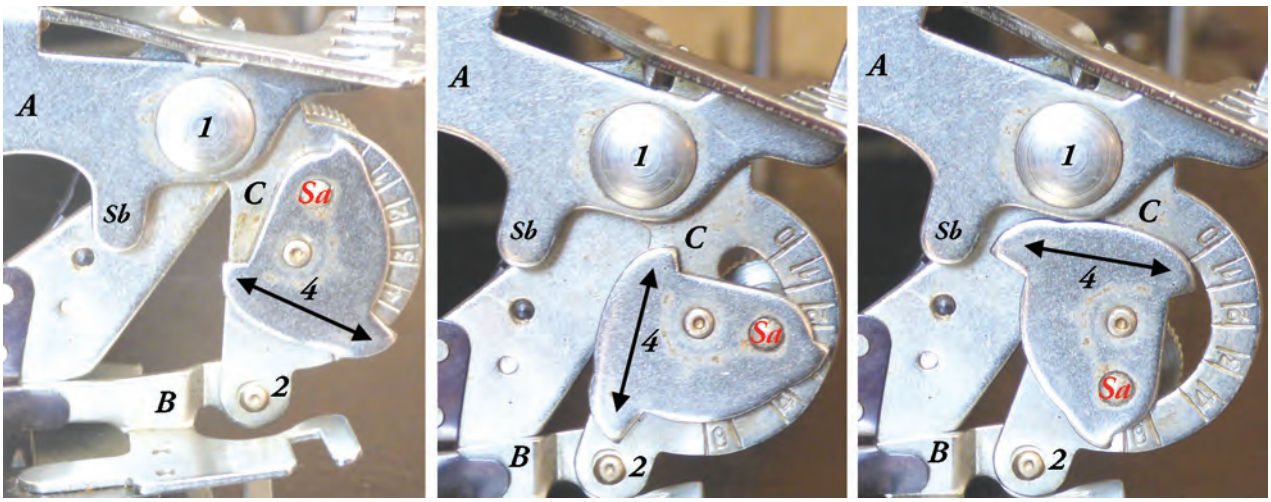


Figure 53

This appears to be the final design for a ruffler and, at the time of writing, it is used by the 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 ***Sb***. Two, made by Husqvarna and Pfaff, have ***Sb*** being a part of the lever ***C*** and the adjustment screw ***Sa*** is on the top, as in Figure 45. The remaining rufflers have ***Sb*** being part of the arm ***A***, as in Figure 48, which moves the screw ***Sa*** to the front of the ruffler.

Finally, the Singer blind stitch attachment (part number 160616) is a zig-zag attachment that is used to create invisible hems;[34] Figures 54 and 55. It can be viewed as a simplified version of the YS-7 attachment (page 14) with the feed-dogs in the attachment having teeth that are at right-angles to the machine's feed-dogs, but the cam moves the foot sideways only once at every twelfth stitch in the original version and once at every sixth stitch in the later model.

However, the folding must be done by hand and the complex attachment is simply a guide for the material.

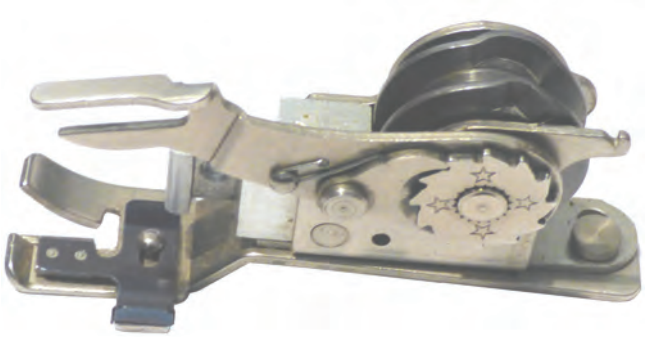


Figure 54

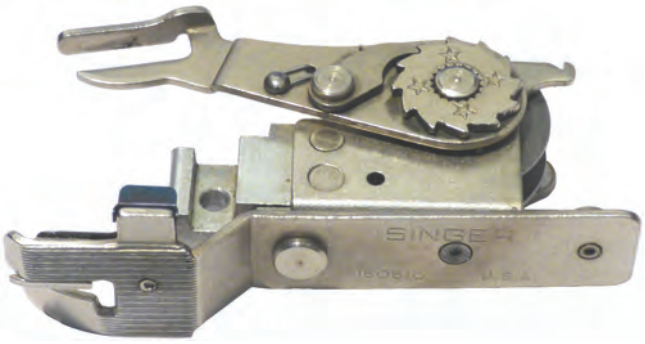


Figure 55

34 Singer, 1949.

Singer Attachment Sets

On page 4 I have mentioned the attachment sets that Singer made and documented. Unfortunately there are very few instruction manuals before 1889 for any brand of sewing machine. But in 1889 Singer started producing separate manuals for attachments. These manuals were produced until about 1915.

