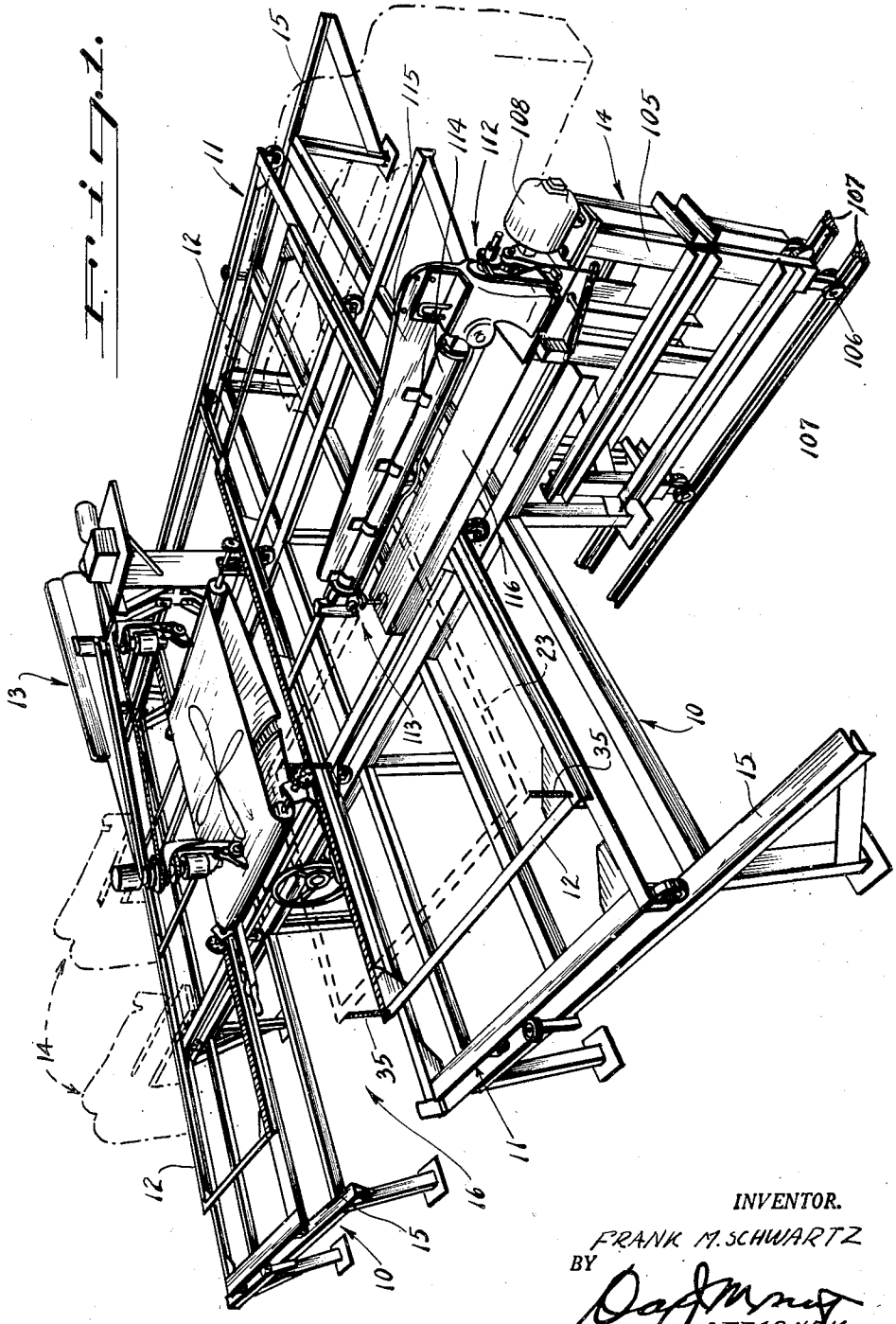
March 21, 1950 F. M. SCHWARTZ 2,501,239

STITCHING MACHINE

Filed Aug. 20, 1946 8 Sheets-Sheet 1

Fig. 1.



