

May 24, 1938.

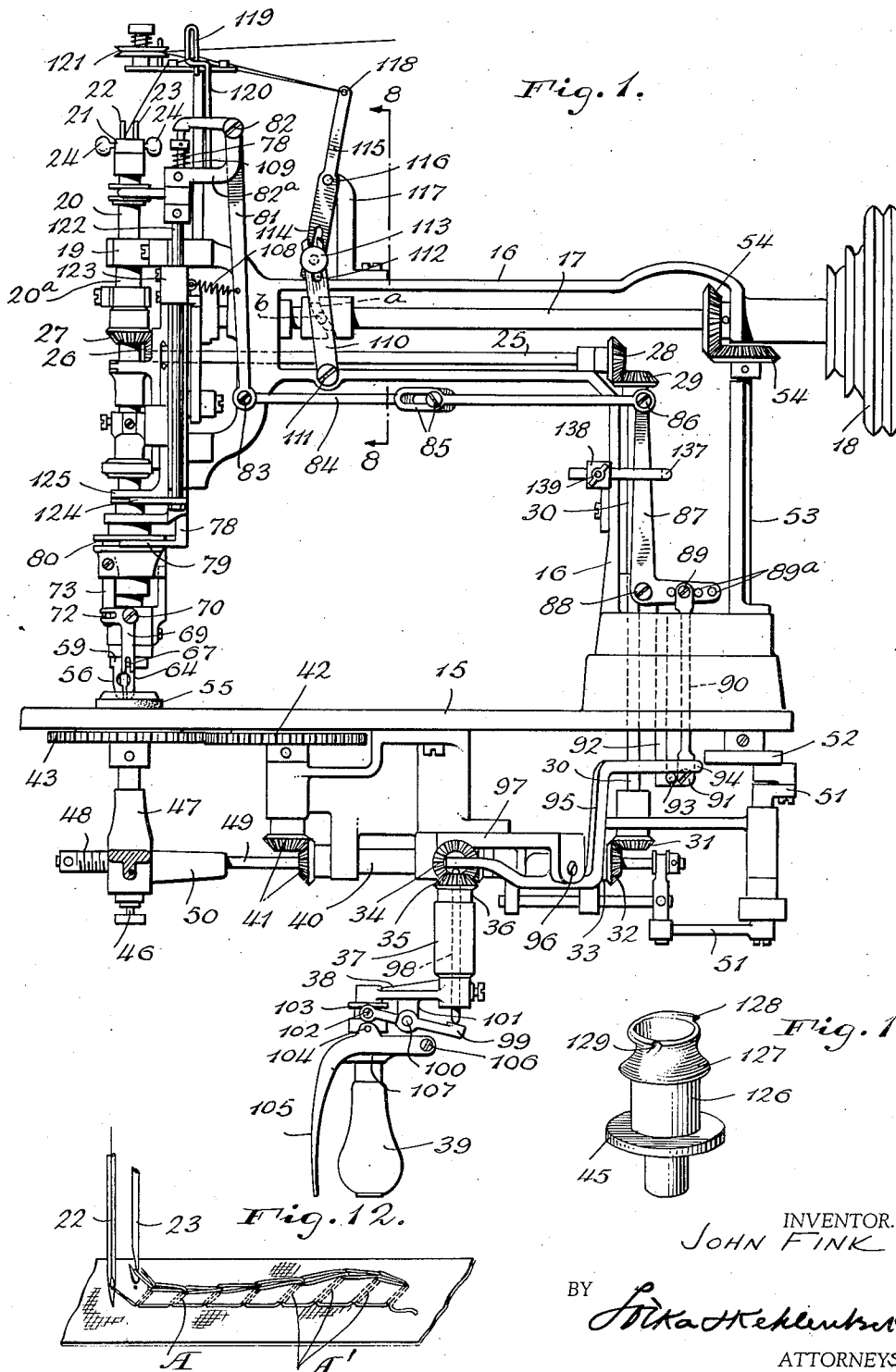
J. FINK

2,118,077

EMBROIDERING MACHINE

Filed July 26, 1935

5 Sheets-Sheet 1



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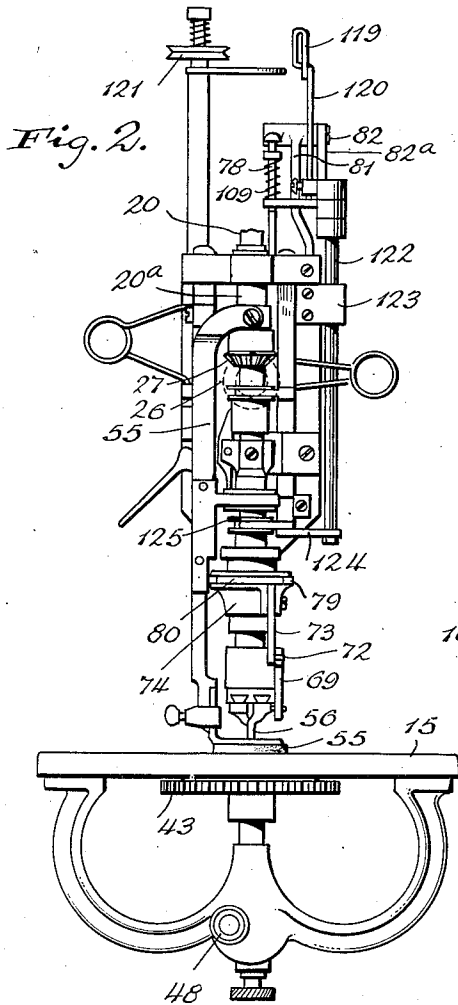
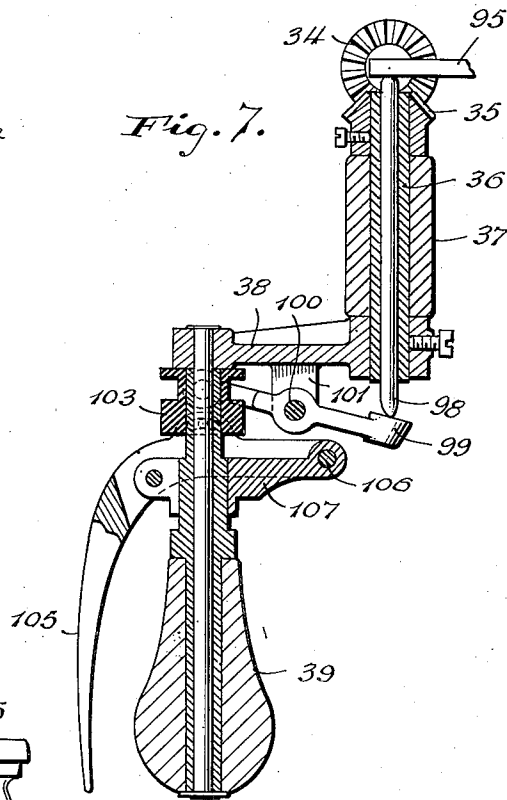
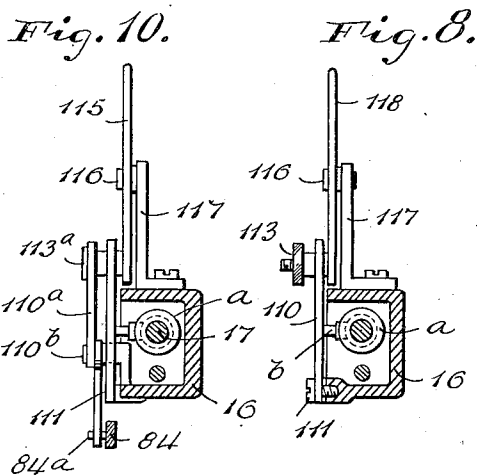
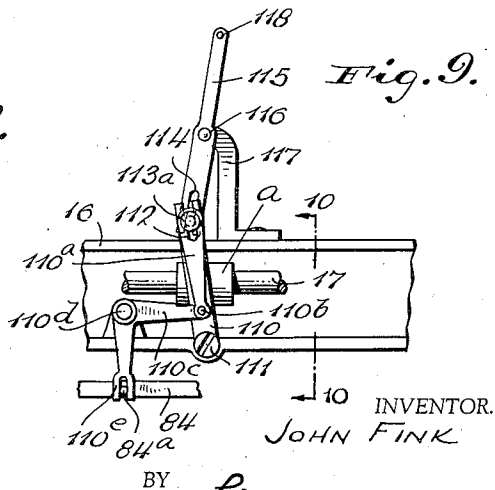
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EMBROIDERING MACHINE

