

- [54] **ARMHOLE FEELING MACHINE**
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N.Y.
- [22] Filed: **June 17, 1971**
- [21] Appl. No.: **154,065**

- [52] U.S. Cl. **112/132, 112/178**
- [51] Int. Cl. **D05b 35/08**
- [58] Field of Search **112/132, 134, 178,**
112/212, 121.12, 121.11, 121.15, 121.24,
121.26, 63

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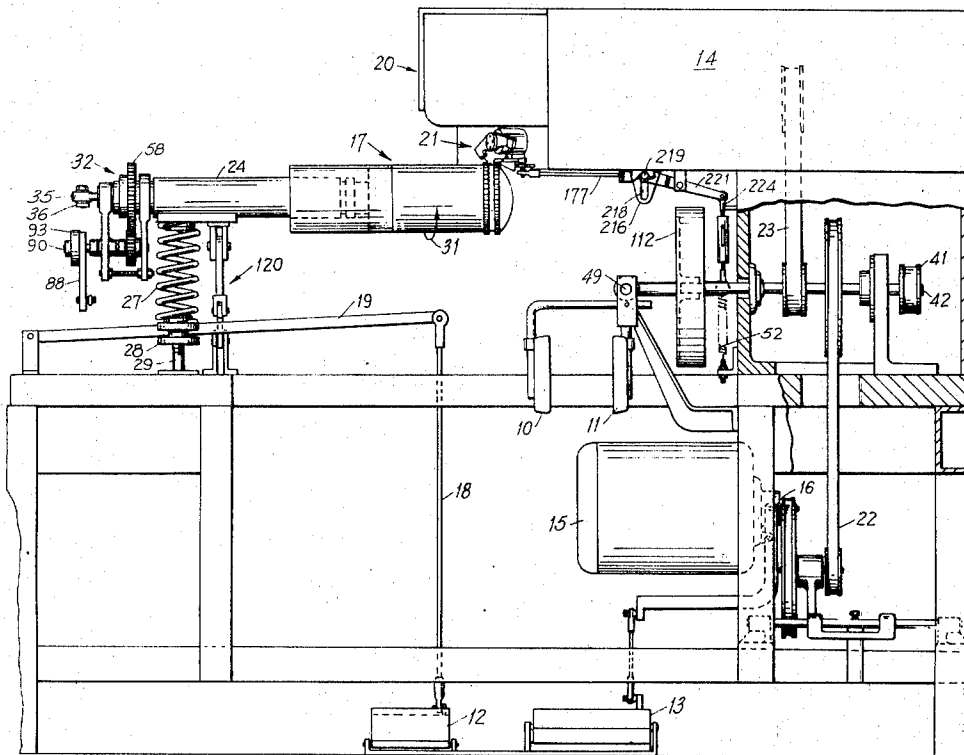
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Primary Examiner—H. Hampton Hunter
Attorney—George W. Price et al.

[57] **ABSTRACT**

A stitching machine for stitching a sleeve part to the armhole part of a garment including a fell stitch needle assembly with its associated drive and thread handling system, a rotatable mandrel for receiving and feeding the body and sleeve, means for indexing the mandrel between stitches, means for increasing the pressure applied to the parts by the mandrel during stitching and for reducing it during feeding thereof, a plunger for raising the portions to be stitched during the stitching, an outer feed wheel engageable with the parts during feeding, a pair of tucking fingers controllable by the operator for engaging one of the parts adjacent the stitching needle for forming tucks and a one-position clutch controllable by the operator to stop feeding while tacking stitches are applied.

14 Claims, 23 Drawing Figures



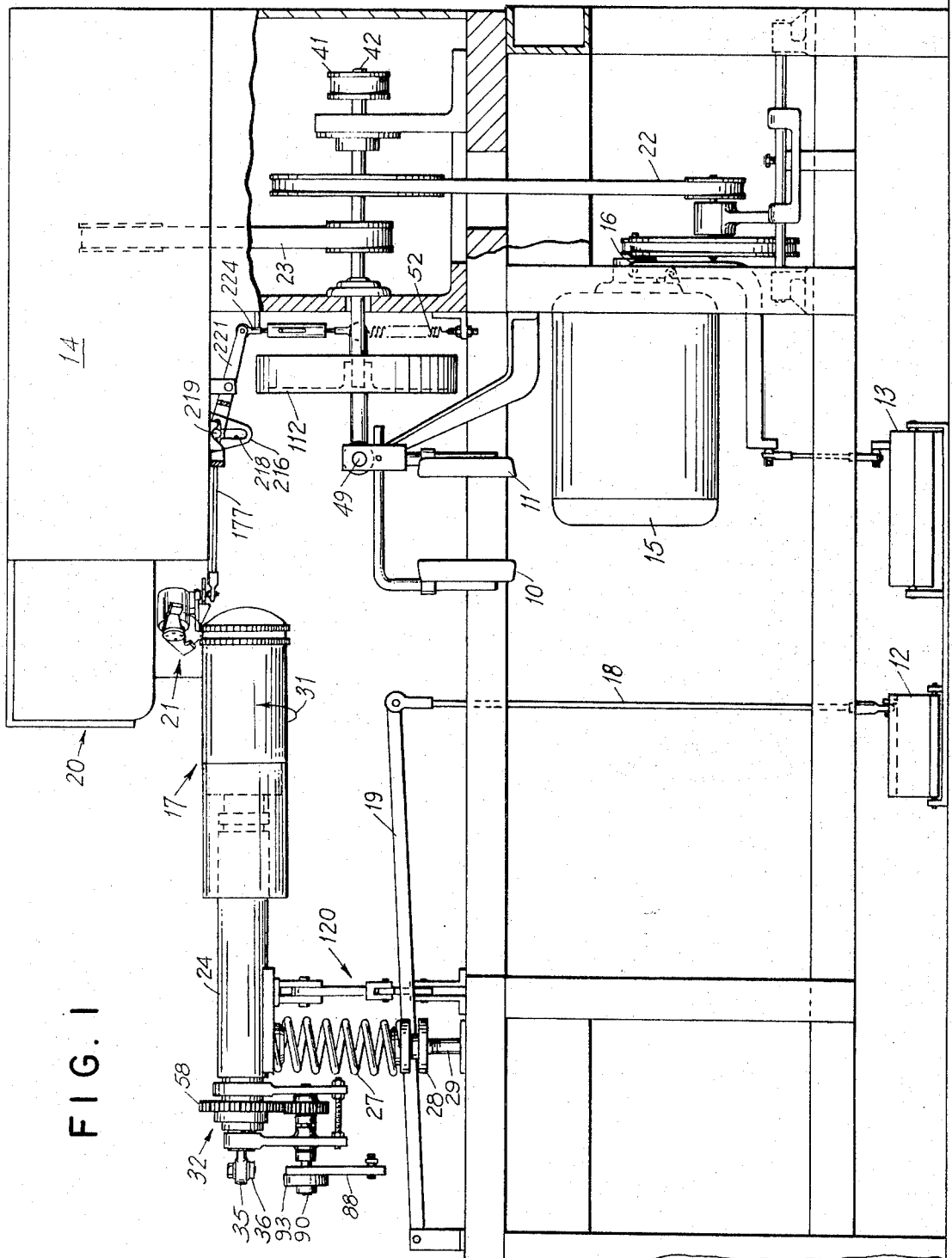
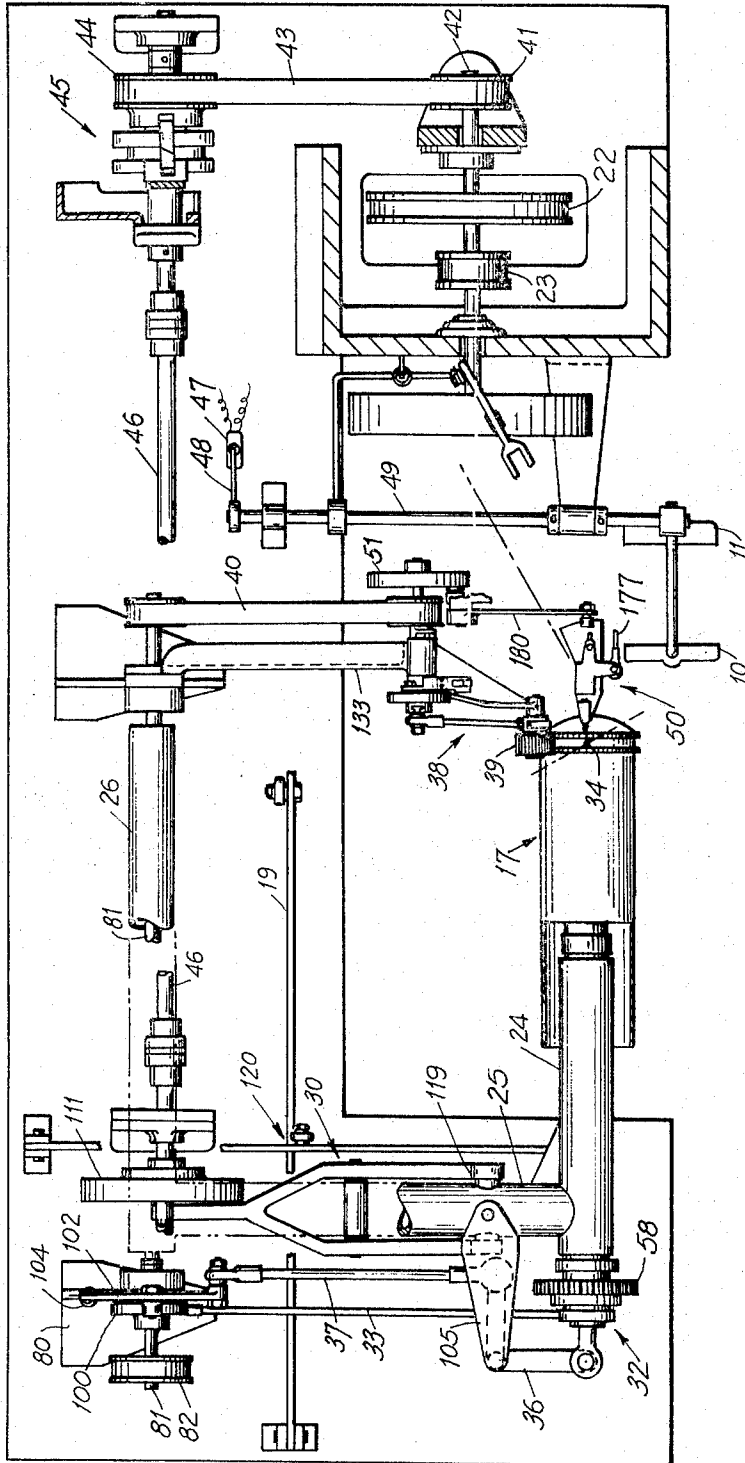