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STITCHING MACHINE

Filed Aug. 20, 1946 8 Sheets-Sheet 2

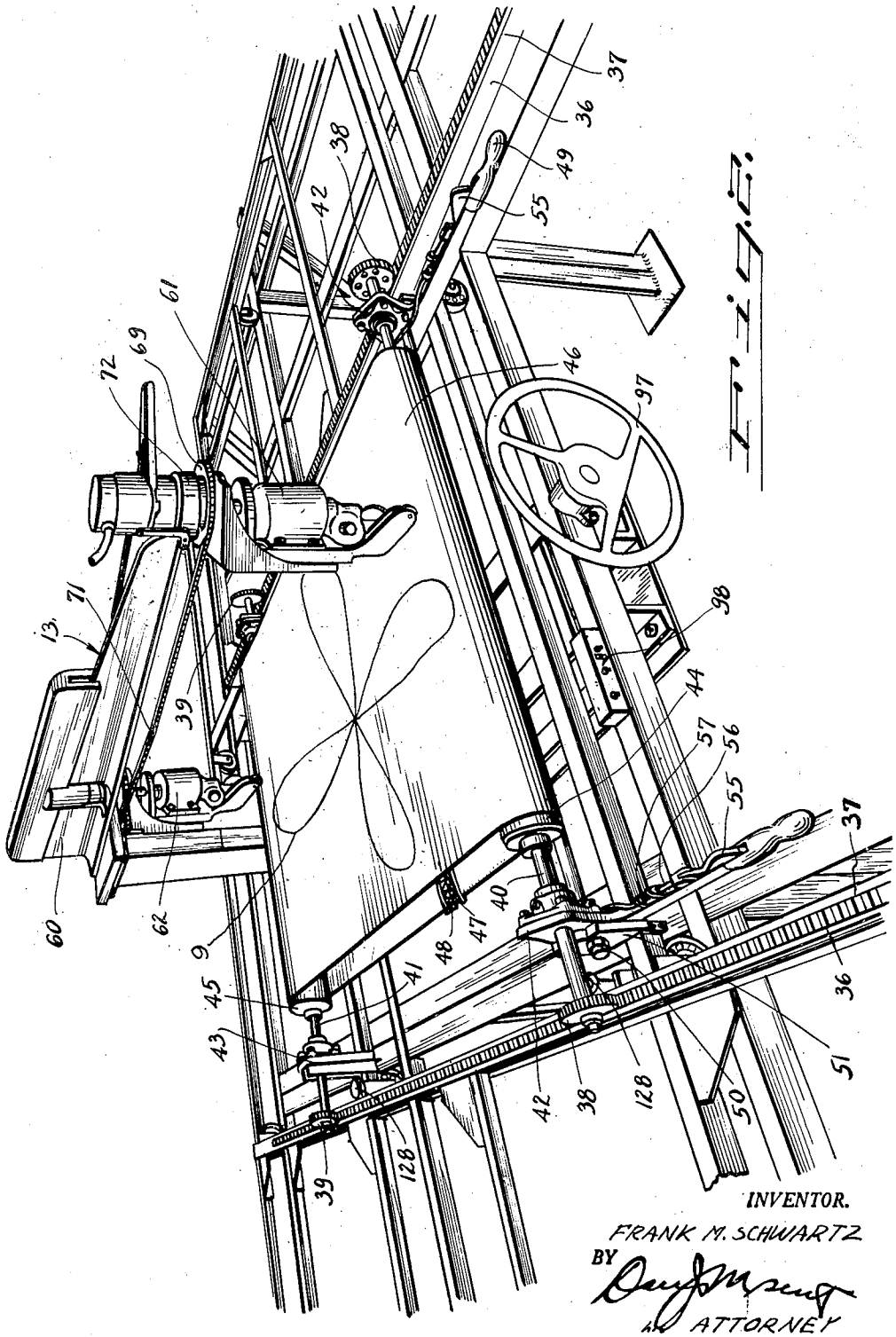


Fig. 2.

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STITCHING MACHINE

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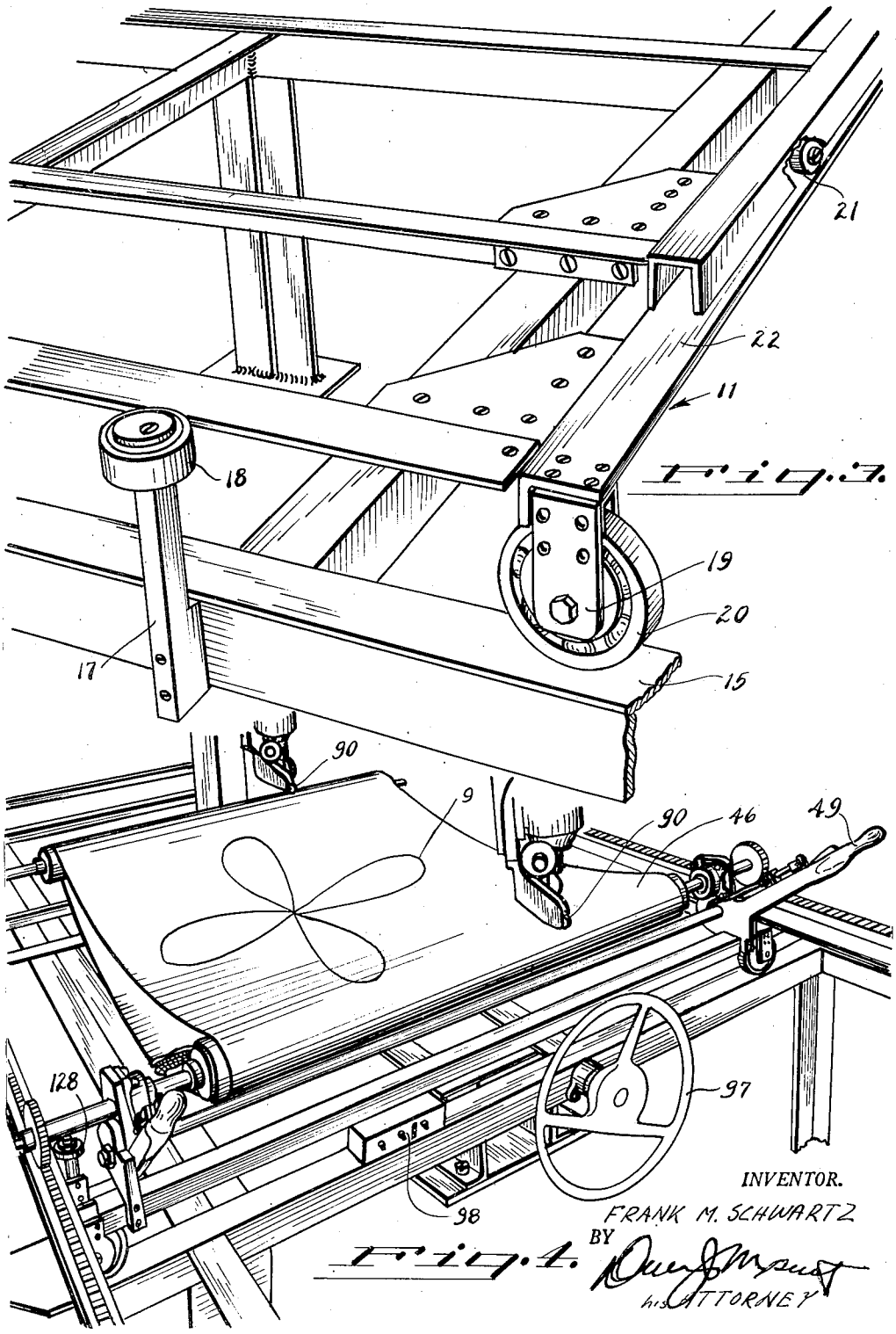


Fig. 1.

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Fig. 4.

