The present invention relates to improvements in or relating to apparatus for making hem-stitched seams in fabrics. It is an object of the present invention to provide a method by which a hem-stitched seam can be produced on zig-zag sewing machines and also by means of a device on household sewing machines whereby the holes are enlarged by means of a coarse needle and then stitched by means of the same needle in various directions of stitching. In this way the enlarged holes are bound together a number of times. By means of this method triangular as well as quadrangular hem-stitches can be produced on household sewing machines with zig-zag devices and also by means of a device which is operated by the needle-rod so that the housewife is able to sew hem-stitches into linen without the aid of a special machine. These hem-stitched seams can be stitched into any kind of material and have the particular advantage that the seam can be cut along the edge (picot edging) whereby collars and volants and so forth for clothes can be produced having pointed edges. Also, this method of stitching enables hem-stitches to be made in stockinette which was not possible hitherto with the special machine which was operated by means of piercers, because the piercers tore the stitches of the fabric. By means of the new method of stitch formation, however, the stitches of the fabric are merely forced apart and the stitches are drawn together by the multiple binding.

Turned up seams can also be produced with this hem-stitch seam whereby the rear side can be neatly cut out on account of the peculiarity of the seam. This formation of seam is made extremely strong on account of the multiple binding and if a thread of another colour is used for the stitching a particularly beautiful ornamental hem-stitch is produced.

The main feature of the method according to this invention resides in the fact that the hole of each stitch is bound with each adjacent stitch hole not only of the one series of stitch holes but also of the other, by means of several thread lengths in the production of one pattern repeat. In this way a complete pattern repeat is stitched without further movement of the material in the direction of stitching. This is most important for the perfection and uniformity of the seam because during this stitching process the material remains under tension. The material feeder of the sewing machine or that of the attachment can then be formed as a frame which prevents the material from drawing together when the coarse needle pierces it.

It is of the greatest importance for the production of hem-stitched seams by means of an attachment for sewing machines that the attachment should be kept as small as possible. The attachment must not only effect the displacement of the material in different directions but it must also effect the feeding of the material in the direction of sewing. A small construction is attained according to the present invention in that the component movements of the material feeder are brought about by means of two curves which operate either alternately or simultaneously to control the material feeder to move in different directions, the control means operating on the feeder being coupled together. By the aid of two curves a large range of patterns is attained so that there is no limitation to any particular hem-stitched seam.

For working with particularly strong materials the device, however, can also be provided with a piercer which pierces in advance of the needle hole and is secured to a lever. The hole which has been pierced by means of the piercer is then drawn apart by the various more or less radiating stitches produced by the device and sewn round whereby the stitches which lie in the direction of sewing connect also with the subsequent holes.

It is of importance in forming stitches that the last stitch of the stitch formation of one pattern repeat shall lie at the correct angle to the first stitch of the following pattern repeat. In order that the invention may be well understood reference will be made to the accompanying drawings in which:

Figure 1 is an end elevation in section of the feeder and stitching needle in which the feeder moves back and forth in the direction of stitching and the needle swings out transversely to the direction of stitching to left and right.

Figure 2 is a plan of the feeder.

Figure 3 is an end elevation in section of a feeder with an up and down moving needle which is not displaceable laterally the feeder being arranged to move not only back and forth in the direction of stitching but also transversely to the direction of stitching to left and right.

Figure 4 is a plan of the feeder shown in Figure 3.

Figure 5 shows the sequence and course of the thread of the individual stitches for a triangular hem stitch.
Figure 6 shows two curve diagrams for displacements in two directions.

Figure 7 shows the position of the thread for a quadrangular hem stitch in which the last stitch runs diagonally.

Figure 8 shows two curve diagrams for displacements in two directions.

Figure 9 shows the sequence and path of the thread of the individual stitches for a quadrangular hem stitch without a diagonal stitch.

Figure 10 shows two curve diagrams for displacements in two directions.

Figure 11 shows diagrammatically the stitch arrangement for a drawn thread, bound single needle hem stitch.

Figure 12 shows diagrammatically a drawn ground effect.

Figure 13 is a side elevation partly broken away and partly in section of a preferred form of device for sewing machines.

Figure 14 is an end elevation in section of the device shown in Figure 13.

Figure 15 is a side elevation of this device, Figure 16 is an end elevation of the mechanism for driving the feeder by means of a plane curve, Figure 17 shows the prismatic means for securing the device on the material presser rod, Figure 18 is a plan in section,

Figure 19 is an underneath plan view.