FIG. 1

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FIG. 2



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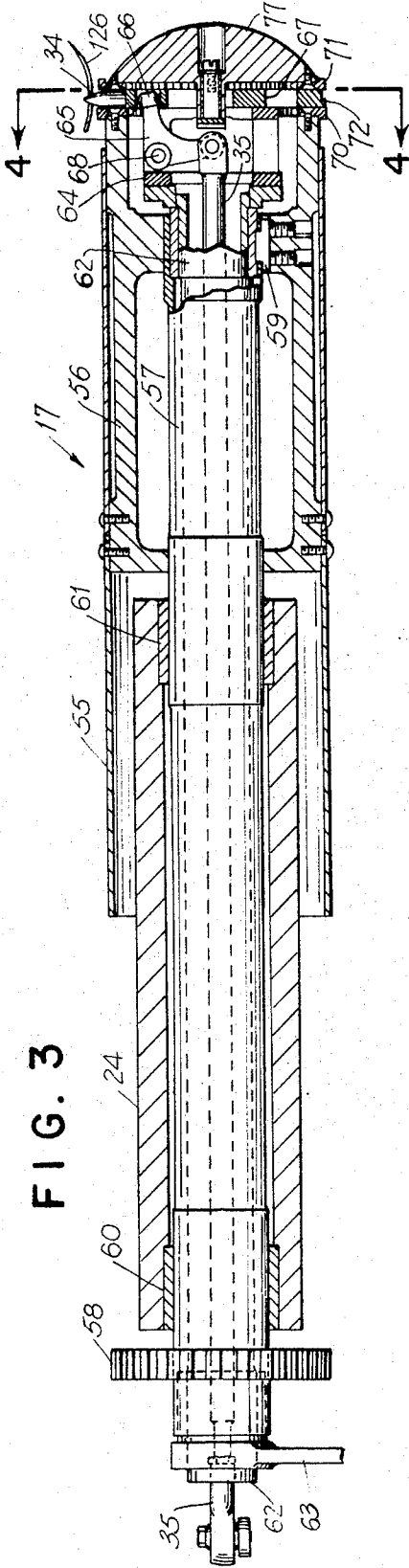


FIG. 3

FIG. 4

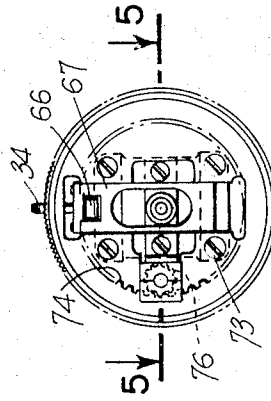


FIG. 5

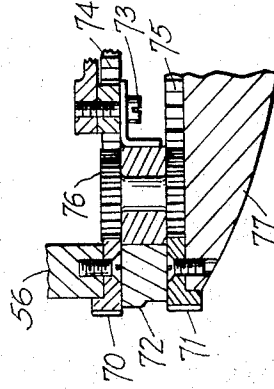
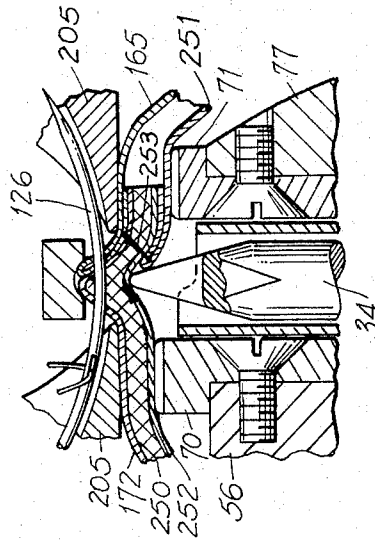


FIG. 23



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FIG. 7

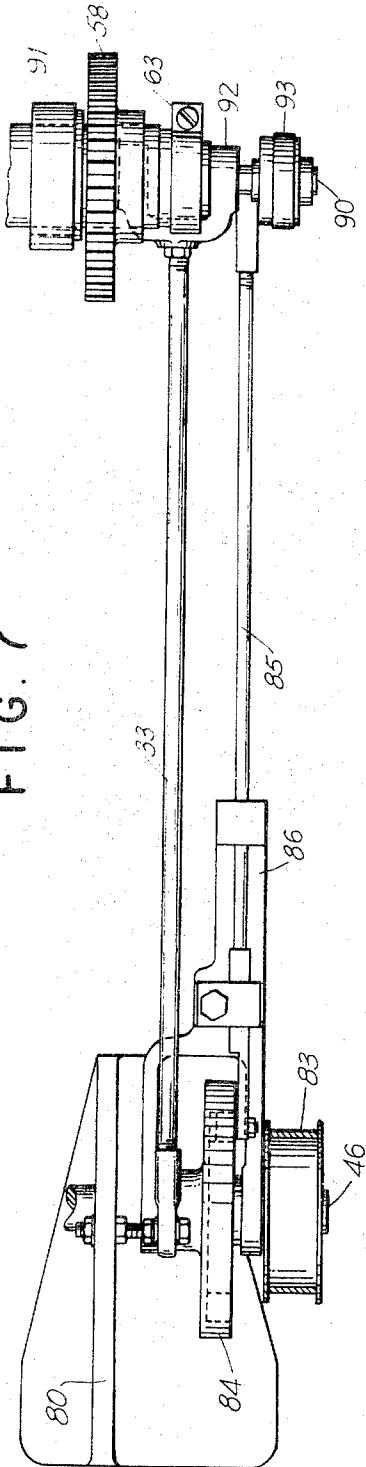
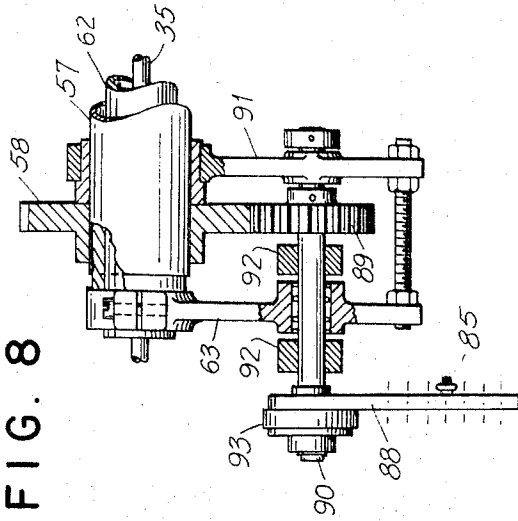


FIG. 8



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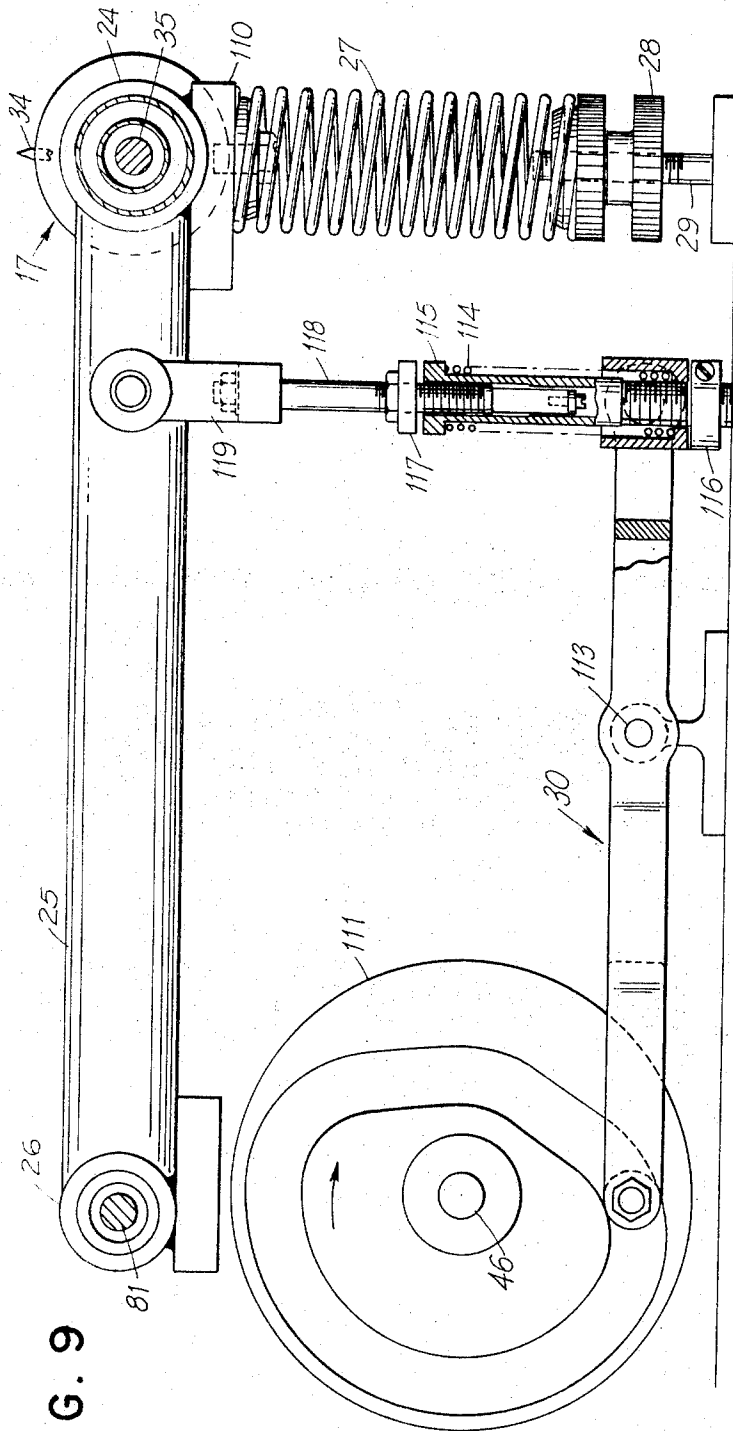