March 21, 1950 F. M. SCHWARTZ 2,501,239

STITCHING MACHINE

Filed Aug. 20, 1946 8 Sheets-Sheet 4

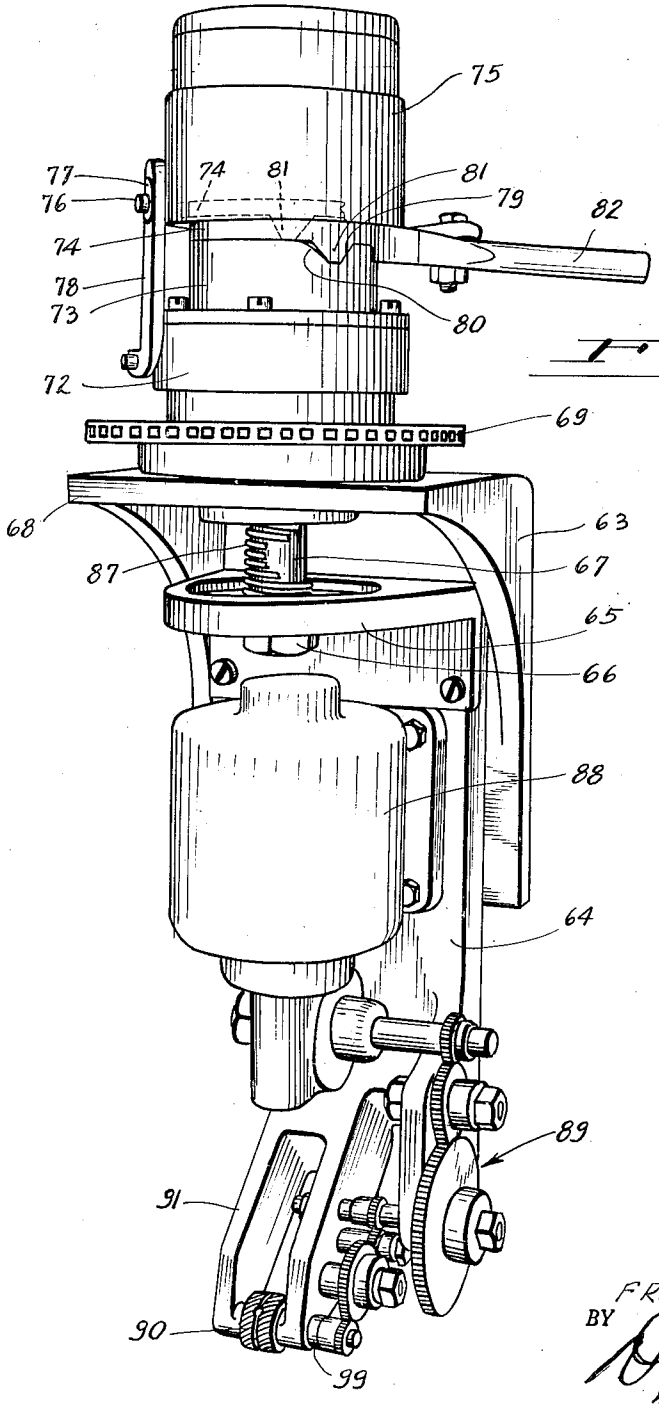


Fig. 5.

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STITCHING MACHINE

Filed Aug. 20, 1946 8 Sheets-Sheet 5

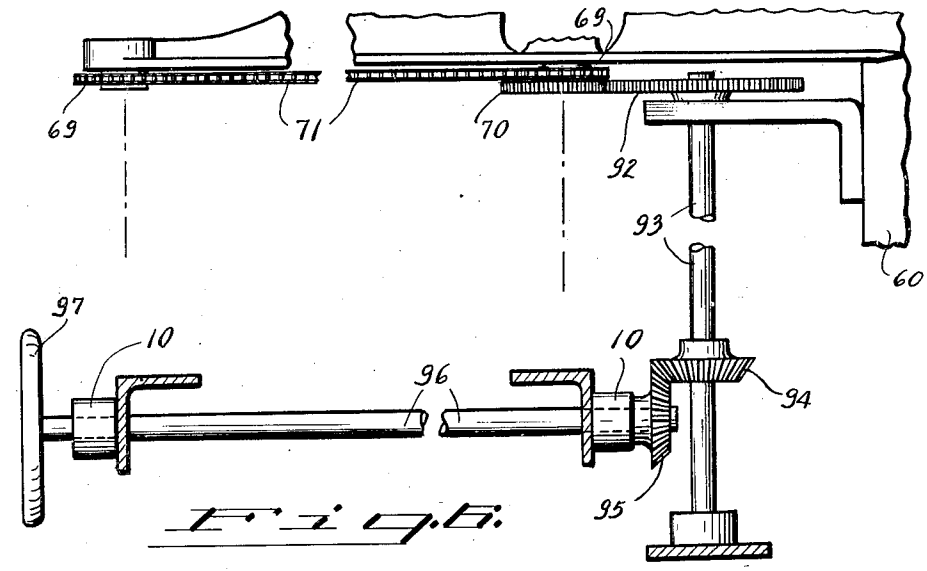


Fig. 6.

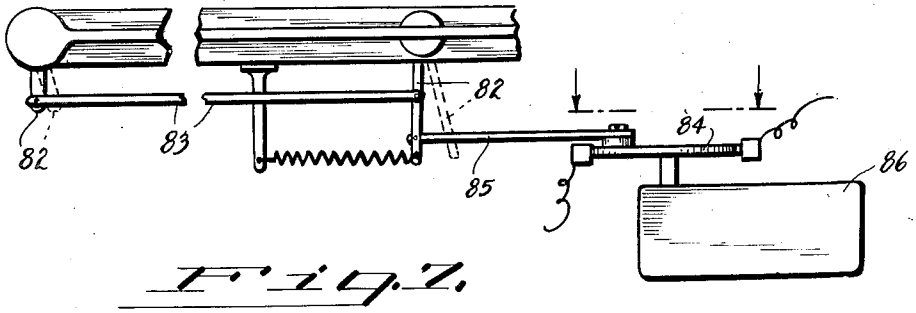


Fig. 7.

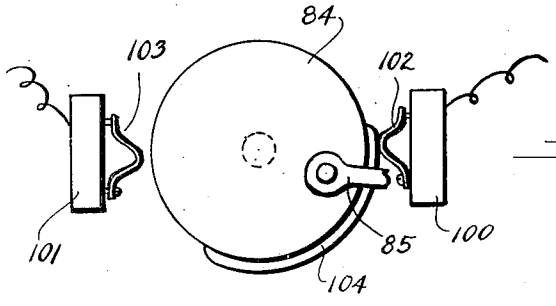


Fig. 8.