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5 Sheets-Sheet 2



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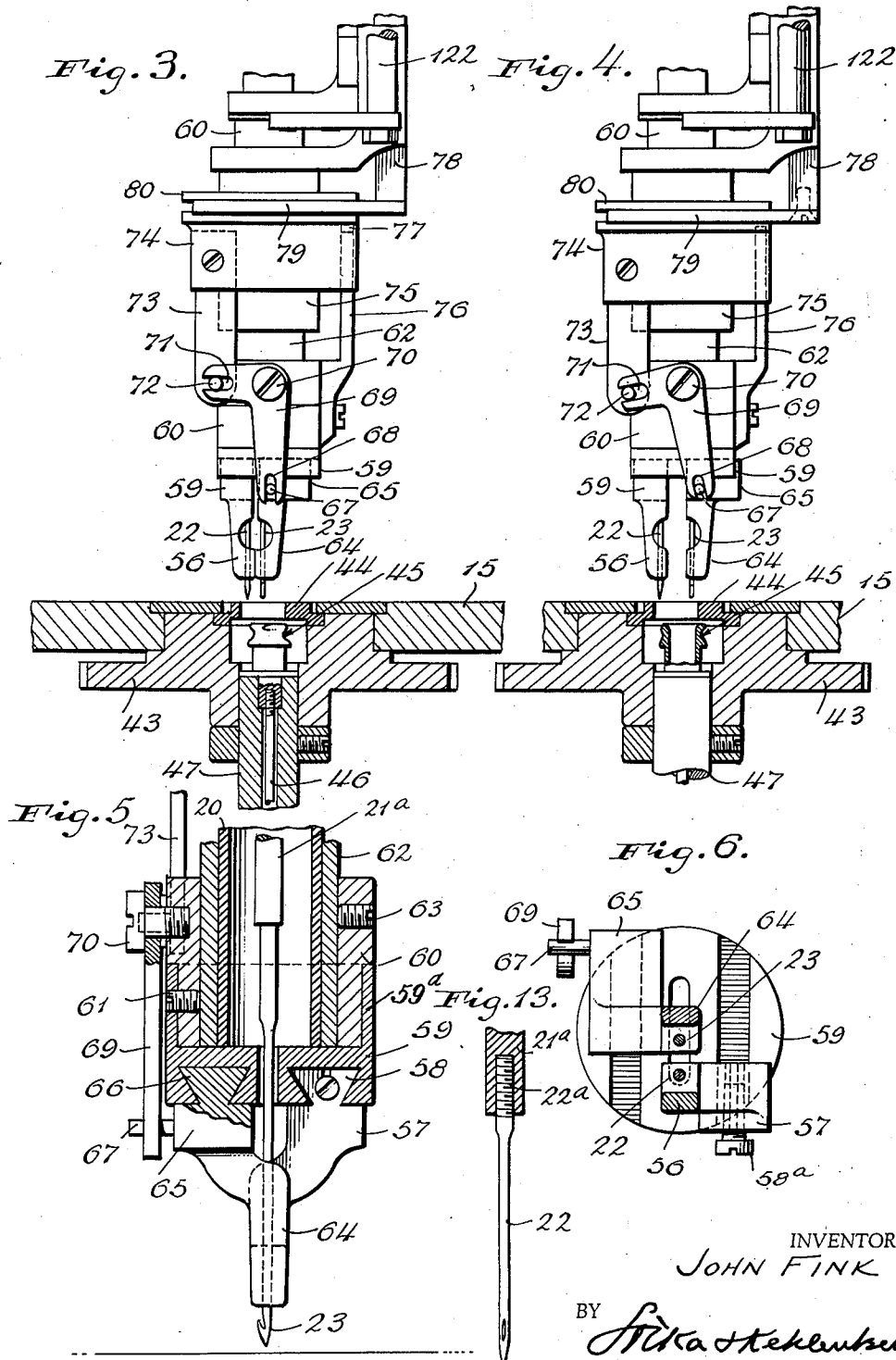
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EMBROIDERING MACHINE

Filed July 26, 1935

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Fig. 14.

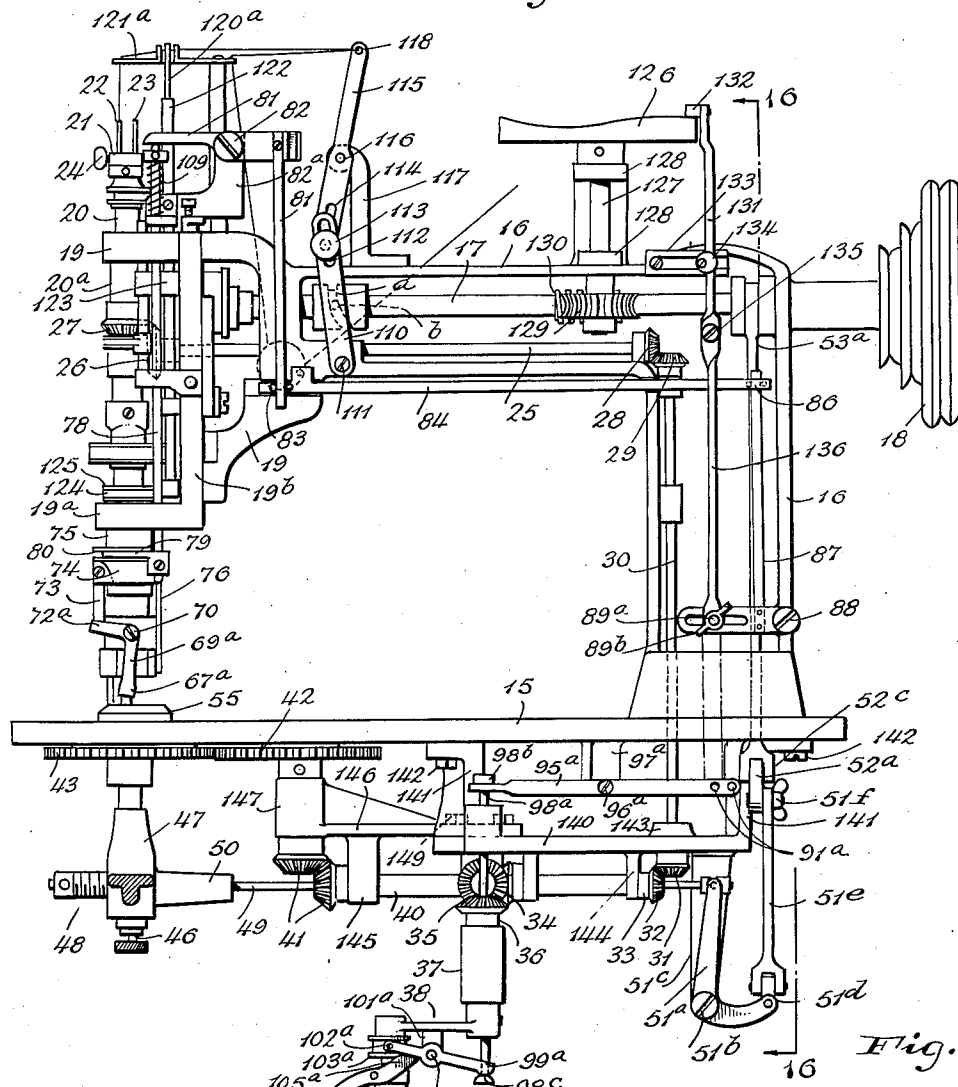


Fig. 18.

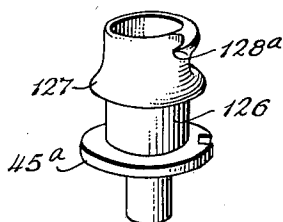
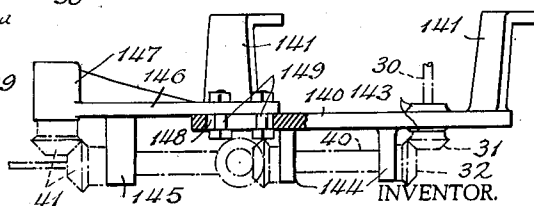


Fig. 19.