FIG. 9

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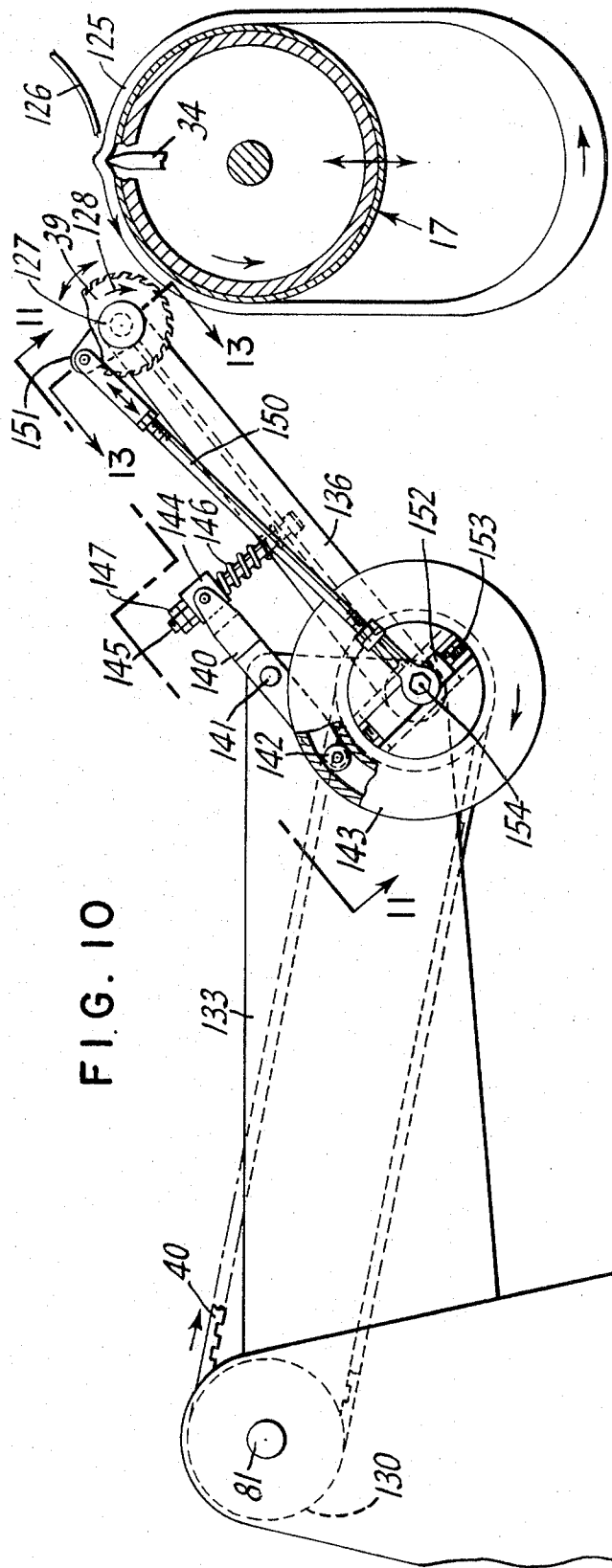


FIG. 10

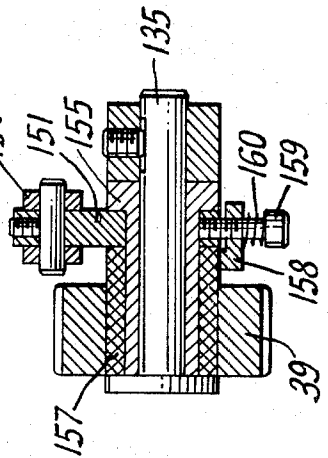
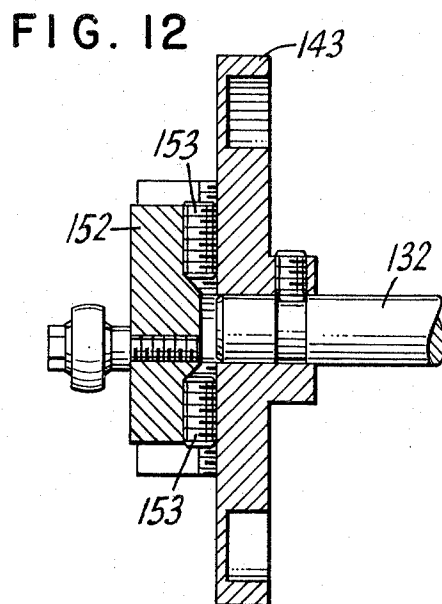
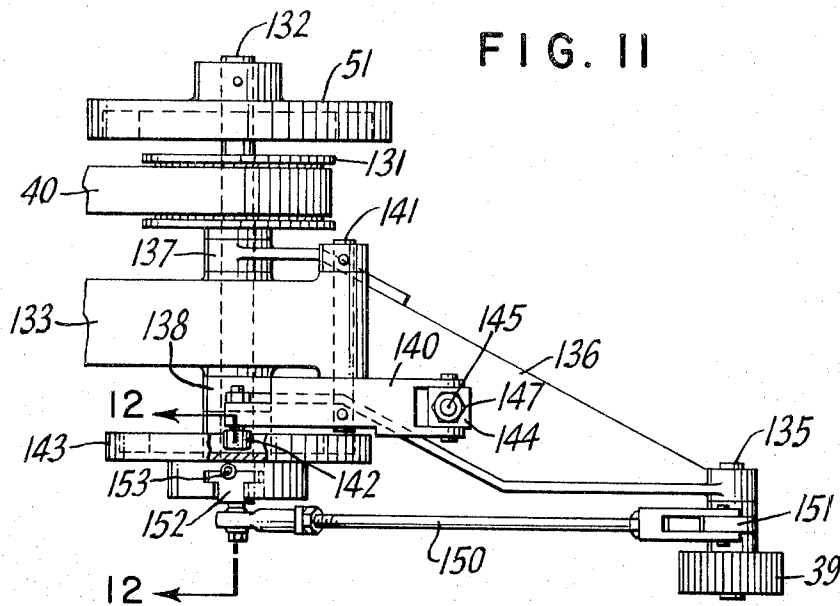


FIG. 13

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FIG. 14

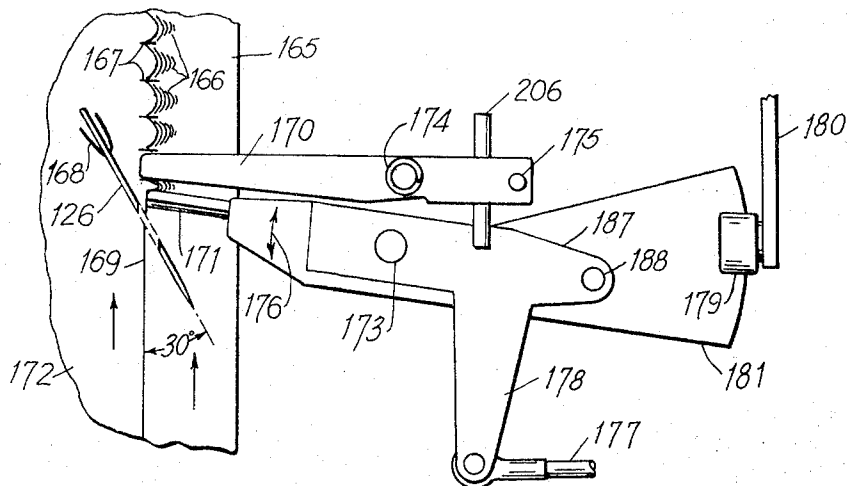
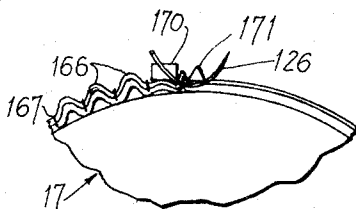