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March 21, 1950 F. M. SCHWARTZ 2,501,239

STITCHING MACHINE

Filed Aug. 20, 1946 8 Sheets-Sheet 6

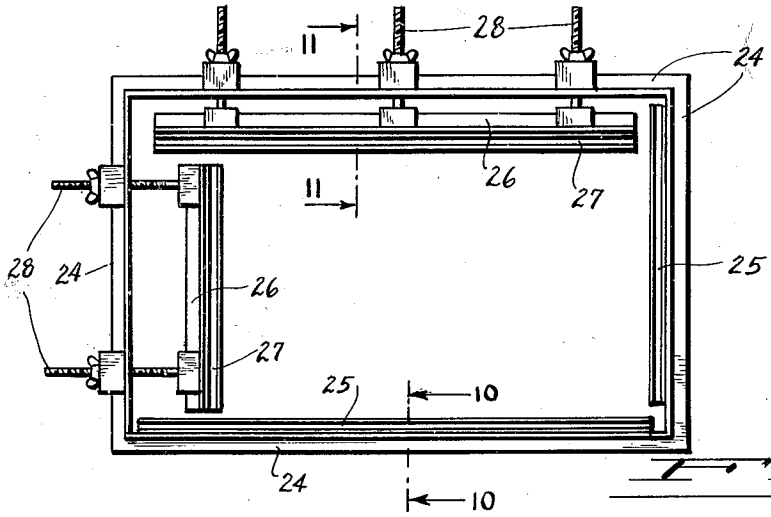


Fig. 9.

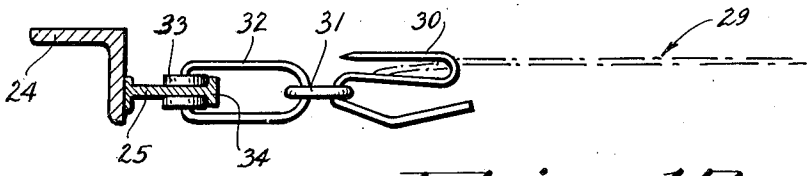
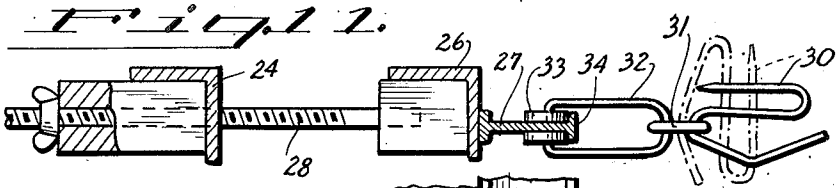


Fig. 10.

Fig. 11.



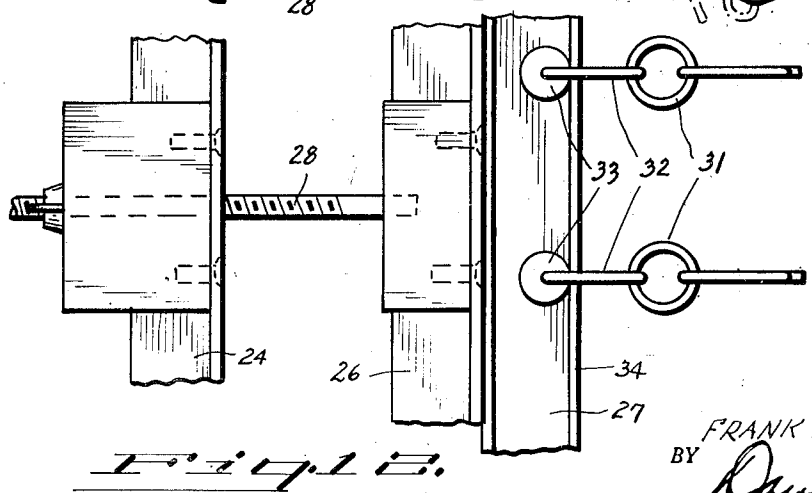


Fig. 12.

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STITCHING MACHINE

Filed Aug. 20, 1946 8 Sheets-Sheet 7

Fig. 13.