Figure 20 is a side elevation of the device in which the lifting device carries a piercer, Figure 21 is a diagrammatic elevation of a pusher lifting device controlled by intermediate levers,

Figures 22 to 24 show diagrammatically different stitch arrangements for sewing round the holes which have been pierced.

Figure 25 is a side elevation partly in section of the device with push plates controlled by curves.

Figure 26 is a plan of this,

Figure 27 is an elevation of the ratchet lever with the ratchet gear.

For the production of a zig-zag seam on a special machine with an up and down moving needle, the needle a moves transversely to the direction of sewing to left and right. The material feeder b moves the material in the direction of sewing (Figures 1 and 2).

In order to produce hem-stitched seams on these machines, the fine needle a is exchanged for a strong needle and the needle-rod is driven by a control curve or cam which has a particular curve inclination corresponding to the Diagram I (Figure 6) for a triangular hem stitch and has a curve inclination corresponding to Diagram I (Figures 10 and 8) for a quadrangular hem stitch. The material feeder b is likewise moved back and forth by means of a special control curve or cam, the curve inclination of which is designed according to Diagram II (Figure 6) for a triangular hem stitch and according to Diagram II (Figures 10 and 8) for a quadrangular hem stitch. The material feeder as well as the needle rod can be driven by means of a known control means from the curve or cams.

The movements of the material feeder and of the needle rod take place in the following sequence for making triangular hollow seams:

The needle rod makes one stitch (stitch 1), the material feeder feeds the material by one stitch length to the second stitch (stitch 2), moves the material back again to the first stitch (stitch 3) and again back to the second stitch (stitch 4).

Note the material feeds the material backward through one half stitch length whilst the needle swings out by the width of one stitch (stitch 5), the material feeder brings the material again forward, the needle rod goes back into its initial position back to the second stitch (stitch 6), both parts then swing back again to the fifth stitch (stitch 7), and the pattern repeat of the seam is completed. The material feeder then goes under the needle plate and swings idly back without moving the material and after rising again feeds the material forward by a complete stitch length, and the needle rod remains swung out for the eighth stitch (stitch 8). The material feeder then brings the material forward again to the fifth stitch (stitch 9) and back again to the eighth stitch (stitch 10). Then the needle rod swings back again into its initial position and at the same time the material feeder moves the material back by one half stitch length to the second stitch (stitch 11), moves it forward again to the eighth stitch (stitch 12) and back again to the second stitch (stitch 13), so that the second pattern repeat which is the mirror image of the first is completed and the material feeder now moves idly under the needle plate for the next pattern repeat and so forth. The last stitch of the second repeat is therefore the same as the first stitch of the first pattern repeat.

The movements of the material feeder and of the needle rod for a quadrangular hem stitch are as follows:—

The needle rod makes one stitch (stitch 1), the material feeder feeds the material through one stitch length to the second stitch (stitch 2), leads the material again forward to the first stitch (stitch 3) and back again to the second stitch (stitch 4). Now the needle rod swings sideways by the width of one stitch to the fifth stitch (stitch 5), back again to the second stitch (stitch 6) and back again to the fifth stitch (stitch 7). The needle rod remains in its displaced position and the material feeder feeds the material by one stitch length forward to the eighth stitch, (stitch 8) brings it back again to the fifth stitch (stitch 9) and again forward to the eighth stitch (stitch 10) and back again to the fifth stitch (stitch 11). The needle rod swings back into its initial position to the second stitch (stitch 12). This last stitch is the same as the first stitch of the new pattern repeat. The material feeder then passes under the needle plate and swings idly without feeding the material in the direction of sewing forward and after rising again feeds the material again by a complete stitch length in the direction of sewing to the second stitch and so forth.

It is in general possible, for example, for triangular hem stitches to select the time sequence in another manner and indeed the material feeder need not move the material in the sewing direction alternately one after the other back and forth by a complete stitch length and then to execute the oblique stitch together with the swinging out of the needle rod, but the sequence can be so selected that the straight stitch and the oblique stitch follow one another alternately until the stitch holes which are arranged in a triangle are bound on three sides by means of three threads. The sequence can also be such that the zig-zag stitch sequence runs according to Figure 5 in the following manner:—

1. 2, 5, 8, 4, 3, 6, 7, 10, 11, 9, 12, 13.