FIG. 15



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FIG. 16

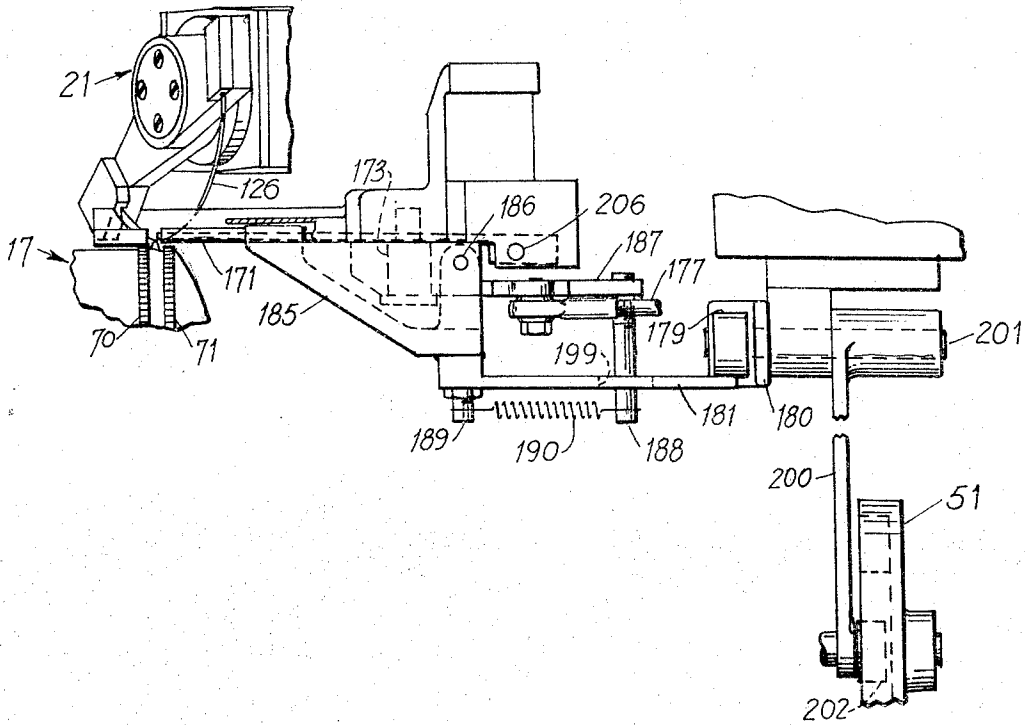
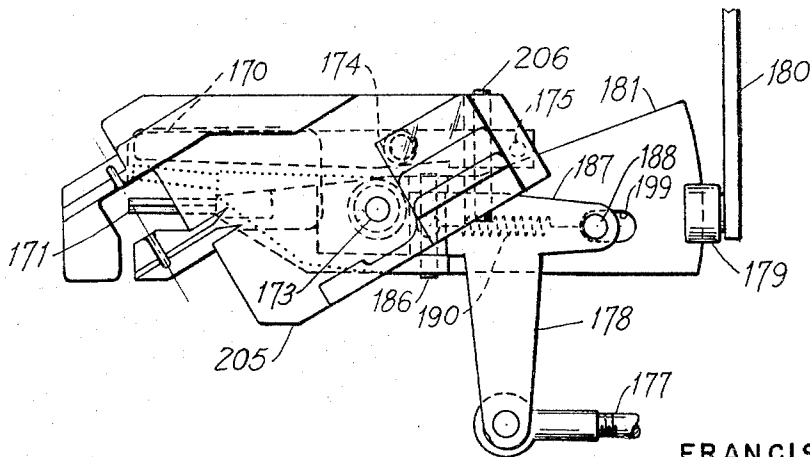


FIG. 17



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FIG. 18

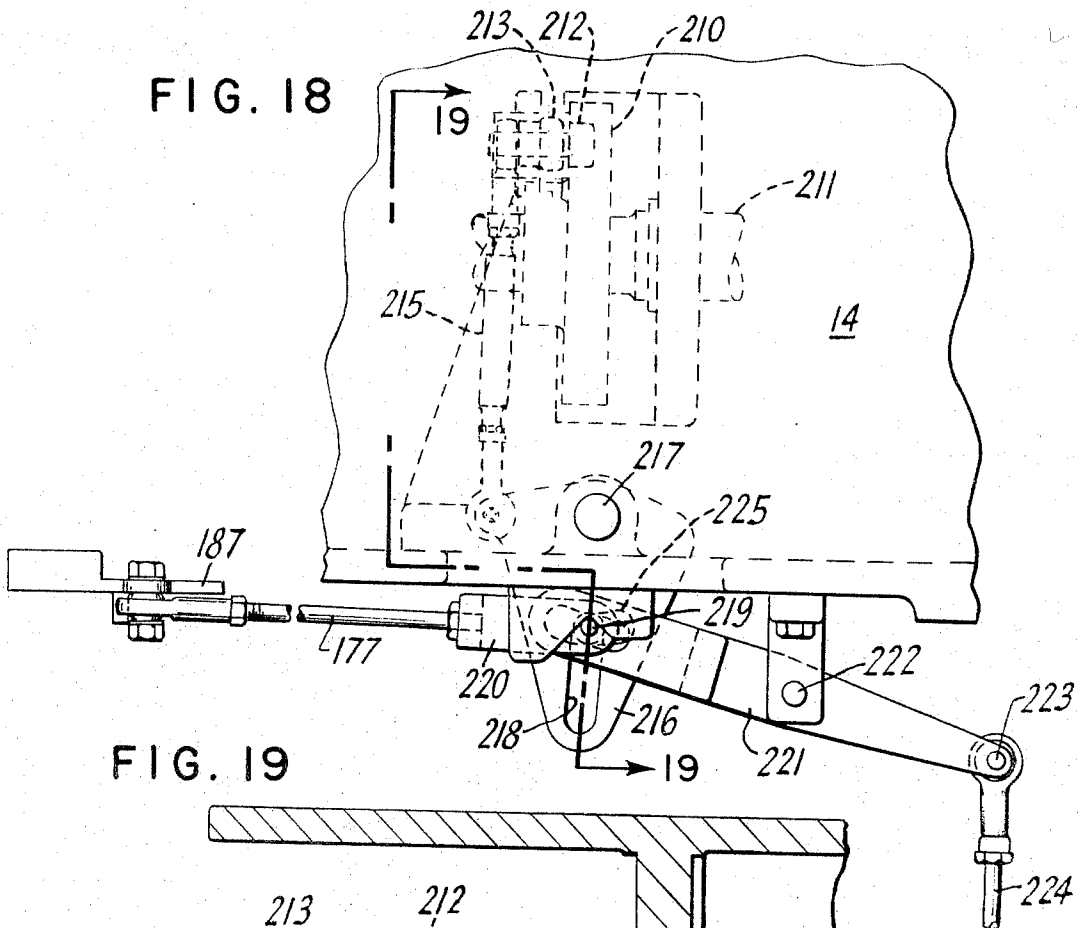
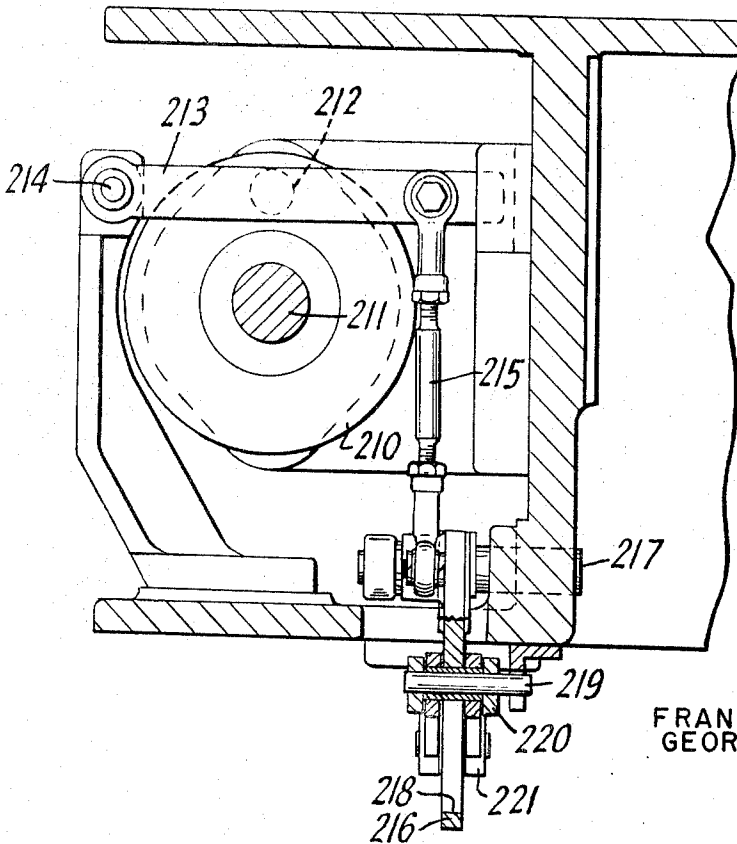