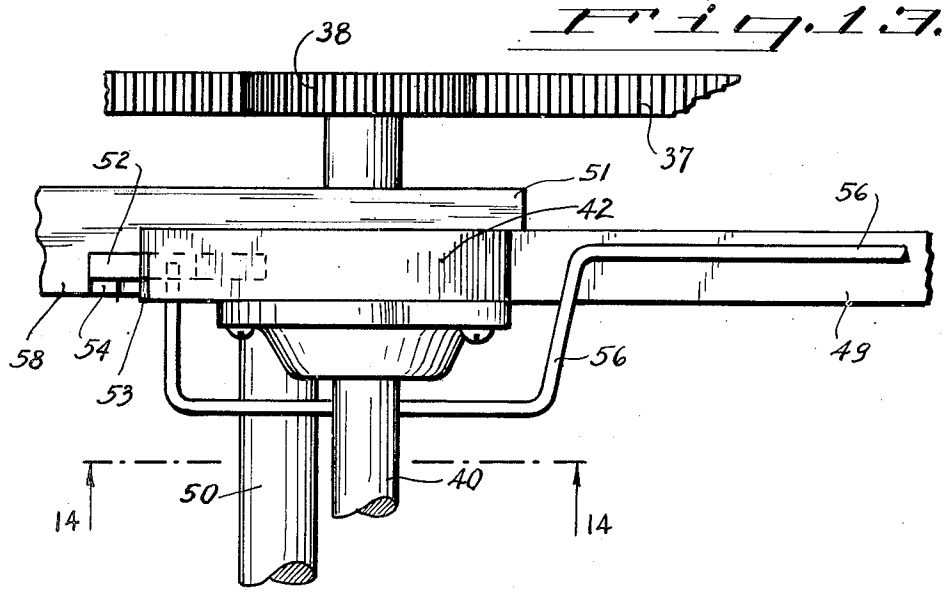
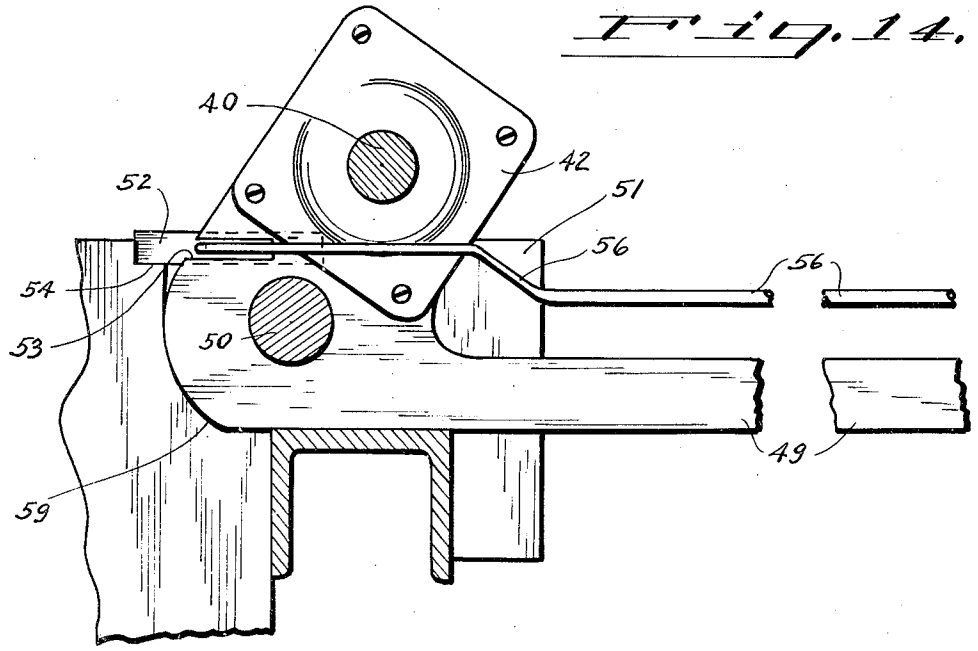


Fig. 14.



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STITCHING MACHINE

Filed Aug. 20, 1946 8 Sheets-Sheet 8

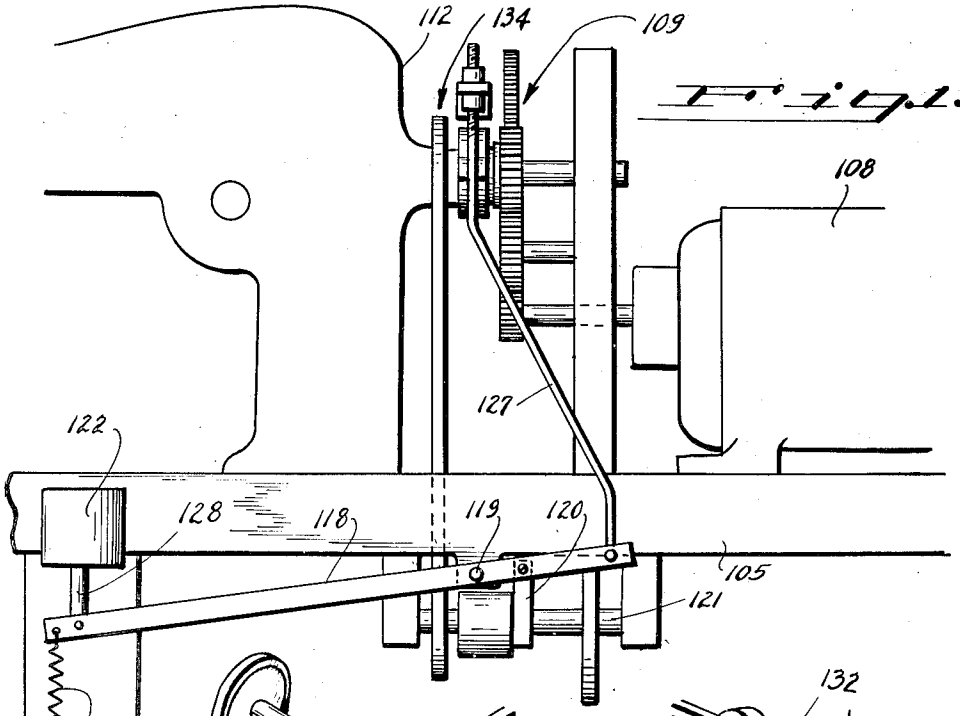


Fig. 15.