In this case, the two mirror image repeats are put together in a common repeat corresponding to the two sides of the triangle. It should be pointed out here, however, that the sequence can also be
chosen in a different manner and at the same time produce the same effect of the hem stitch. The operation in Figure 5 corresponds to the combination of both repeats and the dotted lines represent in each case the idle passage of the material feeder under the needle plate without taking the material with it.

Obviously it is also possible to allow the needle a to swing out in the direction of sewing, in which case the material fed by the material feeder is moved transversely to the direction of sewing. In the case of a triangular hem stitch this has the advantage that the lighter needle rod must sew the large as well as the half-size stitches in the stitching direction, whilst the material feeder would be interrupted during the large stitches in the sewing direction. It is thereby possible to increase the speed of the machine.

Household machines, however, are known according to German patent specifications No. 494,439 and No. 541,661 in which the material feeder c is moved in the sewing direction as well as transversely thereto (Figures 3 and 4).

Referring to these figures, the special needle plate d which is driven by the material feeder e is taken with the material feed and moves in and forth. The needle plate d in known manner is guided in a special plate e provided with slots.

In order to produce hem stitched seams on these machines the material feeder must be moved back and forth and also transversely to left and right corresponding to the direction of the arrow in Figure 4. The displacement of the material feeder can likewise be effected by means of two curves or cams and in fact for triangular hem stitched seams and quadrangular hem stitched seams, the forward and backward movement of the material feeder can be effected by the curve II and the transverse movement of the material feeder can be effected by means of the curve I (Figures 6, 10 and 9).

The sequence of operation for the triangular hem stitch is as follows:

The needle makes one stitch (stitch 1), the material feeder of the sewing machine which is also movable transversely of the direction of sewing feeds the material by one stitch length to the second stitch (stitch 2) and backwards to the first stitch (stitch 3) and backwards again to the second stitch (stitch 4). The material feeder then moves the material backwards by one half stitch length and at the same time moves it by one stitch width sideways to the fifth stitch (stitch 5). The material then moves backwards to the second stitch (stitch 6) and backwards again to the fifth stitch (stitch 7), and the pattern repeat of the seam is completed. The feeder then passes under the needle plate, swings idly back returning its transverse movement. After rising it moves the material by a complete stitch length in the sewing direction forward to the eighth stitch (stitch 8), brings the material again forward to the fifth stitch (stitch 9) and backwards again to the eighth stitch (stitch 10). The feeder then moves the material by one half stitch length and is simultaneously moved by one stitch width transversely of the sewing direction back to its initial position to the second stitch and so produces an oblique stitch (stitch 11). It then swings forward again to the eighth stitch (stitch 12) and backwards again to the second stitch (stitch 13) whereby the second pattern repeat which is the mirror image of the first is completed and the feeder has only to swing idly under the needle plate to the new pattern repeat and so forth. The last stitch of the second pattern repeat is in this manner the same as the first stitch of the first pattern repeat.

The sequence of operation for the quadrangular hem stitch by means of this device is as follows:—

The needle makes one stitch (stitch 1) the feeder of the sewing machine which, as aforesaid, is movable transversely of the sewing direction moves the material by one stitch length to the second stitch (stitch 2) moves the material forwards again to the first stitch (stitch 3) and back again to the second stitch (stitch 4). The feeder then moves the material transversely to the sewing direction by one stitch width to the fifth stitch (stitch 5) back again to the second stitch (stitch 6) back to the fifth stitch (stitch 7), the feeder remains swung out transversely of the sewing direction and moves the material in the sewing direction forward by one stitch length to the eighth stitch (stitch 8) back again to the fifth stitch (stitch 9) and forward to the eighth stitch (stitch 10) and again backwards to the fifth stitch (stitch 11). Then the material feeder goes transversely of the sewing direction back into its initial position and moves the material to the second stitch (stitch 12). This last stitch is identical with the first stitch of the new pattern repeat, the feeder then passes under the needle plate and swings idly without moving the material in the sewing direction forwards and after rising again moves the material again by a complete stitch length in the sewing direction to the second stitch and so forth.