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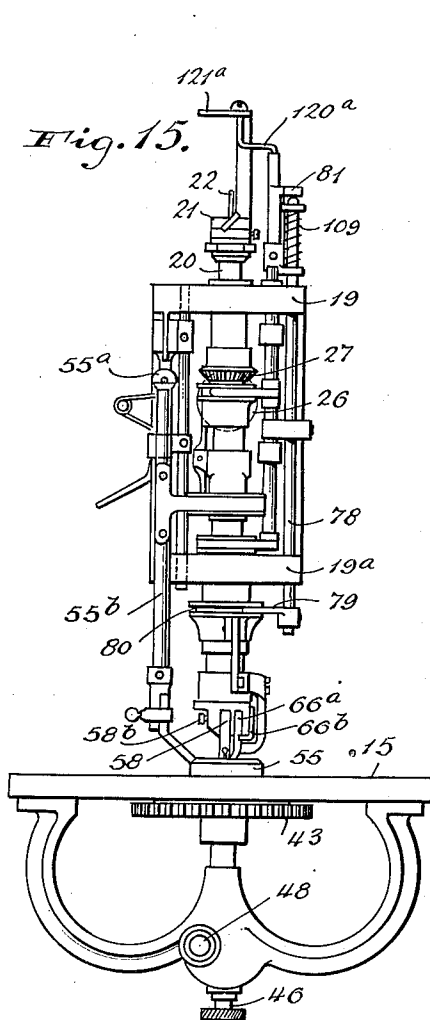
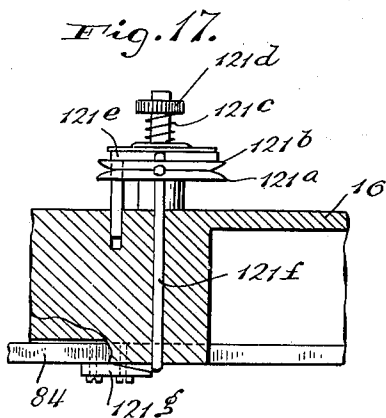
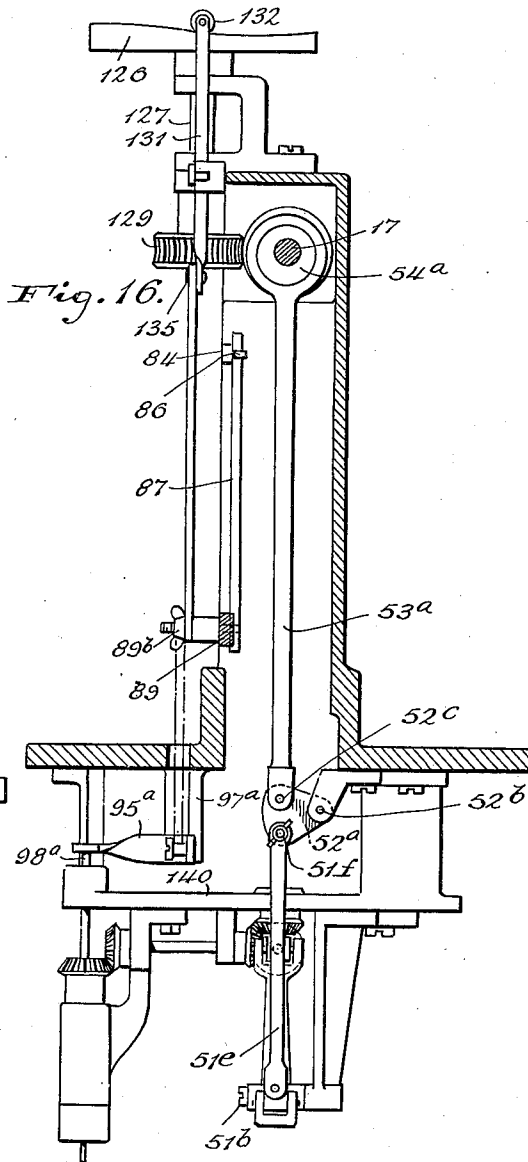
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2,118,077

EMBROIDERING MACHINE

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,118,077

EMBROIDERING MACHINE

John Fink, New York, N. Y.

Application July 26, 1935, Serial No. 33,308

16 Claims. (Cl. 112—98)

My invention relates to embroidering machines of the type disclosed in my United States Patent #1,095,199, which machines generally include two parallel spaced needles for making the double embroidery stitch or seam for which the machine is designed. It is oftentimes desirable, in order to produce predetermined effects in the embroidery seams, to make the transverse stitches composing such seams of varying length. The particular object of the invention is to provide machines of the indicated character with a novel and simple mechanism whereby the width of the seam by changing the length of the transverse stitches may be selectively varied during the operation of the machine and without interfering with the operation of the needles. The invention further contemplates the provision of novel and improved take-up means for adjusting the manipulation of the thread in harmony with the operation of the needles. Other objects will appear from the description hereinafter and the features of novelty will be pointed out in the claims.

In the accompanying drawings which illustrate examples of the invention without defining its limits, Fig. 1 is a side elevation of an embroidering machine including the novel features; Fig. 2 is an end elevation thereof; Figs. 3 and 4 are detail elevations partly in section with the mechanism in different positions; Fig. 5 is an enlarged sectional view of Fig. 3 looking in a direction at right angles thereto; Fig. 6 is a bottom view of Fig. 5 partly in section; Fig. 7 is a sectional view on an enlarged scale illustrating the needle manipulating means; Fig. 8 is a detail section on the line 8—8 of Fig. 1; Fig. 9 is a fragmentary view showing a second form of take-up means; Fig. 10 is a detail section on the line 10—10 of Fig. 9; Fig. 11 is a perspective view of an improved looper which may be included in the machine; Fig. 12 is a perspective view illustrating an example of the type of embroidery stitch or seam which may be produced on this machine; Fig. 13 is a detail view of the sewing needle and a portion of its carrier; Fig. 14 is a side view similar to Fig. 1 showing another form of the novel machine; Fig. 15 is an end elevation of the machine illustrated in Fig. 14; Fig. 16 is a vertical section, on an enlarged scale, on the line 16—16 of Fig. 14; Fig. 17 is a fragmentary section of a portion of the thread-tensioning means embodied in the machine of Fig. 14; Fig. 18 is a perspective view of another form of looper, and Fig. 19 is an elevation of a casting which may be included in the machine.

The machine in both of the forms illustrated comprises the customary bed plate 15 on which the conventional hollow arm 16 is mounted, said arm containing the usual main driving shaft 17 provided with the customary pulley 18 whereby the machine is connected with a source of power. The arm 16 at its free end is provided with a sewing head 19 having a tubular sleeve 20^a rotatably mounted therein, and a tubular holding member 20 adapted to be reciprocated in said tubular sleeve 20^a by suitable mechanism operatively connected with the main shaft 17 and requiring no detailed description as per se it forms no part of the instant invention; while the holding member 20 is capable of reciprocation in said tubular sleeve 20^a, it is arranged to be rotated thereby in the customary manner as will appear more fully hereinafter. At its upper end the holding member 20 carries a clamping member 21 in which the supports 21^a carrying the sewing needle 22 and the hook needle 23 are secured for instance by means of thumb screws 24. The needles 22 and 23 are located side by side in parallel spaced relation and with their supports 21^a extend lengthwise of the holding member 20 in the manner which will be more fully set forth hereinafter. In addition to being reciprocable in vertical directions, the holding member 20 is rotatable about its axis in the sewing head 19 for the purpose of controlling the direction of the embroidering seam or stitch in the conventional way. The mechanism whereby this rotation of the holding member 20 is accomplished may be of any suitable construction and in the illustrated example includes a shaft 25 journaled in the hollow arm 16 and provided at one end with a bevelled gear 26 meshing with a bevelled gear 27 secured on the tubular sleeve 20^a; at its other end the shaft 25 carries a bevelled gear 28 meshing with a bevelled gear 29 fixed upon a vertical shaft 30 rotatably mounted in the arm 16 and extending downwardly below the bed plate 15 as shown in Figs. 1 and 14. At its lower end the vertical shaft 30 is provided with a bevelled gear 31 meshing with a bevelled gear 32; the latter is carried by a sleeve 33 suitably journaled beneath the bed plate 15 and carrying a second bevelled gear and meshing with a co-operating bevelled gear located upon a transverse shaft which further carries a bevelled gear 34 meshing with a bevelled gear 35. The latter is fixed upon a sleeve 36 rotatably mounted in a vertical bearing 37 as shown in detail in Fig. 7, and provided at its lower end with an arm 38 from which an operating handle 39 depends, said 55

arm 38 and handle 39 together constituting a crank-handle; the latter preferably is connected with the arm 38 in a manner to permit said handle 39 to be rotated about its axis as shown in Fig. 7.