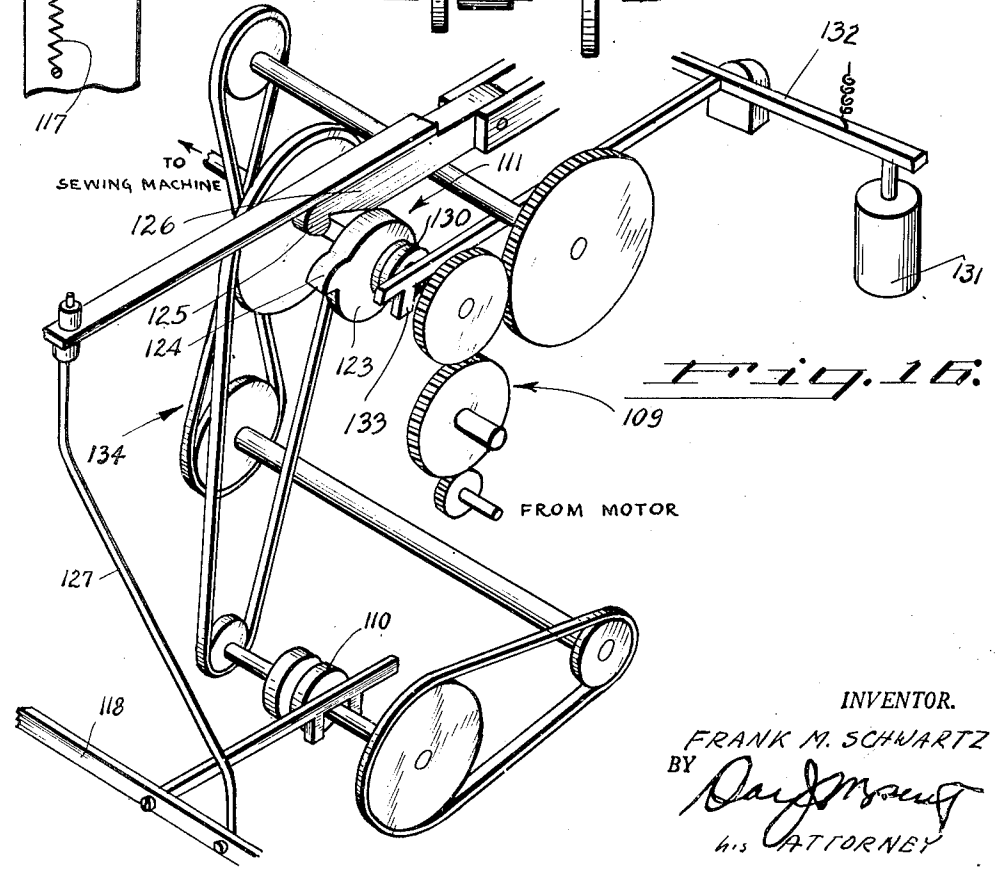


Fig. 16.

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Patented Mar. 21, 1950 2,501,239

UNITED STATES PATENT OFFICE

2,501,239

STITCHING MACHINE

Frank M. Schwartz, New York, N. Y.

Application August 20, 1946, Serial No. 691,736

17 Claims. (Cl. 112—118)

1

This invention relates to machines for stitching fabrics, and more particularly to a machine for sewing ornamental as well as functional stitch lines in quilts, comforters, or the like, in any article consisting of two pieces of fabric enclosing a filler therebetween, and in general in any article consisting of or embodying therein pieces of fabric, as well as for sewing ornamental stitch lines on a single piece of fabric.

A typical example of an article to which a machine according to my invention may be conveniently applied, is a quilt, and therefore the invention will be described with particular reference to a quilt; however, in view of the variety of articles which can be handled by the machine, the word "work" will also be used collectively to designate any and all such articles. In fact, my invention could find application in arts other than the textile art, and precisely wherever it may be desired to define on a number of articles the same pattern to effect a design, a stitch line, a cutting line, or any type of line according to a predetermined master pattern.

Several attempts have been made in the textile art, to provide machine means for stitching quilts or single fabrics, and the like according to predetermined designs, which predetermined designs may be reproduced with substantial exactness in a number of different articles. These machine means may be hand-controlled, semi-automatic or completely automatic. It is, of course, possible to draw the design or pattern to be followed by the stitch line, on each individual article, and then manually to cause the sewing head to move over the article in a path responding to said design or pattern. However, this method offers a number of obvious drawbacks such as lack of accuracy and difficulty in following the design, particularly in the case of comforters or other articles having somewhat large standard dimensions. Obviously as long as the needle is stitching points of the work that are near the operator, this latter can see the pattern fairly well and guide the stitching operation precisely enough; but the portions of the pattern away from the operator are only poorly visible, causing the stitch lines in that region to become rough and inaccurate. Consequently such a total manual control is only permissible in the case of cheap articles.

The art has therefore developed types of automatic or semi-automatic machines for causing a number of quilts or like articles to receive stitch lines conforming to the same master pattern. Such machines comprise a pattern board on which the master pattern is physically defined by means of a groove or ridge and a follower element which successively engages consecutive points of said groove or ridge, said follower element being so shaped or having means associated therewith so constructed as to assure positive

2

engagement of master pattern and follower. The machine may be manually or power driven. In any case the work is mounted thereon in invariable positioned relationship to the master pattern, and the sewing heads in invariable positioned relationship to the follower, whereby the relative motion of follower and master pattern is accompanied by identical relative motion of sewing heads and work. This last mentioned type of machine has some important drawbacks which result from the type of engagement between the track and the follower and definite mechanical limitations which are a consequence of that type of engagement. For one thing, no part of the design can have a curvature exceeding certain limits because it is not possible for the follower to move in a track or over a ridge too sharply curved. Furthermore, crossings, cusps, and multiple points in the pattern constitute a problem which can only be solved by complicated, expensive, and not generally satisfactory mechanical means.

Finally, when the machine is provided with power means as is usually the case, said means can only operate as long as follower and master pattern are in engagement, that is the follower must be brought over a point of the pattern by manual action and likewise any motion or displacement in the plane of the pattern but other than along the pattern must be manually effected. Thus the power means are bound to and limited in their operation to the path of motion defined by the master pattern. The aforementioned limitations, and other undesirable features known to those skilled in the art, may vary in degree depending on the particular design and dimensions of the cooperating parts involved, but they are present in all automatic or semi-automatic machines of the prior art to a significant, irreducible extent.

The general purpose of my invention is to provide a machine for stitching fabrics in a predetermined pattern, which machine allows of the exact reproduction of the master pattern on a number of articles, and is furthermore simple, foolproof and thoroughly efficient.

A more specific object of my invention is to provide a machine of the class described which permits of the reproduction on pieces of fabric of master patterns having parts as sharply curved as it may be desirable in practice.

Another object of my invention is to provide a machine of the class described comprising driving means carrying the master pattern, and driven means carrying the work, wherein the motion of the former may be transmitted to the latter without amplification, which driving and driven means may be modified whenever desired to provide any suitable degree of amplification

of the motion without departing from the invention.

A further object is to provide a machine of the class described whereby the most intricate convolutions, crossings and intertwinings of the master pattern may be exactly followed without the provision of any complicated special devices.

A still further object of my invention is to provide a machine of the class described having a number of features such as means for stopping the same in a practically instantaneous manner, and safety devices, which features render the production of quilted articles or the like easy, efficient and economical.

A still further object is to provide a machine of the class described embodying an element which may have defined thereon a master pattern and power means for controllably moving said elements, which power means are effective to produce any motion of said element in the plane thereof, and are not restricted to motions the trajectory whereof is equal to the master pattern or to parts of this latter.