A particularly effective quadrangular hem stitch is also obtained if the last stitch of the hem stitch forms the diagonal of the quadrangle as is to be seen from Figures 7 and 8, but of course the sequence of operation must be arranged differently. The arrangement is quite clear from these figures so that further and more detailed description is unnecessary. This arrangement of the stitches, however, has the advantage that with a single device triangular as well as quadrangular hem stitches can be sewn by merely changing the curve or cam, because both these stitch formations have the same divisions. It is of importance for the effectiveness of the seam that two adjacent stitch holes shall be bound by at least three threads. If, for example, the binding was effected by only one thread the hem stitch would not have a very good appearance and again, in the first place the needle would not pass through the same stitch hole a few times and would force the material apart to too slight an extent and in the second place the stitch hole would be insufficiently bound so that ends of material would remain. These ends result from the fact that when the needle pierces the fabric a warp or a weft thread is frequently pierced and torn. These torn threads cannot be completely bound in by a single length of thread. Apart from that, however, by reason of the unequal number of the threads it is possible to produce a progressive seam because the starting point of the first stitch and the end point of the last stitch are separated by the size of one stitch.

The method of producing hem stitched seams described, however, can also be carried out by means of attachments for sewing machines which are operated by movement of the needle rod.

According to the present invention there are provided new measures which permit the device to be formed small and at the same time stable as is the case with similar devices for the production
of zig-zag seams and the component movements of the material feeder are effected by two curves which control the feeder to move in different directions by operating either alternately or simultaneously. According to the magnitude of the one or the other component movement various oblique stitches can be produced. It is very important for the compensating of the apparatus that the curved cams can be mounted on a common axis and merely driven by means of a ratchet gear. Thus, the curves may be connected together to a common drum-like body which can be exchanged with very little manipulation for another drum-like body. Since the curves possess contours and steps corresponding to different patterns the range of patterns of the fancy stitch device is very great. Great accuracy in sewing is obtained especially by reason of the fact that the pattern is sewn in a single operation conforming to the repeat. Only after completion of the repeat is the material moved forward by means of a special feeder or else by the same feeder, the movement being preceded by an idle movement of this feeder by the amount of the material feeding movement in the opposite direction. This forward movement is made possible in that a lift lever, controlled by cams presses down on the material, holds this fast and at the same time lifts the whole device with the material presser rod a little so that the material feeder passes idly over the material which is retained in position.

The construction and method of operation of the device are more fully described in the following. The U-shaped housing 3 of the device is mounted by means of a prismatic angle member 4 on the machine 2. The angle member 4 is firmly secured to the housing 3 of the device by means of screws 5 and is interchangeable to suit different sewing machines. A forked ratchet lever 9 is moved up and down by the needle rod 8 by means of a cylindrical boss 7 on the needle holder 8 and sets in intermittent rotation a spindle 11 by means of a pawl and ratchet gear 10 of known form per se. A brake spring 12 of known form is secured to one end of the spindle 11 by means of a screw to prevent return of the spindle 11 upon return of the ratchet lever 9. The spindle 11 is provided in its middle portion with two keys 13 so that it will carry with it a drum member mounted thereon. The drum member consists essentially of a cam I for the horizontal movement and a cam II for the vertical movement. Both cams are connected securely together with interposition of distance pieces 14 and 15 by means of axial bolts 16. The cams carry on their side faces step-like depressions which are graduated according to the pattern in the ratios of 2:2:6:6:4:8: that is to say the cams possess large and small steps which are separated by uniform parts of the cams. The steps can also be twice as large in one direction but it is necessary that the actual ends of the curve close on one another after the complete rotation of the drum member, that is to say the repeat of a pattern must be distributed periodically over one rotation. There is therefore a relation of the individual sections of the curve to the whole curve by a ratio 1:2:1:3:1:1:2:6:6:4:8:9:10:11:12 to the cam divisions. According to the kind of pattern therefore there may be 1, 2, 3, 4, 6 or 6 cam projections distributed around the distance piece 15. The cam projections 41 operate a bell crank lift lever 42 which swings about a pin 43 fixed in the side wall of the housing. The head of the bell crank lever likewise possesses an adjusting screw 44 so that the magnitude of the swinging movement can be adjusted. At the other end the lift lever is forked and embraces the needles 45. If the lift lever is sprung out by the cam projection 41 the forked end presses on the material and lifts the whole device with the material presser rod a little. If now the material feeder carrier 27 is moved it passes idly with the plate 29 over the material and is only brought again into engagement with the material when the cam projection 41 has released the lift lever 42 and when...
the device has dropped again. By means of the co-operation of the lift lever 42 with the material feeder 27 the material can be progressively moved in the direction of sewing. If, for example the material feeder carrier is moved by the cam to follow a definite pattern repeat back and forth or sideways and obliquely then after the completion of the stitched repeat the lift lever comes into operation and raises the material at the same instant the material feeder goes forward where, upon releasing the lift lever it again comes in contact with the material and upon returning feeds on the material in the direction of sewing and so on. Upon the idle forward movement of the material feeder which is operated from the upward movement of the needle rod, the material naturally remains stationary and the needle penetrates again idly into the same hole and so produces a knotted stitch; this knotted stitch may be advantageous for various patterns. This knotted stitch or the empty passage of the material feeder can be avoided if the lift lever 42 simultaneously effects the feeding movement of the material in the direction of sewing. In this manner a progressive movement of the material is obtained. The lift lever can also be formed as a single-armed lever but it is important that the operated lever in both cases directly engages with the material. In sewing curves it is important that the material can be easily rotated under the material feeder of the device. It is therefore advisable that the lift lever should narrowly encompass the needle and be arranged within the closed frame-like plate for the feeding of the material.