FIG. 19



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FIG. 22

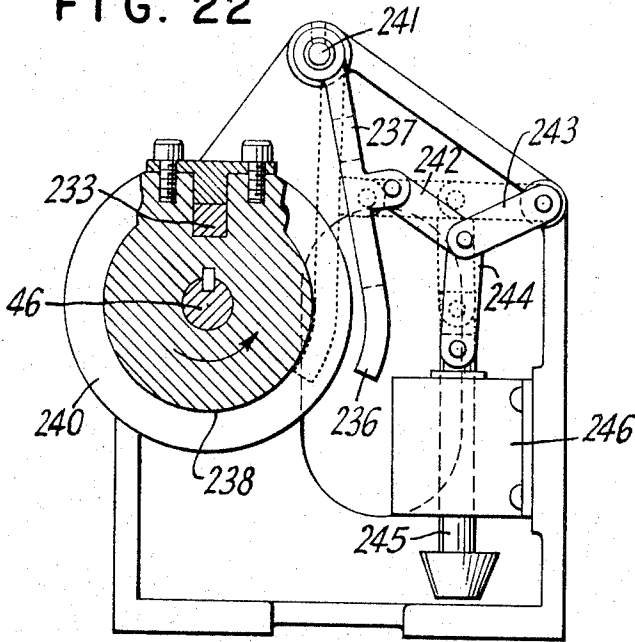


FIG. 21

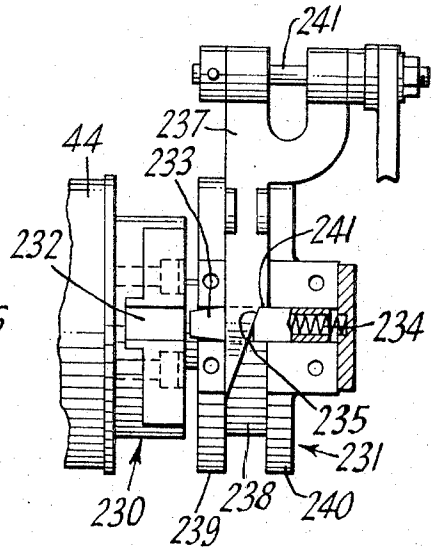
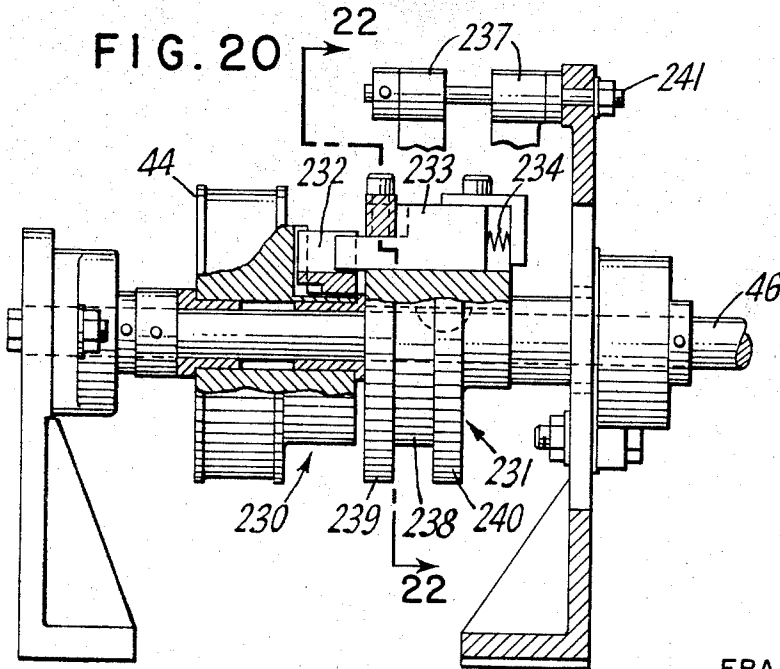


FIG. 20



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ARMHOLE FEELING MACHINE

This invention relates to a sewing or stitching machine for stitching together parts with a blind or fell stitch and particularly, to a machine especially adapted for stitching together a pair of tubular parts, such as the stitching of a sleeve to the armhole portion of a coat or jacket.

Stitching machines for stitching together tubular parts with ordinary stitching, such as chain or knot stitching, are known in the art. However, with such machines only the relatively simple problems of holding the parts in their proper relative positions and feeding them beneath the needle are involved.

A blind or fell stitching machine is shown and described in United States Pat. No. 3,526,197 and in such machine, the parts to be joined, which are relatively flat, are raised at the portions to be sewn and are stitched by a curved, floating needle. The invention relates to the modification of such a machine to adapt it to sewing of parts, particularly tubular parts, which cannot be readily sewn on such a machine.

In the manufacture of coats and jackets, it is customary to sew the sleeve to the armhole portion of the body by blind or fell stitching, and usually, the stitching is done manually which requires substantial manual labor and time. One object of the invention is to accomplish such stitching rapidly with a machine and so that it is difficult to determine whether the stitching has been done by hand or by machine.

Customarily, especially with men's coats or jackets, the body, at the armhole portion, comprises a shoulder pad intermediate the outer cloth and an inner lining. However, the shoulder pad extends only partly around the armhole opening, causing the thickness of the material to be sewn to vary as the sewing proceeds and thereby causing sewing problems in the use of a machine.

Additionally, the sleeve usually is a tube of the outer cloth with a tube of lining cloth therein, and although the outer cloth may be sewn to the armhole portion by ordinary stitching, the lining usually is sewn to the armhole portion by blind stitching and so as to cover the outer cloth stitching. Also, to provide fullness in the shoulder, tucks, which may be of different size, are formed in the lining between stitches. The presence of these several materials and the need for tucking creates additional problems if it is desired to perform the sewing by machine.

At the start and finish of the sewing operation, it is desirable to superimpose several stitches to make fast the ends of the sewing thread and at the start, to secure the lining for the sewing operation.

A further object of the invention is to provide a stitching machine which can perform stitching of parts each having multiple layers of material and which have thicknesses which vary in the direction of stitching.

Another object of the invention is to provide a stitching machine in which tucking of one of the parts can be performed by the machine under the control of the operator during the stitching of the parts.

Another object of the invention is to provide a stitching machine of the type aforesaid in which other operations of the machine can be discontinued while several stitches are superimposed and then can be resumed in synchronism with the stitching.

The preferred embodiment of the invention employs the needle bar system, the thread handling system and the drive therefor set forth in said U.S. Pat. No. 3,526,197 in combination with a rotatable and reciprocable mandrel having a material feed mechanism for engaging and feeding the parts, and a tucking mechanism for tucking one of the parts, all driven in synchronism from a common source but with the parts other than the stitching portion being driven through a clutch controllable by the operator to permit the application of tacking stitches.

Other objects of the invention will be apparent from the following detailed description of the preferred embodiment thereof, which description should be considered in conjunction with the accompanying drawings in which:

FIGS. 1 and 2 are, respectively, front elevation and plan views of the stitching machine of the invention with details of certain parts omitted for the purpose of convenience in illustration;

FIG. 3 is a side elevation view, partly in cross-section of a mandrel forming part of said machine;

FIG. 4 is a cross-sectional, end elevation view of the mandrel shown in FIG. 3 and is taken along the line 4—4 identified in FIG. 3;

FIG. 5 is an enlarged, fragmentary, cross-sectional view of the mandrel shown in FIGS. 3 and 4 and is taken along the line 5—5 identified in FIG. 4;

FIG. 6 is a side elevation view, partly in cross-section of the mandrel indexing and the cloth lifting plunger drive mechanisms forming part of said machine;

FIG. 7 is a plan view of a portion of mechanisms shown in FIG. 6;

FIG. 8 is a fragmentary, cross-sectional, end view of the mechanism shown in FIG. 7 and is taken along the line 8—8 identified in FIG. 7;

FIG. 9 is a side elevation view, partly in cross-section, of the mandrel pressure mechanism forming part of said machine;

FIG. 10 is a side elevation view, partly in cross-section, of the outer material feed mechanism forming part of said machine;

FIG. 11 is a fragmentary, plan view of the outer material feed mechanism shown in FIG. 10;

FIG. 12 is a cross-sectional side view of a portion of the outer material feed wheel drive shown in FIGS. 10 and 11 and is taken along the line 12—12 identified in FIG. 11;

FIG. 13 is a cross-sectional, side view of the outer material feed wheel and its mounting shown in FIGS. 10 and 11 and is taken along the line 13—13 identified in FIG. 11;

FIGS. 14 and 15 are, respectively, diagrammatic plan and end views of the tucking mechanism forming part of said machine in association with material being sewn;

FIGS. 16 and 17 are, respectively, fragmentary elevation and plan views of said tucking mechanism;

FIG. 18 is an elevation view of a portion of the mechanism for driving a finger of said tucking mechanism;

FIG. 19 is cross-sectional view of the driving mechanism shown in FIG. 18 and is taken along the line 19—19 identified in FIG. 18;

FIG. 20 is a side elevation view, partly in cross-section, of a drive shaft clutch forming part of said machine;

FIG. 21 is a fragmentary, plan view, partly in cross-section, of the clutch shown in FIG. 20;

FIG. 22 is an end elevation view, partly in cross-section, of the clutch shown in FIG. 20 and is taken along the line 22—22 identified in FIG. 20; and

FIG. 23 is an enlarged, fragmentary, cross-sectional, elevation view of said mandrel and plunger in association with material to be sewn and the sewing needle and guide plate.

GENERAL DESCRIPTION

FIG. 1 shows the stitching machine as viewed by an operator who controls joined knee pedals 10 and 11 and foot pedals 12 and 13. When the knee pedal 10 is moved to the left for the purpose of performing the tacking operation mentioned hereinbefore only the stitching head, indicated generally by the reference numeral 14, and its associated needle assembly 21 can operate, and when the knee pedal 11 is moved to the right, which causes the knee pedal 10 to move to the right, the tucking operation mentioned hereinbefore is performed, the amount of tucking being determined by the extent to which the pedal 11 is moved to the right. In the neutral position of the pedals 10 and 11, to which they are returned by a spring 52, all of the machine operations except the tucking operation can be performed although, if desired, the tucking controls can be set to produce minimum tucks in such position.

The various parts of the machine are driven by an electric motor 15 through a clutch 16 which is controlled by the foot pedal 13. The parts to be sewn together are supported by a mandrel 17 and the pressure applied to such parts by the mandrel 17 can be moved by operation of the foot pedal 12 which lowers the mandrel 17 by means of a rod 18 and a lever 19.

The stitching head or mechanism 14 corresponds to the stitching head described in said U.S. Pat. No. 3,526,197, with certain modifications described hereinafter, and comprises a thread handling system 20, corresponding to the thread handling system 18 in said patent, and a needle bar assembly 21, corresponding to the needle bar system 16 in said patent. The operation of the thread handling system 20 and the needle bar assembly 21 is the same as that described in said patent. The stitching head 14 is driven by the motor 15 through a belt and pulley system comprising the belts 22 and 23.

The mandrel 17 is supported by a tube assembly comprising the tubes 24, 25 and 26 (FIGS. 1 and 2), the tube assembly being pivotable about the axis of the tube 26. The tube 24, and hence, the mandrel 17, is constantly urged upwardly, as viewed in FIG. 1, by a spring 27, the pressure applied by the spring 27 being adjustable by a nut 28 mounted on a threaded shaft 29. Additional upward pressure is applied to the mandrel 17 during the stitching operation by a yoke 30 (FIG. 2) through a second spring and by means of a cam, both of such being described in detail hereinafter.

The mandrel 17 is rotated intermittently and between stitches in the direction of the arrow 31 (FIG. 1) by means of an indexing mechanism indicated generally by the reference numeral 32. The indexing mechanism 32 is driven by a cam hereinafter described and is stabilized by a rod 33 (FIG. 2).