The mechanism being described in addition includes a sleeve 40 and co-operating bevelled gears 41 which operate intermeshing gears 42 and 43, the latter of which carries a needle plate 44 located in surface registry with the upper face of the bed plate 15 in vertical registry with the looper 45 which co-operates with the sewing needle 22 and the hook needle 23 to form a seam consisting of two spaced lines of stitches and transverse connections extending between the same, said looper 45 being connected with a vertical shaft 46 mounted within a stationary bearing sleeve 47; in the two illustrated examples the needle plate 44 is rotatably actuated in the conventional manner to co-operate with said needles by means of the gear 43 and its associated mechanism, and the looper 45 is operated in the customary way by means of a worm 48 fixed upon a shaft 49 journaled in bearings 50. The shaft 49 is in keyed connection with the bevelled gear 32 and the one bevelled gear 41 and with the associated mechanism adapted to be operated by the handle 39. In the machine shown in Fig. 1 the reciprocation of the shaft 49 is effected by means of linkage 51 operated by a crank disc 52 fixed on a vertical shaft 53 which is connected by bevelled gears 54 with the main shaft 17. In the machine shown in Fig. 14 the same result is attained by means of a bell-crank lever 51^a pivoted at 51^b on a stationary member 51^c and having its one end pivotally connected with the shaft 49 and its other end secured by means of a universal connection 51^d with one end of a link 51^e. The other end of the latter is pivotally connected at 51^f with a rocking member 52^a pivoted at 52^b and in turn pivotally connected at 52^c with a pitman 53^a operatively connected with an eccentric 54^a fixed upon the shaft 17 as shown in Fig. 16.

With the arrangements described a rotation of the arm 38 by means of the handle 39 will effect a rotation of the tubular sleeve 20^a and consequently of the holding member 20 about its axis to adjust the needles 22 and 23 at will in a manner to change the direction of the embroidery seam and to operate the needle plate 44 and looper 45 in operative synchronism therewith. The reciprocation of the shaft 49 by the main shaft 17 through the medium of the mechanisms shown in Figs. 1, 14, and 16 serves to operate the looper in proper operative relation to the needles 22 and 23 as the stitching takes place to develop the embroidery seam. While I have described the mechanisms so far set forth more or less in detail, it is to be understood that these mechanisms, excepting in their operative relation to the needle controlling mechanism and associated elements to be more fully described hereinafter, form no part of the invention. It will further be understood that the machine in both of its illustrated forms includes a presser foot 55 and associated mechanism which may be of customary form and actuated in any conventional manner to properly co-operate with the rest of the mechanism in the machine illustrated in Fig. 1. In the preferred arrangement, as shown in Fig. 15, the presser foot 55 is mounted in the machine in a novel manner by means of a universal joint 55^a of the ball and socket type whereby the presser foot bar 55^b is connected with the mecha-

nism which raises and lowers the presser foot 55 in proper operative synchronism with the associated mechanism. The joint 55^a permits the presser foot 55 to develop the compound movements necessary to its operation, in a reliable and efficient manner, and simplifies the construction of the connecting means and the mounting and dismounting of the presser foot 55 to a maximum degree.

The needles 22 and 23 as previously stated, 10 pass downwardly through the holding member 20 and with their supports 21^a are accordingly of considerable length; the supports 21^a for said needles being held only at their upper ends by the clamping member 21, the needles 22 and 23 15 are capable of being flexed for the purpose which will appear more fully hereinafter. The lower end of the needle 22 which in the illustrated examples is the sewing or eye-needle, extends slidably through a guide 56 which forms 20 part of or is carried by an adjustable support 57 in slidable connection at 58 with a head 59. As shown in Figs. 5 and 6, the slidable connection 58 may be of the dove-tailed type and may be split and fixed in its adjusted position by means 25 of a screw 58^a which serves to jam said connection in the dove-tailed slot of the head 59. In the form shown in Fig. 15 the connection 58 is of flat form and is secured in its adjusted position on the head 59 by one or more set screws 58^b. In 30 any case, as illustrated in Fig. 5, the head 59 may be provided with an annular flange 59^a adapted to slip over a collar 60 and fixed thereon for instance by means of a set screw 61, said collar 60 in turn being secured upon a sleeve 62, 35 for instance, by means of a set screw 63 as shown in Fig. 5. The needle 23 which in the illustrated example is a hook-needle, at its lower end passes through a guide 64 similar to the guide 56 and carried by a support 65 which in the form shown 40 in Figs. 5 and 6 has a dove-tailed or equivalent portion 66 slidably mounted in a dove-tailed slot of the head 59. As illustrated in Fig. 15 the portion 66^a corresponding to the portion 66, may be of flat form and slidably mounted in a co-operating slot of the head 59; in the latter form a 45 holding member 66^b is provided for maintaining the portion 66^a in its slot as shown in Fig. 15.

In order to vary the length of the transverse connections included in the embroidery seam, the needles 22 and 23 are capable of being selectively spread apart at will, and in the illustrated examples the hook-needle 23 is accordingly capable of being shifted toward and away from the needle 22 to selectively vary the length of the aforesaid transverse connections in a given embroidery seam in order to produce an embroidery seam of the character desired. In the illustrated example shown in Figs. 1 and 3 the means whereby the aforesaid spreading of the needles is selectively effected comprises a pin 67 fixed upon and projecting outwardly from the support 65 and extending into the slot 68 of a bell-crank lever 69 pivoted at 70 upon the collar 60 as shown in Figs. 3 and 4; in the form shown in Figs. 14 and 15, 65 a corresponding bell-crank lever 69^a has its one end pivotally connected at 67^a with the support 65, it being understood that the pivotal connection 67^a is the equivalent of and replaces the pin and slot connection 67—68. The opposite end of the bell-crank lever 69 in Figs. 1 and 3 is formed with a slot 71 for the accommodation of a pin 72 carried by a member 73 depending from and connected with a supporting ring 74 vertically slidable upon a stationary tubular bearing 75 in which 75

the sleeve 62 is also rotatable, while the opposite end of the bell-crank lever 69 in Fig. 14 is pivotally and slidably connected at 72^a with the member 73 in a corresponding manner. In order to cause the supporting ring 74 to rotate in unison with the collar 60 and its associated elements when the mechanism is rotated by means of the handle 39 to change the direction of the embroidery seam, a bar 76 is fixed to the collar 60 and projects upwardly therefrom for instance into a vertical slot 77 formed in the peripheral surface of the supporting ring 74 as shown in Fig. 3.