In Figures 5 to 12 a few of the many diagrams of stitch formation are illustrated by way of example. In the patterns according to Figure 5 the feeding movement of the material in the direction of sewing is effected by the material feeder carrier 27, which however, also moves the material for the individual stitches of the repeat. In this case the dotted lines indicate the idle forward movement of the material feeder carrier 27.

At that instant the material remains stationary whilst the needle penetrates again into the stitch hole and executes a knot stitch. This knot stitch is, however, not in any way disadvantageous for the formation of the seam because it is taken up by the subsequent stitches.

In Figure 11 is shown a diagram for a bound single needle hem stitch which can likewise be produced with the device and the threads are drawn together in sewing in known manner. It is characteristic in the case of this seam that the two stitchings 4 and 5 must be sewn by means of double as large steps of the vertical cam II.

Whilst the vertical cams of Figures 7 and 9 merely show simple steps of equal size with straight intermediate portions, the cam II of Figure 6 is divided into large and small steps whereby with the small step on the horizontal curve I likewise curve portions are effected, which upon simultaneous working of the curve produce oblique stiches. A good combination can be seen from Figure 12.

Obviously there are still further possibilities of stitch formation which can be produced by interchanging the drum members with the two cams I and II.

It is to be observed that with the device described it is also possible to stitch a hem stitch which only has one hole as is produced on special manufacturing sewing machines. Such seams, however, cannot be produced with a strong needle. Even with a weak needle and when the stitch formation is such that a hole is drawn apart by radiating stitches, the hole is not sufficiently big to give the effect of a hem stitch. Consequently, it is necessary to make in the material a sufficiently large hole by means of a piercer, the hole being drawn apart by means of different stitches in a more or less radiating form and sewn around the stitches lying in the direction of sewing connecting up with the succeeding hole. It is true that already ornamental stitch devices are known which operate with a specially controlled piercer. In the present invention, however, the piercer is arranged in combination with the lifting means which hold the material fixed and at the same time lift the device. This has the advantage that a special control means is not required. The lifting means forced as a lever or like a feeder then comes in operation if and when the material feeder is to pass idly over the material, in order to bring up fresh material in the direction of sewing. It is essential that the piercer precedes the lift movement upon striking and follows it upon sinking of the device so that the material is always held firm by the material feeder not only upon piercing but also when the piercer rises. The whole piercer assembly must be arranged in a small space and a further example is given to show how the piercer makes a hole ahead of the needle and is secured to a lever the piercer being formed by an arcuate form to correspond with the movement of the lever. In this arrangement the piercer precedes the needle rod and nevertheless pierces the needle rod and next follows hole to be struck.

The device 3 is secured in known manner to the prismatic portion of the material presser rod 1 of the sewing machine 2.

The spindle 11 of the device is likewise set in known manner into intermittent rotary motion by means of a known ratchet gear from the needle rod 6. Cam projections 41 are rigidly connected with the spindle 11 and are distributed one or more times round the periphery of the distance piece 15 according to the stitch formation for the pattern repeat.

An angular or bell crank lift lever 42 oscillates about the pivot pin 43 and is provided at its head with an adjusting screw 44 whereby the magnitude of its oscillation which is effected by means of the cam projections 41 can be adjusted. A tension spring 60 urges the screw 44 of the lift lever 42 against the distance piece 15. At its other end the lift lever 42 carries a pivoting 61, which can be adjusted in height and secured by means of a screw 62.