The mandrel 17 comprises a reciprocable plunger 34 (FIG. 2) which is reciprocated by a mechanism hereinafter described. Such mechanism is driven by a rod 35 (FIG. 1) connected to a bell crank 36 driven by a rod

37 (FIG. 2) and a cam hereinafter described. The plunger 34 raises the parts to be sewn together during the stitching operation.

In the preferred embodiment of the invention, the stitching machine includes an outer feed mechanism indicated generally by the reference numeral 38 for the purpose of advancing the parts being stitched together intermediate the times of actual stitching thereof. The outer material feed mechanism 38 comprises a serrated wheel or a rubber covered roller, 39 which is rotated, in part, by a belt 40 and which is moved toward and away from the material being sewn by a mechanism hereinafter described.

The parts which operate the outer feed mechanism 38, which rotate the mandrel 17, which reciprocate the plunger 34 and which apply additional pressure to the material being sewn by applying additional upward pressure to the mandrel 17, are driven by the motor 15 through the belt 22, the pulley 41 mounted on the shaft 42, the belt 43 (FIG. 2), the pulley 44, the one-position clutch 45 and the shaft 46. The clutch 45 will be described in greater detail hereinafter, but it is of the type in which the driving part thereof can engage and drive the driven part thereof only when the driving and driven parts have a predetermined relation. The clutch 45 is disengaged so as to stop rotation of the shaft 46 when the switch 47 is closed by the arm 48 on the shaft 49 which is rotatable by the knee pedals 10 and 11.

A tucking mechanism designated, generally by the reference number 50, is mounted adjacent the needle assembly 21 so as to engage the uppermost layer of material on the mandrel 17 and below the needle assembly to form tucks of adjustable size intermediate successive passages of the need through the material to be sewn. One portion of the tucking mechanism 50 is driven from the shaft 81 through the belt 40, the latter driving a cam 51 which is connected to the tucking mechanism 50 in the manner hereinafter described.

MANDREL CONSTRUCTION

With reference to FIGS. 3-5, the mandrel 17 comprises an outer sleeve 55 mounted on and secured to an inner sleeve 56 which is supported on an inner tubular shaft 57 which is rotatable by a gear 58. The inner shaft 57 is keyed to the inner sleeve 56 by a key 59 so that the inner and outer sleeves, 56 and 55 respectively, are rotatable with the shaft 57. The shaft 57 rotates in a pair of bearings 60 and 61 mounted on the tube 24, which is non-rotatable.

A second tubular shaft 62, which is prevented from rotating by a hanger 63 secured thereto, is mounted within the tubular shaft 57. A bracket 64 is secured to the end of the shaft 62 and carries a bell crank 65 engageable at the end 66 thereof with a slide 67 which carries the plunger 34. The bell crank 65 is rotatable about the shaft 68 by the rod 35 which is reciprocated, as described hereinafter, to cause reciprocation of the slide 67 and hence, reciprocation of the plunger 34.

A serrated feed wheel 70 is secured to the end of the sleeve 56 and is separated from a second feed wheel 71 by a fixed plate 72 mounted on the fixed bracket 64, such as by the screws 73. Both of the feed wheels 70 71 have internal teeth 74 and 75 which engage the teeth of one or more pinions 76 rotatably mounted on the plate 72. Accordingly, as the feed wheel 70 is rotated by the inner sleeve 56 in relation to the fixed plate 72, the feed wheel 71 is driven in the same direction and

at the same rate as the feed wheel 70 through the pinion 76. This permits rotation of the feed wheels 70 and 71 in synchronism even though intermediate parts such as the slide 67 and the plunger 34 do not rotate with the mandrel 17. A cap 77, for protective purposes and of any suitable shape, may be secured to the feed wheel 71 so as to rotate therewith.

From the foregoing it will be apparent that as the shaft 57 is rotated by the gear 58, the outer sleeve 55 of the mandrel 17 will rotate therewith and both of the feed wheels 70 and 71 will rotate with the sleeve 55. However, at the same time the plunger 34 may be independently given up and down movement by the rod 35 acting through the bell crank 65 without rotation of the plunger 34 about the axis of the mandrel 17.

MANDREL ROTATION

With reference to FIGS. 6-8, the hanger 63, secured to the tubular shaft 62, is prevented from rotation by means of the stabilizing or parallel rod 33 pivotally secured at one end to the hanger 63 and at the opposite end to the stand 80. The main driven shaft 46 drives the auxiliary shaft 81, by means of a pulley 82 secured to the shaft 81, a belt 83 and a pulley (not shown) secured to the shaft 46. The shaft 46 drives a cam 84 secured thereto which in turn causes reciprocation of a rod 85 carried by a carrier 86 pivotally mounted at one end on the shaft 46. The rod 85 is pivotally secured at one end to the lever 88 at one of the holes 87 therein, the amount of rotation of the mandrel 17 being determined by the hole 87 selected and an increase in rotation for each rotation of the cam 84 being obtained by selecting a hole 87 nearer to the gear 89.

As is best shown in FIG. 8, the lever 88 is rotatably mounted on a shaft 90 rotatably supported by the hanger 63 and by a further hanger 91 rotatably carried by the shaft 57, the shaft 90 also being rotatable in the yoke 92 by which the end of the stabilizing rod 33 is connected to the hanger 63. Reciprocating motion of the lever 88 is converted into incremental rotary motion of the shaft 90 by means of a oneway clutch or ratchet 93 mounted on the shaft 90, the gear 89 and hence the gear 58 thereby being rotated by a small increment with each rotation of the cam 84 (FIG. 6).

PLUNGER DRIVE

With reference to FIG. 6, the auxiliary shaft 81 rotates a cam 100 secured thereto, such cam 100 engaging a follower 101 secured to the bell crank 102 which is rotatably mounted at 103 on the tube 25. The follower 101 is urged against the cam 100 by a spring 104 and the rod 37 is pivotally secured to the bell crank 102 at one end and to the bell crank 36 at the opposite end. The bell crank 36 is pivotally mounted on a bracket 105 secured to the tube 25, and as the rod 37 is reciprocated by the bell crank 102 and the cam 100, the bell crank 36 reciprocates the rod 35 axially of the mandrel 17.

MANDREL PRESSURE MECHANISM

With reference to FIGS. 2 and 9, the tube 26 is rotatably mounted on the shaft 81, thereby permitting the tube 24 and 25 to pivot about the axis of the shaft 81. As described hereinbefore, the tube 24 supports the mandrel 17, and therefore, as the tube 24 moves up and down, as viewed in FIG. 9, more or less pressure is applied to the parts to be stitched together when they are

beneath the needle assembly 21. The spring 27 bearing against the plate 110, secured to the underside of the tube 24, applies continuous upward pressure to the tube 24 and hence, to the mandrel 17, and the pressure exerted by the spring 27 may be adjusted by means of the nut 28.

During the time that the needle is actually passing through the parts to be sewed together, it is desirable to exert additional pressure on such parts, and for this purpose, a cam 111 is secured to the shaft 46 and driven thereby so as to reciprocate or oscillate a lever 30 pivoted at 113. As the needle is about to penetrate the material of the parts to be sewn, the right-hand end of the lever 30 is raised by the cam 111, which raises the spring 114 which is preloaded by means of the threaded tube 115 having an adjusting nut 116 thereon. When the end of the tube 115 strikes the nut 117 on the threaded rod 118, upward pressure is applied to the tube 25 through the spring 114, tube 115, nut 117, rod 118 and yoke 119 and hence, additional upward pressure is applied to the mandrel 17. The cam 111 is shaped so that such additional pressure is maintained on the mandrel, and on the material of the parts to be sewn, until the sewing needle has completely passed through such parts. Thereafter the righthand end of the lever 30 moves downwardly releasing the pressure on the parts to be sewn and permitting the parts to be fed more easily by the feed wheels 70 and 71 (FIG. 3).

During the placement and removal of the parts to be sewn on and from the mandrel 17, the mandrel 17 may be separated from the needle assembly a distance sufficient to permit easy placement and removal by manual operation of the foot pedal 12 (FIG. 1) which depresses the lever 19 connected to the tube 24 by the linkage 120 and thereby causes the tube 24 and the mandrel 17 to move downwardly as viewed in FIG. 1 and causes compression of the spring 27.

OUTER FEED MECHANISM

It has been found to be desirable to assist in the feeding of the parts to be sewn together by the use of an outer material feed mechanism, and one preferred form of such outer feed mechanism is illustrated in FIGS. 10-13.

With reference to FIG. 10, one of the parts to be sewn, such as the armhole portion 125 of a coat, is shown mounted on the mandrel 17, the sewing needle 126 having passed therethrough. At this point in the cycle of operation, the serrated outer feed wheel 39 is separated from the part 125, but shortly thereafter, when it is desired to step the part 125 ahead in preparation for the next stitch, the wheel 39 is moved toward the part 125 and into engagement therewith. After the wheel 39 engages the part 125, it is then rotated about its axis 127 and in the direction of the arrow 128 by the amount required to move the part 125 the distance between stitches.

A pulley 130 secured to the shaft 81 drives a belt 40 which in turn drives a pulley 131 (FIG. 11) secured to shaft 132 rotatably mounted on a bracket 133 extending from a stand 134. The wheel 39 is rotatable on a fixed shaft 135 carried by an arm 136 which is pivotally mounted at 137 and 138 on the shaft 132. A rocker arm 140 is secured to a shaft 141 which is rotatably mounted in the bracket 133 and a follower 142 mounted at one end of the rocker arm 140 engages a cam 143 secured to the shaft 132. The opposite end of

the rocker arm 140 carries a pivotally mounted bushing 144 which is slidable on a bolt 145, extending through the arm 136. The bushing 144 bears against one end of a spring 146 and the opposite end of the spring 146 bears against the arm 136.