Suitable mechanism is provided for controlling the vertical movements of the supporting ring 74 to bring about the desired spreading of the needles 22 and 23. This means in the two illustrated examples comprises a vertical bar 78 adapted to be vertically reciprocated relatively to the sewing head 19 in any convenient manner. In the preferred arrangement, as illustrated by way of example in Figs. 14 and 15, the bar 78 is cylindrical in shape and is slidably mounted in a portion of the sewing head 19 and in a bearing member 19^a located in spaced parallel relation to the aforesaid portion of the sewing head 19 as shown in Fig. 14; the bearing member 19^a forms part of a supporting member 19^b which depends from and is suitably connected with the portion of the sewing head 19 previously referred to as also illustrated in Fig. 14. By making the bar 78 of cylindrical form instead of rectangular or equivalent cross-section said bar in the first place is produced with a minimum of effort and in the second place is more easily installed in the machine and operates therein with a minimum of friction; by providing the spaced bearings, exemplified by the above mentioned portion of the sewing head 19 and the bearing member 19^a, the cylindrical bar 78 is guided and held in its vertical path of movement with a maximum of efficiency and operates in an absolutely reliable and uniform manner. In both of the illustrated examples of the machine the bar 78 is provided at its lower end with a transversely extending forked extension 79 fitted into the grooved collar 80 located at the upper end of the supporting ring 74 as shown in Figs. 1, 3, 4, 14, and 15. The upper end of the connecting bar 78 engages one arm of a bell-crank lever 81 pivoted at 82 upon a bracket 82^a and pivotally connected at 83 with a link 84, the pivotal connection 83 being either as shown in Fig. 1 or Fig. 14, or of any other suitable type. In the example of the machine illustrated in Fig. 1 the link 84 is extensible in length and accordingly may consist of two sections in pin and slot connection with each other as indicated at 85 in Fig. 1; instead of being extensible in length as in Fig. 1, the link 84 may be of fixed length and as illustrated in Fig. 14 may be guided in guide grooves formed at suitable points of the hollow arm 16. The link 84 is pivotally connected at 86 with one arm of a bell-crank lever 87 pivoted at 88 at a suitable point in the hollow arm 16 as illustrated in one form in Fig. 1, and in another equivalent form in Fig. 14. For the purpose of manually controlling the spreading of the needles 22 and 23 at will, the other arm of the lever 87, as shown in Fig. 1, is pivotally connected at 89 with one end of a link 90 which at its opposite end is pivotally connected at 91 with a slide 92 vertically slidable in the machine in any convenient manner and projecting downwardly below the bed plate 15. The slide 92 as illustrated in Fig. 1 carries a pin 93 which is

engaged by an arm 94 of a double bell-crank lever 95 pivoted at 96 in a bracket 97 beneath the bed plate 15. In the form illustrated in Fig. 14 the machine is provided with mechanism whereby the spreading of the needles 22 and 23 is effected automatically as will be more fully described hereinafter, the illustration in said Fig. 14 showing the manually operated means for controlling such spreading being disconnected and inoperative. If the use of the aforesaid manually operated means is desired in the machine shown in Fig. 14 the automatic means may be disconnected in the manner to be set forth in detail hereinafter; in such case a link similar to the link 90 of Fig. 1 will have its one end detachably connected with the pivot 89^a of the bell-crank 87 preferably by means of a wing-nut 89^b and its other end pivotally connected at 91^a with a rocking lever 95^a corresponding in function to the bell-crank lever 95 of Fig. 1, and pivoted at 96^a on a bracket 97^a beneath the bed plate 15 as shown in Fig. 14.

In the construction shown in Fig. 1 the lever 95 bears against a rod 98 vertically reciprocable in the vertical bearing 37, said rod 98 projecting downwardly beyond the arm 38 into engagement with a lever 99 pivoted at 100 upon a lug 101 depending from said arm 38 as illustrated in Figs. 1 and 7. The lever 99 carries a pin 102 which projects into the annular groove of a collar 103 vertically slidable upon the stem of the handle 39 as illustrated in Fig. 7, said collar 103 being pivotally connected at 104 with an operating or hand lever 105; the latter is pivoted at 106 upon a support 107 mounted to turn with the handle 39, the latter as previously stated being rotatable about its axis.

In the arrangement shown in Fig. 14 the rocking lever 95^a is forked at its one end and straddles a rod 98^a beneath a collar or head 98^b carried by said rod 98^a at its upper end, the latter being the equivalent of the rod 98 in Fig. 1; at its lower end the rod 98^a is provided with a head 98^c against which the forked end of a lever 99^a is arranged to bear as shown in Fig. 14. The lever 99^a, which is the equivalent of the lever 99 in Fig. 1, is pivoted at 100^a upon a lug 101^a depending from the arm 38 in Fig. 14; the lever 99^a carries a pin 102^a which projects into the annular groove of a collar 103^a vertically slidable upon the stem of the handle 39 as in Fig. 1. In the construction illustrated in Fig. 14, the collar 103^a is engaged by the forked end 105^a of an operating or hand lever 105^b for the purpose to be more fully set forth hereinafter, said hand lever 105^b corresponding in function to the hand lever 105 of Fig. 1. A suitable number of springs such as illustrated at 108 and 109 may be provided for restoring the parts to normal condition.

As the length of the transverse connections included in the embroidery seam may be varying in length, it is desirable to have the take-up of the thread synchronously co-operate with the spreading of the needles 22 and 23 in order to properly supply the thread to said needles and to maintain said thread under the desired tension regardless of the length of the transverse connections being made. In the illustrated examples as shown in Figs. 1 and 14 the take-up means accordingly consists of a lever 110 pivoted at 111 upon the hollow arm 16 and having its free end slotted at 112 for the accommodation of a set screw 113 arranged to project into the slot 114 of a co-operating lever 115; the latter is pivoted at 116 upon a bracket 117 mounted upon

the hollow arm 16 and at its free end is provided with an opening 118 for the passage of the thread. The lever 110 is rocked on its pivot 111 by means of a cam *a* into which a pin *b* carried by the lever 110 projects, said cam *a* being mounted upon the main shaft 17. In addition the machine shown in the two examples includes an auxiliary take-up consisting of a loop 119 formed upon a rod 120 which is mounted upon the aforesaid bracket 121 to which the bell-crank 81 is pivotally connected at 82, or an apertured rod 120^a mounted upon a vertically movable bar 122. Any conventional form of tension means such as indicated at 121 in Fig. 1 may also be included in the machine, or as illustrated in Figs. 14 and 15 the thread may pass through the several apertures of a fixed plate 121^a for the same purpose.

As an additional means for controlling the tension of the thread in accordance with variations in the length of the transverse connections in the embroidery seam, the machine shown in Figs. 14 and 15 is provided with a tension device consisting of co-operating disks 121^a and 121^b the latter of which is normally pressed against the former by means of a spring 121^c which is confined between an adjustable nut 121^d and a pressure plate 121^e capable of being shifted out of contact with the disk 121^b to relieve the same from the pressure of the spring 121^c and to thereby release the thread from tension; the shifting of the plate 121^e is accomplished in proper operative synchronism by means of a rod 121^f slidably mounted in the arm 16 and controlled by a cam 121^g fixed upon the link 84 as shown in detail in Fig. 17.

The previously mentioned bracket 82^a is carried by the above mentioned bar 122 vertically slidable in a stationary bearing 123 and provided at its lower end with a member 124 projecting beneath or connected with a co-operating member 125 fixed upon the upper end of the sleeve 60.

In the operation of the machine as so far described, power is applied to the pulley 18 from any suitable source to bring about a rotation of the main shaft 17 and to thereby cause the holding member 20 and the needles 22 and 23 carried thereby to be reciprocated in vertical directions relatively to the needle guides 56 and 64. At the same time the needle plate 44 and the looper will be actuated in properly timed relationship to the needles 22 and 23 to develop the embroidery seam of the type illustrated in Fig. 12. As long as the needles 22 and 23 remain in their normally spaced relation, the transverse connections of this seam will all be of equal length as indicated for instance by the stitches A in Fig. 12, this normal length of said transverse connections depending upon the setting of the needle 22 relatively to the needle 23 as effected by the position of the support 57; the normal length of the transverse connections A will further be determined by the dimensions and type of the looper 45 which is always such as to properly co-operate with said needles to develop the transverse connections A of the aforesaid normal length. During these operations the needle guides 56 and 64 and associated elements together with the sleeve 62 and supporting ring 74 are raised and lowered to bring about the operations in properly timed relationship with the operation of said needles. At the same time the presser foot 55 is actuated in the customary manner in co-ordination with the parts so far mentioned. As the sleeve 62 rises and falls during these operative periods, the connecting bar 78 and the bar 122 will be corre-

spondingly raised and lowered which movements will be transmitted to the bracket 82^a and bell-crank lever 81; in Fig. 1 the latter during these operative stages will simply rock the link 84 on its pivot 86 without any particular operative effect, on said link 84, while in Fig. 14 the depending arm of the bell-crank lever 81 will simply be slidably shifted relatively to its connection 83 with the link 84 also without any operative effect thereon. At the same time the cam *a* in co-operation with the pin *b* will rock the lever 110 to correspondingly rock the lever 115 in reverse relation and to thereby control the thread which passes through the opening 118. Coincidentally with these movements the auxiliary take-up 119—120 due to the fact that it is mounted upon the bracket 82^a or the apertured rod 120^a which elements also partake of the vertically reciprocating movements of said bracket and supplement the action of the take-up levers 110 and 115 to properly control the thread in accordance with the spacing of the needles 22 and 23; it will be understood that the spacing of the needles mentioned herein refers to the spacing at the lower operative ends of said needles. As long as the handle 39 is not manipulated, the embroidery seam produced by the machine will extend in a straight line in a given direction. If the crank handle 38—39 is manually rotated, the mechanism controlled thereby will correspondingly rotate the tubular sleeve 25^a and holder 20 and the needles 22 and 23 to correspondingly change the direction of the aforesaid embroidery seam and to develop it along curved lines or in other directions deviating from the straight line previously mentioned.