The method of operating the device is as follows:—The lift lever 42 is so rotated by means of the cam projection 41 of the device 3 that the piercer 61 passes through the material 63 at a certain stitch hole 64. During this the material feeder plate 29 holds the material firmly so that the material cannot be drawn into the perforated hole 64. Upon further movement of the cam projections 41 the underside 65 of the lift lever 42 is pressed on to the material, the material is held fixed and the whole device with the material presser rod 1 is lifted a little. Thereby at the same time the material feeder plate 29 is removed from the material and the material feeder 145 carrier 27 is moved forward idly so that the material feeder plate 29 moves over the material which is held fixed. Then the lift lever 42 is released by the cam projections 41 and by reason of the tension spring 60 it returns to its original 150
position as shown in Figure 20, thereupon the device with the material presser rod descends again and the material feeder plate 29 again comes into engagement with the material 62. The piercer 61 then goes over the edge of the material whilst at the same time the material is held fixed by the material feeder plate 29.

The perforated hole in the material is now sewn around in the known manner in different directions. After the sewing has been completed according to the pattern repeat the lift lever 42 is again set in operation whilst the material feeder plate 29 passes idly over the material and upon backward movement the new material is further moved in the direction of sewing.

In Figure 20 the piercer is mounted on the lift lever 42. The piercer therefore executes an arcuate movement which, if the centre of rotation is sufficiently far removed and is suitably chosen, does not present any great disadvantage.

In Figure 21 a further example is given in which the piercer is secured to a push rod 66 which is guided vertically in bearings 67 of the device 3.

The lift lever 42 engages in the slot 68 of the push rod and is controlled by cam projections 61 in the same manner as is described above. Essentially, however, in this arrangement the arcuate movement of the lift lever 42 is converted into a vertical movement of the push rod 66.

The push rod 66 in Figure 21 as well as the lift lever 42 in Figure 20 may also carry a plurality of piercers which are graduated in length with respect to one another that the first piercer pierces the hole and the second piercer completely enlarges the hole. It is important however that the piercer should be arranged in the immediate neighbourhood of the needle 45 of the sewing machine so that curves can also be sewn on this device. In Figure 20 the piercer is arranged immediately in front of the needle 45.

In Figures 22 to 24 various stitch forming operations are diagrammatically illustrated and for the sake of simplicity round, enlarged holes 70 are shown.

The small figures show the sequence of the individual stitches and the dotted line 1 indicates the idle movement of the material feed plate 29 over the material which obviously takes place in the same direction of stitching as the stitch 2 and merely for the sake of clearness is indicated obliquely and not as a stitching movement. In Figure 22 two holes are always bound by three stitches, 2, 5, 6. It is very important for the quality of the stitching that the last stitch 6 (Figure 22) should be at the correct angle of stitch formation according to the pattern repeat to the stitch 1 of the next repeat, because the knotted thread always lies at the edge of the hole of the material. If both stitches run behind one another in one direction then the knotted stitch would lie in the middle of the hole so that the hem stitch would not come out clean.

In Figures 22 and 23 the hole is drawn open in four directions by radiating stitches. Figure 24 shows a diagram of stitch formation in which the hole is sewn around in six directions radiating from the hole. A very beautiful clean seam is produced which does not go together after washing.

In the following example a further construction is shown in which push plates are controlled by the cams for moving the material feeder. This arrangement makes possible a very narrow construction and also the utilization of severalcams.

The device is secured in known manner to the material presser rod of the sewing machine. A number of cam discs 71, 72, 73, 74 are fixed on a spindle 70. The spindle 70 is intermittently moved by means of a ratchet wheel 75 from a ratchet lever 76 through a pawl 77. A slot 78 in the end of the ratchet lever 76 engages with a cylindrical boss 79 on the needle rod 80 and is oscillated by this. In order that the engagement of the pawl 77 with the ratchet wheel 75 may be varied the pawl 77 is rotatably secured to a separate plate 81 by means of bolts 82 so that the plate 81 can be rotated on the ratchet lever 76 about the spindle 70 by means of two screws 83.