As the cam 143 rotates, it oscillate the rocker arm 140 about the axis of the shaft 141 causing raising and lowering of the wheel 39 which moves around the axis of the shaft 132. When the wheel 39 engages the part 125, the spring 146 is compressed slightly and the pressure applied to the part 125 by the wheel 39 may be adjusted by adjusting the compression of the spring 146 by means of the nuts 147.

The shaping and timing of the cam 143 is such that when the mandrel 17 has the additional upward pressure removed therefrom and commences its feed indexing operation from the inside of the part 125, the wheel 39 engages the part 125. After the part 125 has been moved forward the desired amount and the additional upward pressure is again applied to the mandrel 17, the wheel 39 is withdrawn from contact with the part 125 until after the needle 126 has penetrated and passed through the parts to be stitched. Thereafter, the wheel 39 remains separated from the part 125 until the additional pressure on the mandrel 17 is again removed. The purpose of the separation of the wheel 39 from the part 125 is to permit the part 125 to be adjusted more readily by an operator and without this feature the parts would tend to take a direction of movement, either desirable or undesirable, and would be difficult to guide or track in the desired direction.

The wheel 39 is rotated intermittently and to the desired extent by means including a rod 150 pivotally connected at one end to a lever 151 and at the opposite end to a slide 152 adjustable radially with respect to the axis of the shaft 132. The slide 152 is adjustable with respect to the axis of the shaft 132 by means of screws 153 (FIG. 12) so that the pivot axis 154 at one end of the rod 150 may be adjusted toward or away from the axis of the shaft 132. In this way, the length of the stroke of the rod 150 may be adjusted to be longer or shorter.

With reference to FIG. 13, the lever 151 is mounted on a sleeve 155 rotatably mounted on the fixed shaft 135 and drives a conventional one-way clutch mechanism or ratchet 157 which causes the wheel 39 to be driven by the lever 151 in only one direction, namely, that of the arrow 128 in FIG. 10. Reverse motion of the wheel 39 is opposed by the brake shoe 158, the friction of which may be adjusted by means of the screw 159 acting on the spring 160 between the head of the screw 159 and the brake shoe 158.

TUCKING MECHANISM

The tucking operation and a portion of the tucking mechanism is illustrated diagrammatically in FIGS. 14 and 15. As shown therein, the part 165 which may, for example, be the inner lining of a coat sleeve, has a plurality of tucks 166 with intervening stitches 167 formed by the thread 168. In the preferred embodiment of the invention, the path of the needle 126 extends at an angle of approximately 30° with respect to the seam line 169.

The tucking mechanism includes a pair of fingers 170 and 171, the finger 170 being movable toward and away from the part 165 which is being sewn to the part 172, and the finger 171 being movable both toward and

away from the part mounted on and around the axis of the shaft 173. The finger 170 is urged toward the part 165 by a spring 174 and is limited in its movement by an adjustable stop 175. Just before, or while, mandrel 17 is being raised by virtue of the additional pressure applied thereto, the finger 170 maintains sufficient pressure on the part 165 to permit a tuck to be formed between the finger 170 and the finger 171 as the finger 171 moves toward the finger 170. However, when the mandrel 17 is lowered by virtue of the reduction of the additional pressure, the finger 170 can slide over a previously formed and stitched tuck.

The finger 171 is reciprocated in the direction of the arrow 176 by the rod 177 pivotally connected to the arm 178. The finger 171 is also lifted away from and permitted to move toward the part 165 by means of a roller 179 mounted on the end of an arm 180 and engaging a plate 181 secured to the finger 171 as described hereinafter. As the finger 171 moves away from the finger 170 the roller 179 engages the plate 181 lifting the finger 171 from the surface of the part 165. When the finger 171 has separated a sufficient distance from the finger 170 to form the desired tuck, the roller 179 moves away from the plate 181 permitting the finger 171 to engage the part 165 and move toward the finger 170 forming a tuck between the fingers 170 and 171.

The details of the tucking mechanism are illustrated in FIGS. 16-19. As shown therein, the finger 171 is mounted on a bracket 185 which is secured to the plate 181 and pivotally mounted at 186 on a portion of the crank 187. The crank 187 pivots about the shaft or stud 173 and has a pin 188 extending therefrom which is connected to a pin 189 extending from the plate 181 by a spring 190. The spring 190 urges the finger 171 toward the part 165. The pin 188 extends through a slot 199 in the plate 181 and movement of the finger 171 about the axis 186 is limited by engagement of the walls of the slot 199 with the pin 188.

The roller 179 which engages the plate 181 and which is carried by the arm 180 is moved up and down by a lever 200 in driving relation with the arm 180 and rotatable about a shaft 201. The lever 200 has a follower 202 mounted on the end thereof, which engages a rotatable cam 51 (see also FIG. 2).

With reference to FIG. 17, the fingers 170 and 171 extend below the needle assembly guide plate 205, and the finger 170 is rotatable about the axis of a shaft 206.

With reference to FIGS. 18 and 19, the rod 177 and hence, the finger 171 are driven from a cam 210 included in the stitching head 14. Thus, the cam 210 is secured to the drive shaft 211 of the needle drive assembly and engages a follower 212 mounted on a lever 213 pivoted at one end of the shaft 214. On the opposite side of the follower 212, the lever 213 is pivotally connected to a link 215 which is pivotally connected at its opposite end to a bell crank 216 which pivots about the shaft 217. The bell crank 216 has a T-shaped slot 218 which receives a pin 219 which pivotally interconnects a yoke 220 secured to the end of the rod 177 and the control lever 221 which is pivoted at 222. The opposite end of the control lever 221 is pivotally connected at 223 to the end of a rod 224 which is controlled by the knee pedal 11 (FIG. 1).

When the pin 219 is in the position shown in FIG. 18, it is within the arcuate portion of the slot 218 indicated in dotted lines 225, and therefore, as the bell crank 216

reciprocates, the pin 219 and hence the rod 177 remain stationary since the pin 219 is not engaged by the walls of the slot 218 in the bell crank 216. However, if the rod 224 is raised, as viewed in FIG. 18, the pin 219 moves downwardly into the vertical leg of the T-shaped slot 218 so that the pin 219 is engaged by the walls thereof causing reciprocation of the rod 177. The amount of movement of the rod 177 and hence, the amount of movement of the finger 171 is determined by the spacing of the pin 219 from the shaft 217 as it moves into the vertical part of the slot 218, and therefore, the magnitude of the movement of the finger 171, and the size of the tuck, can be controlled by the knee pedal 11 which controls the spacing of the pin 219 from the shaft 217, the greater the distance of the pin 219 from the shaft 217 the greater the movement of the finger 171.

DRIVE SHAFT CLUTCH

As pointed out hereinbefore, it is sometimes desirable to disable the mechanisms driven by the shaft 46 (FIG. 2) while tacking stitches are applied to the parts being sewn. However, when spaced stitching is resumed, it is necessary that the various mechanisms start in synchronism with the stitching needle assembly.

For this purpose a single position clutch, that is a clutch which engages in only one relative position of the driven part to the driving part, interconnects the driving motor 15 with the drive shaft 46. Although many forms of such clutches are well-known in the art, one form thereof illustrated in FIGS. 20-22. As shown therein, the clutch has a driving part 230 secured to the pulley 44 and a driven part 231 secured to the shaft 46. Except when the clutch is engaged the pulley 44 and the driving part 230 rotate freely around the shaft 46.

The driving part 230 has an aperture 232 therein which normally receives a plunger 233 which is carried by the driven part 231 and which is biased toward the driving part 230 by a spring 234. When the plunger 233 is within the aperture 232, the driving and driven parts are locked together so that the shaft 46 rotates with the pulley 44. However, when the plunger 233 is withdrawn from the aperture 232, the driving connection is interrupted and the shaft 46 stops its rotation. Disengagement of the clutch is timed so that the drive shaft 46 stops at the time that additional pressure is applied to the mandrel 17, the plunger 34 is raised and the needle 126 is about to penetrate the material to be sewn together.

The plunger 233 has a sanded surface portion 235 which is engageable by the wedge-shaped end 236 of a lever 237 when it is moved against the surface 238 between the pair of hubs 239 and 240 on the driven part 231. By such engagement of the end 236 with the portion 235, the plunger 233 is withdrawn from the aperture 232, and the lever 237 has a projection engageable with the surface 241 on the plunger 233, so as to prevent further rotation of the driven part 231 and rotation of the shaft 46.

The lever 237 is pivotally mounted at 241 and is rotatable by a linkage system 242, 243 and 244 connected to the plunger or core 245 of a solenoid 246. The energization of the solenoid 246 is controlled by the switch 47 (FIG. 2), and when it is energized, the plunger 245 moves upwardly as viewed in FIG. 22 causing the end 236 of the lever 237 to move toward the surface 238. Accordingly, when the operator moves the

knee pedal 10 to the left as viewed in FIG. 1, the solenoid is energized causing disengagement of the clutch 45 and preventing further rotation of the shaft 46. When the knee pedal 10 is released the solenoid 246 is de-energized, and the end 236 is disengaged from the surface 235. When the aperture 232 comes into registration with the plunger 233, the clutch is re-engaged and rotation of the shaft 46 is resumed.

DESCRIPTION OF OPERATION

For purposes of illustration, it will be assumed that it is desired to secure a lined sleeve to the armhole portion of the body of a coat and that the shoulder portion thereof contains padding. FIG. 23 illustrates such an operation at the time when the needle 126 has penetrated the shoulder lining 172, the shoulder pad 250 and the sleeve lining 165. It will be noted that both the body portion and the sleeve have been turned inside out and that the body is draped over the mandrel 17. Prior to being placed on the mandrel 17 the outer cloth 251 of the sleeve was stitched to the outer cloth 252 of the body, to the pad 250, and to the body inner lining 172 by means of stitching 253.