If at any time during the described operations of the machine it is desired to vary the length of the transverse connections A as indicated for instance at A' in Fig. 12, a pressure is exerted by the operator on the hand lever 105 in Fig. 1 to swing it toward the handle 39 on the pivot 106. This manipulation of the lever 105 pulls the collar 103 downwardly and causes the lever 99 to exert an upward pressure on the rod 98 whereby the double bell-crank lever 95 is caused to press downwardly upon the pin 93. This downward movement is transmitted to the slide 92 and link 93 and rocks the bell-crank lever 87 on its pivot 88 to pull the link 84 toward the right in Fig. 1.

In the form shown in Fig. 14 a corresponding pressure of the hand lever 105^b toward the handle 39 causes the forked end 105^a of said lever 105^b to exert an upward pressure on the collar 103^a whereby the latter is shifted upwardly relatively to said handle 39. The described shifting of the collar 103^a pivotally actuates the lever 99^a in a manner to pull the rod 98^a downwardly and to pivotally operate the rocking lever 95^a. Assuming that the manually operated means is operatively connected in the machine of Fig. 14 and that the rocking lever 95^a is in such case connected with the pivot 89^a of the bell-crank lever 87 by means of a link similar to the link 90 of Fig. 1, said bell-crank lever 87 in Fig. 14 will also be rocked on its pivot 83 in a manner to pull the link 84 to the right in Fig. 14.

As a result of these operations the bell-crank lever 81 in Fig. 1 and also in Fig. 14 is thereby rocked at its pivot 82 in a manner to force the connecting bar 78 downwardly and through the medium of its forked end 79 to correspondingly shift the supporting ring 74 downwardly on the tubular bearing 75. This downward movement of the supporting ring 74 relatively to the head 59 and collar 62 carries with it the member 73

in both forms of the machine and through the medium of the pin 72 and slot 71 in Fig. 1 and the corresponding connection 72^a in Fig. 14 rocks the bell-crank lever 69 of Fig. 1 and the corresponding bell-crank lever 69^a of Fig. 14 on their respective pivots 70 and thus develops a transverse force on the pin 67 or the corresponding connection 67^a which slidably shifts the dove-tailed portion 66 in the head 59 in a direction to adjust the support 65 and guide 64 transversely to the vertical axis of the needle 23. By this transverse movement of the guide 64 the needle 23 will be flexed to cause its lower end to move away from the lower end of the needle 22 or in other words to spread the needles 22 and 23 further apart; in the arrangements under discussion the extent of this spread or the variation of the spacing of the two needles is dependent upon the extent of movement given to the hand lever 105 or its equivalent, the hand lever 105^b, as will be obvious. During these operations whereby the spaced relationship of the needles 22 and 23 is varied selectively at will, the operation of the needles to complete the stitches for making the embroidery seam proceeds without interruption and the other operations of the machine are carried on without interference. The transverse connections A' may be successively reduced in length by permitting the hand lever 105 or 105^b to gradually return to its normal position and the needles 22 and 23 to be restored into their normally spaced relationship. The direction of the seam shown in Fig. 12 may also be changed at will by the rotative operation of the crank handle 38—39 without interruption during the aforesaid variations in the spacing of the needles as described. The return of the parts to their initial positions is assisted by the springs 108 and 109 or their equivalents.

In the form shown in Fig. 1 the range of adjustment of the needles from a normally spaced relationship to a maximum separation or spread may be varied by changing the length of the link 84 through the medium of the pin and slot connection 85 and by shifting the position of the pivot 89 on the one arm of the bell-crank lever 87 which for this purpose may be provided with a series of holes 89^a for the accommodation of said pivot 89 as shown in Fig. 1; the same results may be obtained in the form shown in Fig. 14 by shifting the pivot 89^a on the corresponding one arm of the bell-crank lever 87 and by utilizing one or the other of the pivot apertures 91^a with which the rocking lever 95^a is provided. As the length of the transverse connections is changed, for instance as indicated at A' in Fig. 12, by the operations set forth above, the auxiliary take-up 119—120 of Fig. 1 or the corresponding devices 120^a—121^a of Fig. 14, will supplement the action of the take-up levers 110—115 in a manner to properly control the supply of thread to the needles 22 and 23; in addition as the link 84 in Fig. 14 is shifted to the right as set forth above the cam 121^c by acting on the rod 121^f will release the disk 121^b from the effects of the spring 121^e and thereby relieve the thread from tension.

In the preferred arrangement the machine may include means operatively connected with the adjusting means for varying the spacing of the needles to automatically adjust the operation of the take-up means, as exemplified by the levers 110 and 115, in accordance with the spacing of the needles as the latter is effected in a manner described hereinafter. As shown in Figs. 9

and 10 this automatic means may consist of a member 110^a carrying a screw 113^a corresponding to the screw 113 but extending slidably into the slots 112 and 114 of the levers 110 and 115 respectively. The member 110^a is pivotally connected at 110^b with one arm of a bell-crank lever 110^c pivoted at 110^d within the hollow arm 16 and provided at the free end of its other arm with a forked extension 110^e for the accommodation of pin 84^a; the latter is carried by the link 84 and partakes of the movements thereof.

With this automatic take-up means, which may be included in both forms of the machine illustrated in the drawings, regardless as to whether the spreading of the needles is effected manually as set forth above, or automatically as will be hereinafter described, as the link 84 is reciprocated during variations in the spacing of the needles 22 and 23, the bell-crank lever 110^c will be actuated to shift the pivot screw 113^a in the slots 112 and 114 and to thereby vary the extent of the rocking movements of the lever 115 which result from the rocking of the lever 110 by the cam *a*. The rocking movements of the lever 115 will accordingly always be automatically adjusted in operative harmony with the spacing of the needles 22 and 23 with the result that the thread will be controlled in proper relationship to such spacing of said needles whatever this may be.

In machines of the type under discussion the eye or sewing needle 22, by its upward movements, forms the thread-loops which comprise part of the embroidery seam produced by the machine and illustrated by way of example in Fig. 12; these thread-loops are engaged by the hook of the rotating looper 45 and by the rotation of the latter are carried on the annularly grooved head of said looper to the hook needle 23 by which said thread-loops are carried upwardly to produce the embroidery stitch or seam. This looper 45 in the form shown in Fig. 11 consists of a body 126 provided with an annularly grooved head 127 having a hook 128. In order to facilitate the removal of the thread from the looper, the improved looper 45 is provided with an open recess 129 terminating in the end face of the head 127 and communicating with the annular groove thereof as shown in Fig. 11. This recess 129 permits the thread by the action of the hook needle 23 to readily leave the looper and consequently prevents the thread from being broken because of any entanglement with said looper 45. Another form of looper 45^a adapted specially for use in the novel machine is shown in Fig. 18 and likewise includes a body 126 carrying an annularly grooved head 127 provided with a hook 128^a; in the form now being described the hook 128^a comprises part of an outwardly bulged portion 128^b formed at the upper edge of the head 127 and avoiding the necessity for the recess 129 of the looper shown in Fig. 11. The bulged portion 128^b also facilitates the withdrawal of the thread from the looper and reduces the possibility of breakage of the thread or its entanglement with the looper to an absolute minimum. In all of its forms the looper 45 or 45^a may be made in varying dimensions and of different characteristics for co-operation with the needles 22 and 23 to produce different types of embroidery seams and may be mounted in the machine in any conventional or customary manner.