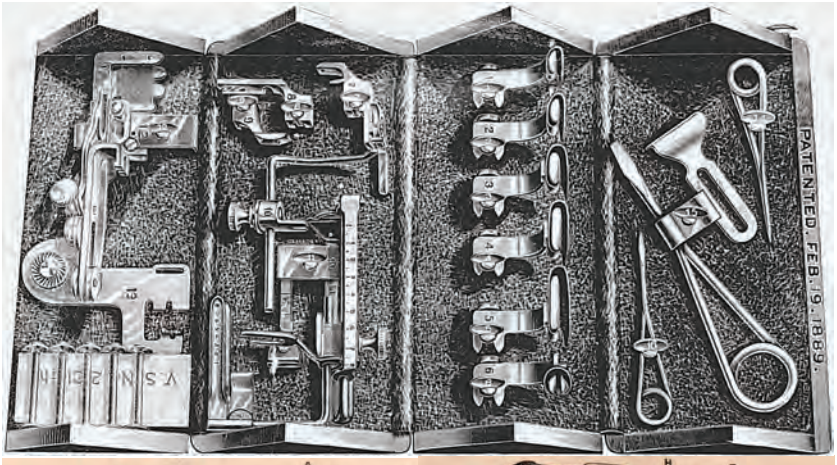
The following summarises most of the known separate manuals for attachment sets, *style manuals*, followed by three machine manuals. *Reissue* manuals mean that at least one earlier manual for that style should exist. There are some variations depending on the model of the machine the set was made for, VS (vibrating shuttle with a long bobbin) or IF (improved family with a round bobbin). Sets were made for both machines but all the following illustrations up to style 14, except for style 8, are for VS machines.

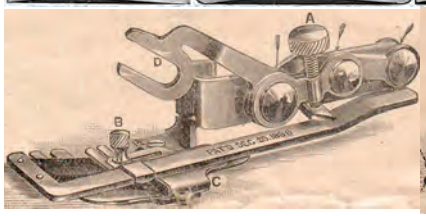
At present, one attachment set is undocumented.

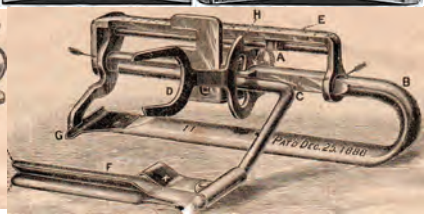
As I have noted before (page 4), some actual existing boxes of attachments (usually folding boxes, tins or cardboard boxes) have an assortment of attachments that do not belong together. And so I have used illustrations from manuals in preference to photographs.

I don't know for certain, but it is a reasonable assumption that new style sets were created when there was at least one change in the container or the set of attachments. The comments highlight some of the changes.

Style 1: 1888[35]





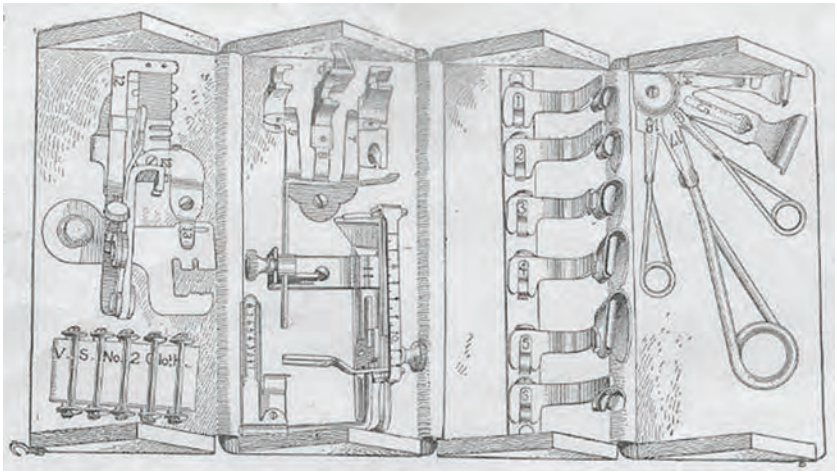


The wide-hemmers (under thumb-screws) are clamped at the back of an attachment foot. Looped screwdrivers in the accessories.

This set and the style 2 set are not described by Singer as style sets, which is not surprising as Singer probably could not predict future developments.

This ruffler (Figure 42, page 21) was used up to style set 8, but there may have been variants of it.

Style 2:[36]



A simpler method of fixing the attachments under clips.

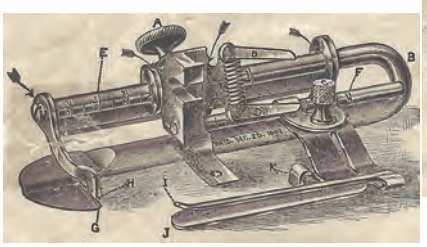
There is no doubt about the numbering of the Style 1 and Style 3 sets. Because of the method of clamping the wide-hemmers this set must be before Style 3 and probably dates from 1889. The attachments are the same as style 1.