Slots 84 in the plate 81 limit the extent of adjustment. This adjustment is necessary so that thecams 71, 72, 73 and 74 can be brought into the correct sequence to follow the needle rod stroke of the sewing machine. The push plate 85 is driven through the agency of a pin 86 by the cam 73 so that it follows the curvature of the cam. The push plate 85 moves in a straight guideway provided by the spindle 70 and the bolt 87. The bolt 87 like the needle 70 passes through the whole device and is mounted rotatably in both side walls of the housing. In order that the push plate can be moved, slots 88 are provided for the spindle 70 and slots 89 for the bolt 87. The push plate is provided with an arm 105 which by means of a slot 91 embraces a bolt 92. The bolt 92 is firmly connected with the material feeder 93. The material feeder 93 is moved back and forth by means of the push plate 85 and the cam 73, the material feeder 93 being guided by a pin 94 which is fixedly connected with the housing and passes through a slot 95. Similarly a push plate 96 is moved by the cam 74 and is likewise guided in a straight line by means of the spindle 70 and the bolt 87 in slots 89 and 115.

This push plate also has an arm 97 which is placed at the lower edge is provided with a slot 98 in which one arm 99 of the bell crank lever engages. The bell crank lever is rotatable about a pin 100 fixed to the housing and carries on its other arm 101 a pin 102 which is guided in a slot 104 of the material feeder. Upon movement of the push plate 96 the bell crank lever is rotated about the pivot pin 100 and thereby moves the material feeder sideways by means of the pin 103, the material feeder swinging about the pin 94 as pivot. The material feeder can be swung sidewaysthrough the push plate 96 by means of the bell crank lever as well also as backwards and forwards through the push plate 85 by means of the pin 92. If both push plates are operated from the cams at the same time oblique stitches in any direction can be produced.

The piercer 106 is secured to the lever 107 which oscillates about the pivot pin 107 and is driven from the cam 71 through the pin 108 in such manner that the piercer strikes the material under tension and in the same manner is removed from the hole so that the material can be moved to different sides by the material feeder.

If the hole is made and the material feeder so moved that the hole as explained in the introduction is enlarged and sewn around, then two levers 109 which are mounted about pivot pin 110 are swung downwardly by the two cams 71.

Two guide pins 112 are secured to the levers 109 and two slots 113 in the walls of the housing permit the levers to swing downwards. A special material feeder 114 is movable backwards and forwards having slots 115 engaging with the two
guide pins 112. The material feeder is held together by a common bridge piece 116. This carries a pin 117 in which a limb 118 of a push plate 119 engages. The push plate 119 is driven by means of the pin 120 from the cam 72 and is guided in a straight line by the spindle 70, the pin 87 and the two slots 88 and 89. The material feeder is therefore moved backwards and forwards by the push plate 119 whilst it is oscillated up and down by means of the two levers 109. On the forward end of the material feeder are two toothed feet 121 on the two sides of the material feeder 93. If the hole is enlarged and sewn around all ready then the material feeder 114 is swung downwards by the lever 109 the feet lie on the material against the needle plate and raise the whole device about 1–2 millimetres high whereby the material pressure rod 99 which forms a complete whole with the device serves as a guide and the material is moved backwards by one stitch length in the direction of sewing by the feet 121 of the material feeder by means of the push plate 119. Thereupon the material feeder is again moved upwards by the lever 109 and the material is held fast so that a new hole can be perforated and sewn around. In this time the material feeder 114 moves back idly again over the material.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:

1. In hemstitching attachments for sewing machines, a material feeder, and alternately operating cams for controlling the movement of said material feeder in different directions, a driving spindle on which said cams are interchangeably mounted, a bell crank lift lever, for cooperating with the material feeder for moving the material progressively in the direction of sewing, cam projections rotatable about the common axis of the cams to operate said bell crank lift lever, and means to adjust the field of the swinging movement of said bell crank lift lever, one end of said bell crank lift lever being forked to embrace the needle.

2. In hemstitching attachments for sewing machines, a bell crank lift lever, cam projections to rotate said lift lever, a piercer mounted on said lift lever to pass through the material at a certain stitch hole, a material feeder plate to hold the material firmly during the operation of the piercer to prevent the material from being drawn into the stitch hole, said cam projections operating to press the underside of said lift lever onto the material to hold the same, and lift the attachment, a spring for returning the lift lever to its original position upon release of the same by the cam projections to allow the material again to be engaged by said material feeder plate.

KURT GUSTAV SCHEBEL.
ARTHUR ALBRECHT BOHANN.