Prior to the time that needle 126 reached the position shown in FIG. 23, the sleeve and body parts were placed on the mandrel 17 while the machine was inactive by virtue of the operation of the foot pedal 13, and by operating the foot pedal 12 so as to separate the mandrel 17 a sufficient distance from the needle assembly 21. When the parts were in the proper position, the pedal 12 was released after making certain that the needle 126 was in a position to the left, as viewed in FIG. 23, where it would not engage the parts to be sewn as the mandrel 17 was raised. Positioning of the needle 126 may be controlled by the hand wheel 112. After the parts were properly placed and the mandrel 17 was raised, the operator moved the knee pedal 10 to the left, as viewed in FIG. 1, and then pressed the foot pedal 13 so as to activate the machine.

The operator then maintains the knee pedal 10 to the left while the needle 126 passes through the body lining 172, the pad 250 and the sleeve lining 165, two or three times to provide tacking stitches, the needle producing such stitches as described in said U.S. Pat. No. 3,526,197, and it being noted that the feed mechanism and the tucking mechanism are inactive due to the position of the knee pedal 10. Thereafter, the knee pedal 10 is released and the needle 126 continues to stitch the parts together but with stitches spaced apart by an amount determined by the setting of the mandrel and outer feed mechanisms.

Shortly after the time that the needle 126 passes completely through the parts, the additional pressure on the mandrel 17 is removed and the plunger 34 is lowered. At the same time, the outer feed wheel 39 is lowered to engage the parts and is then rotated as described hereinbefore, and the mandrel 17 with its feed wheels 70 and 71 are rotated by the amount required to produce the desired spacing between stitches. If required, the operator guides the parts by hand as they are advanced. Prior to the time that the needle 126 again commences the penetration portion of its cycle, the additional pressure is applied to the mandrel 17, the plunger 34 is raised and rotation of the mandrel 17 and the feed wheel 39 is discontinued.

When larger tucks in the sleeve lining 165 are desired, the operator moves the knee pedal 11 to the

right, as viewed in FIG. 1, and the size of the tuck is determined by the extent to which the knee pedal 11 is moved to the right. Each tuck is formed by the fingers 170 and 171 intermediate the time that the additional pressure is removed from the mandrel 17 and hence, after the needle 126 has passed completely through the parts, and the time that the additional pressure is applied to the mandrel 17 in preparation for penetration of the parts by the needle 126.

After all the spaced stitching of the sleeve to the body is accomplished, the operator moves the knee pedal 10 to the far left as viewed in FIG. 1, thereby disabling the feed and tucking mechanisms, and permits the needle 126 to make a few tacking passes. The operator then releases the pedal 13, de-activating the machine, but controlling the pedal or, if preferred, the hand wheel 112 so that the needle 126 is withdrawn from the parts and preferably, is in a position for subsequent commencement of penetration of the needle into the parts. The sewn parts are then removed from the mandrel by operating the foot pedal 12, and the machine is ready for the sewing of the next garment.

While the invention has been described in connection with a preferred embodiment, it will be obvious to those skilled in the art that various modifications can be made therein within the scope of the invention.

1. In a fell stitching machine comprising a stitching needle assembly including a stitching needle, a thread handling system and needle driving means for periodically passing said needle into one portion and out of another portion of a surface of material to be sewn to provide fell stitches therein, the combination therewith of a rotatable mandrel having a free end adjacent said needle assembly for receiving the portion of the material to be sewn and holding said last-mentioned portion of said material between said free end and said needle assembly and drive means synchronized with said needle driving means and having a driving connection with said mandrel for intermittently rotating said mandrel, and thereby feeding said material, intermediate passes of said needle through said material.

2. A machine as set forth in claim 1 further comprising means connected to said mandrel for intermittently moving said free end of said mandrel toward said needle assembly prior to a pass of said needle through said material, for maintaining it in the position to which it is moved during said pass of the needle and for thereafter moving said free end away from said needle.

3. A machine as set forth in claim 1 further comprising a plunger mounted at said free end of said mandrel for reciprocating movement toward and away from said needle and means for intermittently moving said plunger toward said needle prior to a pass of said needle through said material, for maintaining it in the position to which it is moved during said pass of said needle and for thereafter moving said plunger away from said needle.

4. A machine as set forth in claim 1 further comprising outer feed means including a feed wheel, means for moving said feed wheel toward and away from said free end of said mandrel for engaging said material between said wheel and said free end and feeding said material in the direction of rotation of said mandrel and means for intermittently rotating said feed wheel in synchronism with the rotation of said mandrel.

5. A machine as set forth in claim 1 further comprising a pair of tucking fingers mounted with their free

ends adjacent said free end of said mandrel and spaced from said needle in the direction of feed of said material for engaging said material and forming tucks therein, means for moving the finger farther from said needle toward and away from said free end of said mandrel and the finger nearer said needle toward and away from said free end of said mandrel and reciprocating movement in the direction of feed of said material, means for reciprocating said last-mentioned finger intermediate passes of said needle, and means for moving said last-mentioned finger away from said free end of said mandrel during movement of said last-mentioned finger in the direction opposite to the direction of feed of said material.

6. A machine as set forth in claim 1, wherein said mandrel comprises an outer sleeve extending axially of said mandrel and a first feed wheel at said free end mounted for rotation with said sleeve; a first tubular shaft extending axially of and within said sleeve, said shaft being rotatable and being secured to said sleeve for rotation thereof; a second tubular shaft extending axially of and within said first tubular shaft; a bracket mounted on the end of said second tubular shaft at the free end of said mandrel; a second feed wheel mounted coaxially with said first feed wheel but spaced therefrom in the direction of said free end; a slide mounted between said first and second feed wheels and for reciprocating movement toward and away from said needle; a plunger mounted on said slide for movement therewith toward and away from said needle, said plunger, at least in the position thereof nearest said needle, extending above the surface of said mandrel; a bell crank mounted on said bracket and having one arm thereof in engagement with said slide; a reciprocable rod extending axially of and within said second tubular shaft and means connecting said rod to the other arm of said bell crank for reciprocating said crank and said slide; each of said feed wheels having internal teeth, and at least one pinion gear mounted for rotation on said bracket and having its teeth in engagement with the internal teeth on both of said wheels for causing concurrent rotation thereof upon rotation of said first tubular shaft with respect to said second tubular shaft.

7. A machine as set forth in claim 6 further comprising reciprocable support means for said first tubular shaft, said support means being reciprocable in a direction transverse to the axis of said first tubular shaft; adjustable means for continuously urging said support means in a direction which urges said free end toward said needle; and further means for urging said support means in said last-mentioned direction comprising a pivotally mounted lever connected to said support means by a spring, cam means for oscillating said lever, and means for driving said cam means in synchronism with the movement of said needle whereby said free end of said mandrel is urged toward said needle by said cam means during the time that it passes through said material.

8. A machine as set forth in claim 6 further comprising means for restraining rotation of said second tubular shaft and means for intermittently rotating said first tubular shaft comprising driving means connected thereto at a point spaced axially from said free end and cam means for operating said driving means in synchronism with the movement of said needle whereby said first tubular shaft is rotated between one pass of said needle through said material and the next pass thereof

but is stationary during the passage of said needle through said material.

9. A machine as set forth in claim 8, wherein said driving means comprises a gear on said first tubular shaft and a one-way clutch interconnecting said last-mentioned cam means and said gear for causing intermittent movement of said gear.

10. A machine as set forth in claim 8 further comprising cam means connected to said reciprocable rod at a point thereon spaced axially from said free end for reciprocating said rod in synchronism with the movement of said needle whereby said plunger is moved by said rod to its position nearest said needle and is maintained in said position during the time that said needle passes through said material.

11. A machine as set forth in claim 10 further comprising driving means for driving said cam means for driving said first tubular shaft and said cam means for reciprocating said rod, said last-mentioned driving means including a oneposition clutch and manually operable means for disengaging said clutch whereby feeding of said material may be stopped and said needle may be passed through said material a plurality of times without feed of said material.

12. A machine as set forth in claim 6 further comprising outer feed means for engaging and feeding said material in synchronism with the rotation of said outer sleeve, said outer feed means comprising a feed wheel mounted with its axis of rotation parallel to the axis of said sleeve and mounted adjacent said free end; cam means for moving said wheel toward and away from said free end in synchronism with the movement of said needle whereby said last-mentioned feed wheel is in engagement with said material except for a short period between passes of said needle through said material; and cam means for rotating said wheel in synchronism with the rotation of said outer sleeve.

13. A machine as set forth in claim 6 further comprising tucking means adjacent said free end and said needle for engaging said material and forming tucks

therein between said stitches, said tucking means comprising a first finger having its free end adjacent said free end of said mandrel and engageable with said material and adjacent said needle but spaced therefrom in the direction of rotation of said sleeve, means for moving the free end of said first finger toward and away from said free end of said mandrel; a second finger disposed and mounted in the same manner as said first finger but with its free end between said needle and the free end of said first finger, means for moving the free end of said second finger for reciprocation of its free end toward and away from the free end of said second finger; and cam means connected to said second finger for moving the free end thereof toward and away from the free end of said second finger intermediate passes of said needle through said material and for moving said free end thereof away from said free end of said mandrel while the free end of said second finger is moving away from said first finger.

14. In a fell stitching machine comprising a stitching needle, a thread handling system, means for periodically passing said needle through material to be sewn to provide fell stitches therein, and means for feeding said material intermediate passes of said needle there-through, the combination therewith of a pair of tucking fingers mounted with their free ends adjacent said feeding means and said needle and spaced from the latter in the direction of feed of said material for engaging said material and forming tucks therein, means for moving the finger farther from said needle toward and away from said material and the finger nearer said needle toward and away from said material and reciprocating movement toward and away from the other of said fingers, means for reciprocating said last-mentioned finger intermediate passes of said needle through said material, and means for moving said last-mentioned finger away from said material during movement thereof away from said other finger.

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