As a substitute for the previously described manually operated means for controlling the spreading of the needles 22 and 23 to selectively

vary the length of the transverse connections forming part of the embroidery seam, it may be desirable under certain circumstances to provide automatically operating mechanism for automatically varying the length of said transverse connections in accordance with a predetermined design of embroidery seam. This automatic mechanism may be of any suitable type designed to produce the desired automatic control of the spreading of the needles 22 and 23 and is shown by way of example in Fig. 14 of the drawings.

In the illustrated example the automatic spreading mechanism consists of a suitable cam 126 shaped in accordance with the desired results and fixed upon a vertical shaft 127 journaled in bearings 128 on the hollow arm 16 as shown in Fig. 14. The shaft 127 projects into the hollow arm 16 and carries a worm pinion 129 in mesh with a co-operating worm gear 130 secured upon the main shaft 17 of the machine.

The arrangement, as illustrated in Fig. 14, further includes a link 131 carrying a roller 132 at its upper end in engagement with the cam 126 and slidable in a fixed guide 133 located on the hollow arm 16; an adjustable catch 134 is provided for maintaining the link 131 in the guide 133 and for permitting its removal therefrom when the automatic mechanism is to be rendered inactive or disconnected. At its lower end the link 131 is pivotally connected at 135 with one end of a second link 136 which at its other end is attached to the pivot 89^a by means of the wing nut 89^b and accordingly is pivotally connected with the one arm of the bell-crank lever 87. It will be understood that the latter is disconnected from the rocking lever 95^a by the removal of the link corresponding to the link 90 of Fig. 1, when operation of the automatic mechanism is desired; under such conditions the means manually controlled by the hand-lever 105 or 105^b is disconnected and rendered inoperative.

With automatic mechanism shown and described the cam 126 is rotated about its axis by the worm pinion 129 and worm gear 130 as the shaft 17 is actuated by the pulley 18. As the cam 126 is thus rotated the links 131 and 136 will be vertically reciprocated thereby in dependence upon the contour and shape of said cam 126 to correspondingly actuate the bell-crank lever 87 and link 84 in the manner previously described with respect to the manually controlled means. With the aforesaid mechanism or its equivalent the needles 22 and 23 will accordingly be spread apart at predetermined intervals to automatically vary the length of the transverse connections forming part of the embroidery seam by shifting the needle 23 toward and away from the needle 22 in the same way as is done under the manual control of the operator as explained hereinbefore. The extent of the spreading of the needles and the resultant variation in the length of said transverse connections will depend upon the shape of the cam 126, it being understood that cams 126 of different type and form may be mounted upon the shaft 127 to automatically provide different variations in the length of said transverse connections. During the aforesaid automatic variations in the length of the transverse connections the duration of the embroidery seam may be controlled and changed at will without interference by properly manipulating the handle 38—39 as hereinbefore set forth.

In all forms of the novel machine the eye or sewing needle 22 may be connected with its support 21^a in a novel manner by providing the one

end of said needle 22 with a screwthreaded portion 22^a which screws into an internally threaded socket provided at the lower end of said support 21^a as illustrated in Fig. 13. This arrangement enables the needle 22 to be easily disconnected from its support 21^a and replaced if this for any reason should become necessary.

In many forms of the novel machine, particularly in connection with the means for manually spreading the needles 22 and 23, for instance in the manner set forth hereinbefore, it may be desirable to provide means for preventing any spreading of the needles 22 and 23 and for maintaining the same in a spaced relation which remains constant; this means may also be designed to limit the maximum length to which the transverse threads of the embroidery seam may be varied.

In the illustrated example, as shown in Fig. 1, this means may comprise a stop 137 adjustably mounted in a bearing 138 located at a predetermined point upon the hollow arm 16 and fixed in an adjusted position therein for instance by means of a set screw 139. The stop 137 includes a transverse member which projects into the rocking path of the bell-crank lever 87 as indicated in Fig. 1.

If this stop 137 is set so that its transverse member engages the bell-crank lever 87 when the latter is in its normal position, it is obvious that a pivotal operation of said bell-crank lever 87 will be prevented with the result that the mechanism associated with said bell-crank lever 87 will also be incapable of being operated and it consequently will be impossible to spread the needles 22 and 23. Similarly if the stop 137 is adjusted to position its transverse member at different distances from the bell-crank lever 87 the swing of the latter in its operative direction will be arrested to correspondingly limit the spread of said needles 22 and 23; in other words, in such case, the maximum spread to which said needles may be adjusted, either manually or automatically, will be predetermined by the setting of the transverse member of the stop 137 relatively to the bell-crank lever 87.

It will of course be understood that the stop 137 and its transverse member may be positioned for cooperation with other parts of the needle spreading means to effect results corresponding to those set forth above, and also that said stop 137 and its associated elements may be replaced by other means for effecting corresponding results. The means under discussion is capable of being used, in a suitable form, in combination with means for manually controlling the spread of the needles or with automatic means for controlling such spread.

For the purpose of simplifying the construction and the assembly of the parts the machine, in all of its forms may include the casting illustrated in Fig. 19, which casting is shown in place in the machine of Fig. 14, it being understood that this casting may also be embodied in the machine of Fig. 1, or in any equivalent form of the machine.

The casting under discussion comprises a main horizontal member 140 which depends from the bed plate 15 and is attached thereto by means of brackets 141 fixed in place by means of suitable screws, bolts or equivalent fastening devices 142 as shown in Fig. 14. The member 140 includes integral bearings 143 for the vertical shaft 30 and is further provided with integral bearing members 144 which depend from said member 140

for the accommodation of the sleeve 40 and shaft 49. The sleeve 40 and shaft 49 are further journaled in a bearing member 145 depending from an auxiliary member 146, the latter being provided with a bearing 147 in which the shaft carrying the one bevel pinion 41 and the gear 42 is suitably journaled. To enable the parts to be operatively combined and to provide for the proper meshing of the gears 42 and 43 the auxiliary member 146 is adjustably combined with the member 140. Any suitable arrangement may be utilized to provide the desired adjustability of the auxiliary member 146, an example of such arrangement being shown in Figs. 14 and 19; in the illustrated example the member 140, and if desired also the auxiliary member 146, is provided with a slot 148 for the accommodation of a bolt and nut 149 or equivalent clamping means whereby the auxiliary member 146 is fixed in an adjusted position.

With a casting of the type shown in Fig. 19 all bearings and associated elements are combined in the form of a single unit so that the assembling of the parts is reduced to the simplest operation and the necessity for handling and carefully positioning a plurality of individual elements is entirely avoided. By providing the relatively adjustable auxiliary member 146 and its associated elements a range of adjustment is provided which enables the same casting to be used in different machines and thereby makes the same interchangeable and reduces the cost of production thereof to a minimum; in other words, the casting may be produced in quantity from a given mold. It will of course be obvious that the unit referred to above as a casting may be otherwise produced than by casting if this should be deemed desirable.

The improved embroidery machine in the forms shown and described and in equivalent constructions by permitting the length of the transverse connections or threads to be selectively varied at will as indicated at A and A' either manually or automatically within the operative range of the mechanism, makes it possible to readily and easily produce embroidery seams or many different types during any given operative period of the machine and without interference with the operation of the needles and other functions of the machine during such periods. At the same time the novel take-up means in its various forms serves to efficiently control the thread in proper co-operation and co-ordination with the needles at each and every stitch throughout the spreading range thereof.

While the novel arrangements illustrated in the drawings and described herein are designed primarily for use in the so-called embroidery machines, they are equally well adapted for incorporation in any type of two-needle sewing machine.

Various changes in the specific forms shown and described may be made within the scope of the claims without departing from the spirit of the invention.

I claim:

1. In a sewing machine including spaced co-operating needles, a looper co-operating with said needles to produce a seam consisting of spaced lines of stitching and transverse connections extending between the same, mechanism for operating said needles and looper, and seam controlling mechanism for selectively changing the direction of said seam at will, that improvement which comprises adjusting means for vary-

ing the spacing of said needles to vary the length of the transverse connections included in a given seam, and a movable hand lever associated with the seam controlling mechanism for operating said adjusting means during the operation of the machine without interference with the operation of said needles or the manipulation of said seam controlling mechanism.