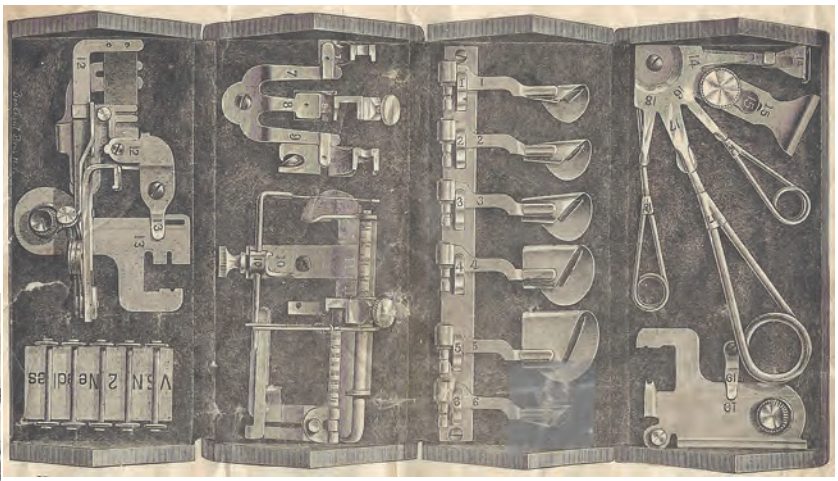
35 Singer, 1889a.
36 Singer, 1889?.

Style 3: 1890 [37]

Rod-clamped hemmers with a different attachment foot. Style 1 ruffler and new tuck-marker.

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

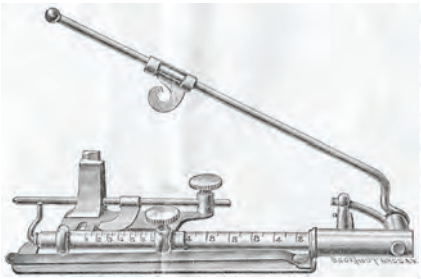


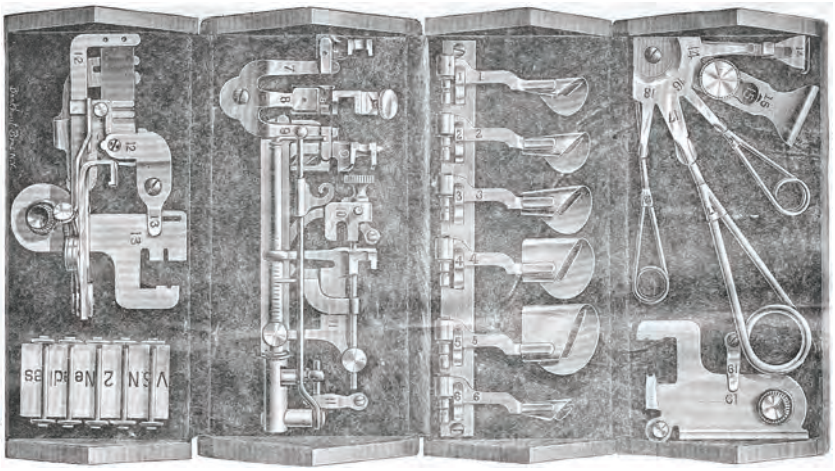


Style sets 4, 5, and 6 are missing. As they probably fit between Style 1 in 1888 and Style 7 in 1891 they might be variants of style 1, 2 and 3, or perhaps these numbers were not used.

Style 7: 1891 [38]

Style 1 ruffler and new tuck-marker.

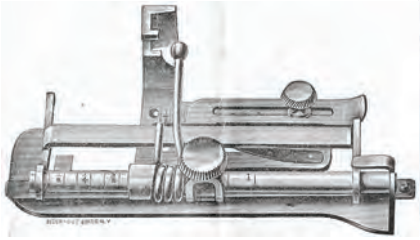


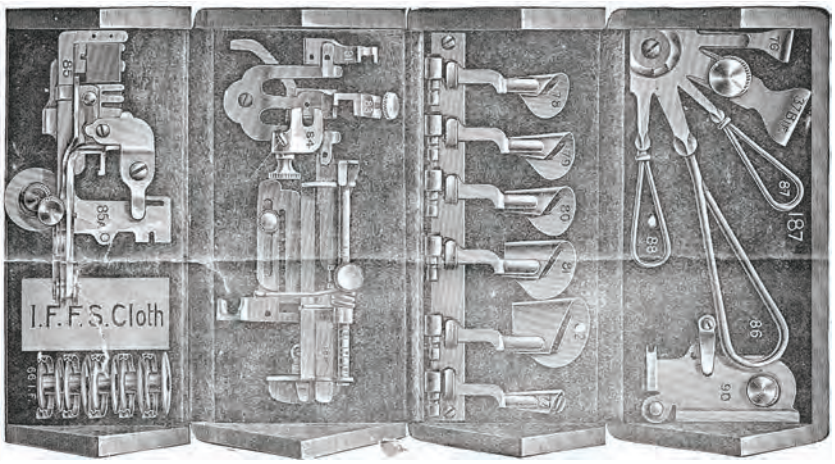


Style 8: 1893 reissue [39]

Plain screwdrivers.

Style 1 ruffler, new tuck-marker. (Different under-braider, shirring plate and bobbins for the IF machine.)





37 Singer, 1890
38 Singer, 1891a.
39 Singer, 1893a.