A still further object is to provide a machine of the class described provided with a flexible element having defined thereon the master pattern and a follower element which is to follow said pattern, whereby said pattern is reproduced on the work, wherein the follower element is fixed in space and near the operator, so that the part of the master pattern which this latter has to watch is always near to him and well visible, and the master pattern carrying element by reason of its flexibility does not interfere with the operator's maintaining a fixed position in the immediate vicinity of the follower element and the part of the master pattern to which this latter is juxtaposed.

A still further object is to provide a machine of the class described, embodying a removable and replaceable element upon which a master pattern may be defined, and means for causing the work to receive a stitch line corresponding to said master pattern, wherein said element is inexpensive in itself, and is such that a master pattern can be traced thereon easily and cheaply without the need of any special devices, and further that several master patterns can be successively traced thereon and erased, if so desired.

A still further object is to provide a machine of the class described embodying an element upon which a master pattern may be defined, and means for causing the work to receive a stitch line, corresponding to said master pattern, wherein said master pattern may be physically traced on said element only in part, such as by means of a number of separate points or arc segments, allowing an experienced operator to visualize the portions of said master pattern not physically traced on said element and to introduce variations in the same, if so desired.

A number of other related and ancillary objects of my invention will fully appear as the description proceeds.

In the drawings:

Fig. 1 is a perspective side view of the machine, certain parts being shown in broken lines, and certain others being omitted for the sake of clarity.

Fig. 2 is a front perspective view of the central part of the machine, particularly illustrating the pattern belt and members associated therewith.

Fig. 3 is a perspective view of a detail of the mounting of the carriages.

Fig. 4 is a perspective view of part of the elements of Fig. 2, showing the pattern belt in its loose condition.

Fig. 5 is a perspective view of the front drive head.

Fig. 6 is a schematized elevation of the steering means for the drive heads.

Fig. 7 is a schematized plan view of the means for lifting and lowering the drive heads.

Fig. 8 is an elevation of a detail of Fig. 7.

Fig. 9 is a plan view of a work carrying frame.

Fig. 10 is a vertical section on an enlarged scale taken on the line 10—10 of Fig. 9, also showing work holding means associated with the frame of Fig. 9.

Fig. 11 is a vertical section at an enlarged scale taken on the line 11—11 of Fig. 9, also showing work holding means associated with the frame of Fig. 9.

Fig. 12 is a plan view of the elements of Fig. 11.

Fig. 13 is a plan view of a detail of the belt stretching means.

Fig. 14 is a vertical section taken on the line 14—14 of Fig. 13.

Fig. 15 is a side elevation of a detail of a sewing head assembly.

Fig. 16 is a schematized perspective view of a portion of Fig. 15.

Referring now in detail to the drawings, the preferred embodiment therein illustrated comprises the following sub-assemblies, which will be severally described in detail, and are generally indicated each by one numeral: a support or base frame 10, a lower or transverse carriage 11, a number (in the case of the preferred embodiment shown, two) of upper or longitudinal carriages 12, a drive head assembly 13, and a number (in the case of the preferred embodiment shown, four) of sewing head assemblies 14. Of the sewing head assemblies, only one is shown in full lines, the outline of the others being indicated in dotted lines in Fig. 1.

The base frame 10 consists of a number of suitable elements, such as metal bars, angles, channels, or the like, connected with one another in an appropriate rigid way, to achieve maximum strength and lightness, and secured to the floor, or to foundation plates or blocks, or to any other type of foundations or pedestals. The base frame 10 is so formed so that it has on its upper surface rails or guideways 15 extending parallel to the front of the machine, and preferably jutting outwardly at the sides thereof, one of which rails 15, and precisely the front one, is interrupted centrally to permit an operator to enter the space 16 wherefrom he operates the machine. The frame 10 has attached to the front and rear thereof brackets 17, best shown in Fig. 3, mounting retaining rollers 18, the purpose of which will be set forth later.

The lower or transverse carriage 11 is superimposed to the base frame 10. It is to be pointed out here that the words "transverse" and "longitudinal" are employed in this specification to designate dimensions, structures, or motions respectively parallel and perpendicular to the front of the machine, which use, although arbitrary in itself, will be consistently maintained to contribute to the perspicuity of the description. The words "upper" and "lower," as applied to the carriages in the decription and the claims, are used for the sake of clarity, and are not to be taken absolutely. As will become apparent later, in the embodiment described the upper carriages are the ones which remain in invariable posi-

tioned relationship with respect to the work. It might be possible so to modify the details of construction of the machine that the carriages would no longer be superimposed as in the embodiment illustrated, or their relationship might even be inverted. The words "lower" and "upper" therefore are to be construed as including a fair range of equivalents.

The transverse carriage 11 also consists of a frame-work of suitable constituent elements rigidly interconnected. It carries on the underside thereof forked brackets 19, best shown in Fig. 3, upon which are mounted wheels 20, which in the particular embodiment herein illustrated, are simply ball bearings. The lower carriage 11 is also centrally interrupted in its front portion in correspondence of the space 16, that is, it leaves the space 16 free when it is positioned centrally with respect to the base frame 10. However in the course of the operation of the machine, parts of the carriages actually protrude into the space 16 at either side thereof, always leaving nevertheless a sufficient clearance for the operator. The lower carriage 11 is preferably narrower than the base frame 10 to facilitate ample transverse motion of the former on the latter, in which transverse motion the lower carriage is guided at its front and rear by the retaining rollers 18, which prevent any longitudinal motion of the lower carriage 11.

The upper or longitudinal carriages 12 are provided with wheels 21 which in the embodiment shown are simply ball bearings, and which bear on and move along the longitudinal rails 22 of the lower carriage 11. This latter mounts upper retaining or guide rollers 128 best shown in Fig. 2, having the function of preventing any transverse motion of the upper carriages 12 with respect to the lower carriage.