2. In a sewing machine including spaced co-operating needles, a looper co-operating with said needles to produce a seam consisting of spaced lines of stitching and transverse connections extending between the same, mechanism for operating said needles and looper, and seam controlling mechanism for selectively changing the direction of said seam at will, that improvement which comprises adjusting means for adjusting one of said needles toward and away from the other at will to selectively vary the length of the transverse connections included in a given seam, and a pivoted hand lever associated with the seam controlling means for manually operating said adjusting means during the operation of the machine without interference with the operation of said needles or the manipulation of said seam controlling means.

3. In a sewing machine including spaced co-operating needles, a looper co-operating with said needles to produce a seam consisting of spaced lines of stitching and transverse connections extending between the same, mechanism for operating said needles and looper, and seam controlling mechanism for selectively changing the direction of said seam at will, that improvement which comprises adjusting means for adjusting said needles relatively to each other to vary the length of the transverse connections included in a given seam, and interchangeable manually and automatically controlled means for operating said adjusting means either manually or automatically at will.

4. In an embroidery machine of the kind described including spaced co-operating needles, a looper cooperating with said needles, and mechanism for operating said needles and looper to produce an embroidery seam consisting of spaced lines of stitches and including transverse connections extending between the same, that improvement which comprises adjusting means for varying the spacing of said needles during the operation of the machine without interference with the operation of said needles to selectively vary the length of transverse connections included in a given embroidery seam, take-up means for controlling the thread in timed relation to the operation of the needles, and auxiliary take-up means for controlling the thread in accordance with the spacing of said needles.

5. In an embroidery machine of the kind described including spaced co-operating needles, a looper cooperating with said needles, mechanism for operating said needles and looper to produce an embroidery seam consisting of spaced lines of stitches and including transverse connections extending between the same, and manually operated means for adjusting said needles to vary the direction of said embroidery seam, that improvement which comprises adjusting means associated with said manually operated means for varying the spacing of said needles at will during the operation of said machine without interference with the operation of said needles and the adjustment thereof, to selectively vary the length of transverse connections included in a given embroidery seam.

6. In an embroidery machine of the kind described including spaced co-operating needles, a looper cooperating with said needles, mechanism for operating said needles and looper to produce an embroidery seam consisting of spaced lines of stitches and including transverse connections extending between the same, and manually operated means including a rotatable crank handle for adjusting said needles to vary the direction of said embroidery seam, that improvement which comprises adjusting means associated with said manually operated means and including a hand lever carried by said crank handle for varying the spacing of said needles at will during the operation of said machine without interference with the operation of said needles and the adjustment thereof, to selectively vary the length of transverse connections included in a given embroidery seam.

7. In an embroidery machine of the kind described including spaced co-operating needles, a looper co-operating with said needles, and mechanism for vertically reciprocating said needles and operating said looper to produce an embroidery seam consisting of spaced lines of stitches and including transverse connections extending between the same, that improvement which comprises a head vertically reciprocable in operative relationship to said needles, a needle guide transversely movable on said head, and means for transversely shifting said guide during the operation of said machine and without interference with the relative reciprocation of said needles and head, to flex one of said needles toward and away from the other needle and thereby vary the length of the transverse connections included in a given embroidery seam.

8. In an embroidery machine of the kind described including spaced co-operating needles, a looper cooperating with said needles, and mechanism for vertically reciprocating said needles and operating said looper to produce an embroidery seam, that improvement which comprises a head vertically reciprocable in operative relationship to said needles, and provided with a guideway extending transversely of said head, a support slidably mounted in said guideway, a needle guide carried by said support, one of said needles extending slidably through said needle guide, a supporting ring vertically reciprocable with said head and movable relatively thereto, a bell-crank lever movable with said head and having its arms connected respectively with said support and said supporting ring, and means for moving said supporting ring relatively to said head whereby said bell-crank lever is actuated to transversely adjust said support and needle guide to flex the needle extending therethrough to thereby vary the spacing of said needles without interference with the operation of the machine and the reciprocation of the needles.

9. In an embroidery machine of the kind described including spaced co-operating needles, a looper cooperating with said needles, mechanism for operating said needles and looper to produce an embroidery seam, and manually operated means including a rotatable crank handle for adjusting said needles to vary the direction of said embroidery seam, that improvement which comprises a head movable in operative relationship to said needles, a needle guide transversely movable on said head, a supporting ring movable with said head and independently thereof, means including a hand lever associated with the crank handle of said manually operated means for mov-

ing said supporting ring independently of said head, and means whereby said independent movements of said supporting ring are transmitted to said needle guide to shift the latter transversely at will to thereby selectively vary the spacing of said needles without interference with the operation of the needles and of the machine.

10. In an embroidery machine of the kind described including spaced co-operating needles, a looper cooperating with said needles, and mechanism for operating said needles and looper to produce an embroidery seam consisting of spaced lines of stitches and including transverse connections extending between the same, that improvement which comprises adjusting means for varying the spacing of said needles during the operation of the machine without interference with the operation of said needles to selectively vary the length of transverse connections included in a given embroidery seam, a pair of take-up levers pivotally actuated by said mechanism for controlling the thread, and auxiliary take-up means vertically movable in timed relation to the operation of said needles for controlling the thread in accordance with the spacing of said needles.

11. In an embroidery machine of the kind described including spaced co-operating needles, a looper cooperating with said needles, and mechanism for operating said needles and looper to produce an embroidery seam consisting of spaced lines of stitches and including transverse connections extending between the same, that improvement which comprises adjusting means for varying the spacing of said needles during the operation of the machine without interference with the operation of said needles to selectively vary the length of transverse connections included in a given embroidery seam, a pair of pivoted take-up levers having slotted ends overlapping each other, a pivot member extending through said slotted ends to connect said levers with each other, one of said levers being rocked by said mechanism to inversely rock the other lever for controlling the thread, and means connected with said adjusting means whereby said pivot member is automatically shifted in said slotted ends coincidentally with a variation in the spacing of the needles for automatically controlling the thread in accordance with said spacing.

12. In an embroidery machine of the kind described including a hooked needle and an eye-pointed needle arranged in spaced relation and adapted to be reciprocated to form a thread loop, that improvement which comprises a looper having a body and a hook at the upper edge thereof, said body being provided with an annular groove and a recess terminating in the end face of the tubular body and communicating with the annular groove thereof.

13. In an embroidery machine of the kind described including a hooked needle and eye-pointed needle arranged in spaced relation and adapted to be reciprocated to form a thread loop, that improvement which comprises a looper having a body provided with an outwardly bulged portion at its upper edge, and a hook forming part of said outwardly bulged portion and located at the end face of said body.

14. In an embroidery machine of the kind described including spaced co-operating needles, a looper cooperating with said needles, and mechanism for operating said needles and looper to produce an embroidery seam consisting of spaced

lines of stitches and including transverse connections extending between the same, that improvement which comprises mechanism for varying the spacing of said needles during the operation of the machine without interference with the operation of said needles, to vary the length of the transverse connections included in a given embroidery seam, and means independent of but cooperating automatically with said mechanism to establish a limit for the spacing of said needles.

15. In an embroidery machine of the kind described including spaced co-operating needles, a looper cooperating with said needles, and mechanism for operating said needles and looper to produce an embroidery seam consisting of spaced lines of stitches and including transverse connections extending between the same, that improvement which comprises mechanism for varying the spacing of said needles during the operation of the machine without interference with the operation of said needles, to vary the length of the transverse connections included in a given embroidery seam, and adjustable means inde-

pendent of but co-operating with said mechanism to selectively establish a limit for the spacing of said needles.

16. In an embroidery machine of the kind described including spaced co-operating needles, a looper cooperating with said needles, and mechanism for operating said needles and looper to produce an embroidery seam consisting of spaced lines of stitches and including transverse connections extending between the same, that improvement which comprises adjusting means for varying the spacing of said needles during the operation of the machine without interference with the operation of said needles to vary the length of the transverse connections included in a given embroidery seam, and take-up means operating in synchronism with said adjusting means to control the thread in harmony with the spacing of said needles in a given embroidery seam, and interchangeable manually and automatically controlled means for operating said adjusting means either manually or automatically at will.

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