Each upper carriage is adapted to support two work carrying frames such as the frame 23, one of which is schematically indicated in broken lines in Fig. 1, and which are particularly illustrated in Figs. 9 to 12 inclusive. Each frame 23 consists of four angles 24 or other suitable elements arranged and rigidly connected in rectangular formation, and means for holding a quilt or other piece of work. These means, in the preferred embodiment shown, comprise guide rails 25 fixed to two of the sides 24 which are at right angles to each other, and two adjusting bars 26 having guide rails 27 fixed thereto, which bars 26 are attached by means of bolts 28 to the two sides 24 which do not have guide rails, said bolts 28 permitting to adjust the distance of each adjusting bar 26 from the respective side 24 to stretch or relax the quilt. The guide rails 26 and 27 are substantially I-shaped in cross-section, as best shown in Figs. 10 and 11, with the web of the I horizontal in the operating position of the frames 23.

A quilt or other piece of work indicated at 29 is engaged by a number of suitably shaped, suitably spaced hooks 30, particularly shown in Figs. 10 and 11. One end of each hook 30 engages the work, and the other end can be slipped through a ring 31, whereby the hook is connected to a fork 32 provided with rollers 33. The forks 32 straddle the web of the I-shaped guide rails 26 and 27, so that one roller 33 is over said web and the other is underneath the same. When the bolts 28 have been adjusted to tension the work, the rollers 33 bear against the inner ribs of the guide rails 26 and 27, such as the rib 34, and are free to roll thereon. In this fashion they automatically position themselves so as to provide uniform tension throughout the work and allow the same to dispose itself in a perfectly smooth and flat configuration. At the same time the tension of the work maintains the hooks 30 firmly in interlocking engagement with their respective rings 31. When the work is slack, on the other hand, the hooks 30 can be turned to the position shown in broken lines in Fig. 11 and disengaged from or engaged with the rings 31, as the case may be. It is to be understood that the work carrying frames and work holding means described hereinbefore are merely examples of a preferred embodiment, and that other equivalent or similar devices could be used in connection with my invention. In any case, the work carrying frames are so mounted on the upper carriages that the work will be in a suitable position for stitching, that is will pass between the presser foot and the work table of each sewing device associated therewith. This can be accomplished very simply by supporting each work carrying frame and spacing it vertically from the respective upper carriage by means of uprights 35 bolted or otherwise connected thereto in any suitable manner, as shown in the case of one work carrying frame in Fig. 1, or by any other convenient arrangement adapted to achieve substantially the same results.

In each upper carriage, the longitudinal element 36 located closest to the center of the machine has a rack 37 on the top thereof. Each of said racks 37 meshes with two pinions 38 and 39 operatively mounted on shafts 40 and 41 respectively, which are journalled in brackets 42 and 43 respectively. The shafts 40 and 41 carry respectively, besides the two pinions 38 and 39 and coaxially therewith, the elongated front guide roller 44 and rear guide roller 45, the diameter of these latter being substantially the same as that of the pinions 38 and 39 in the embodiment shown in the drawings. This is not necessarily the case, however, and the diameter of the pinions may be and in some applications will be, different from that of the guide rollers, for reasons which will be clearly set forth in the course of this specification. Between front guide roller 44 and rear guide roller 45 there is stretched a belt 46, made of a suitable stout fabric or any other appropriate flexible material. The belt 46 is preferably provided with zipper closures 47, or other suitable means for looping the same, preferably embodying elastic elements such as the spring elements 48, which latter in cooperation with belt stretching means soon to be described, assure a proper tension in the belt 46. The belt has a master pattern defined thereon in any suitable manner, which pattern is indicated schematically at 9.

The brackets 43 are mounted on and rigid with the lower carriage 11, and maintain the axis of the rear guide roller 45 and pinion 39 in invariable positioned relationship with respect to said lower carriage. The brackets 42, on the contrary, form part of the belt stretching means, are rigid with the handles 49, and pivoted therewith by means of the rod 50 to the brackets 51 rigid with the lower carriage 11. In the operative position of the machine, shown in Figs. 1 and 2, and in detail in Figs. 13 and 14, the handles 49 are substantially horizontal, the front guide roller 44 is all the way to the front thereby stretching the belt, the pinions 38 engage the racks 37, and all these elements are maintained fixedly in this position by the detents 52, best shown in Figs. 13 and 14. Each of said detents 52 engages a slot 53 in the respective bracket 42 and bears on a flat surface 54 in the

respective bracket 43, against which it is urged by the tension of the belt 46.

When it is desired to loosen the belt, latch triggers 55 (Fig. 2) connected to the detents 52 by means of the links 56, are depressed, compressing the springs 57, and withdrawing the detents 52 entirely within their slots 53. The brackets 42 are then allowed to rotate freely with respect to the brackets 51, which latter are provided with a protruding portion 58 having a circular surface 59 to keep the detent within its slot. The handles 49 can then be raised to the position of Fig. 4, carrying the front guide roller 44 and the pinions 38 upwards and forwards. To tighten the belt, the handles 49 are again depressed until the detents 52 reach a position wherein the resiliency of the springs 57 causes them to snap back over the flat surfaces 54, locking the brackets 43 and 51 once again with respect to each other.

The drive head assembly 13 comprises a bracket frame 60 of any suitable sturdy construction, a front drive head 61, a rear drive head 62, and means for steering the drive heads.

Each drive head (Fig. 5) comprises a swivel frame 63 and a drive motor frame 64 which are vertically slidable with respect to one another, for instance by means of a dovetail guide and guideway arrangement. The drive motor frame 64 has a horizontal portion 65 at the top thereof which is mounted by means of a nut 66 on the lower end of a vertical shaft 67. The swivel frame 63 also has a top horizontal portion 68 which has rigidly connected thereto a sprocket 69. In addition the rear drive head 62 has mounted below the sprocket 69 and in invariable position relationship with respect thereto, a gear wheel 70, best shown in Fig. 6. The presence of this latter in the rear drive head 62 only constitutes the sole substantial structural differentiation between the two drive heads. The two sprockets 69 of front and rear drive heads are operatively connected by means of a chain 71. The shaft 67 passes freely through the portion 68 of the swivel head, the sprockets 69, a portion 72 of the frame 60, a drum 73 superimposed and bolted or otherwise rigidly connected to the portion 72, and a cam follower ring 74. In the case of the rear drive head, the shaft 67 also passes through the gear wheel 70. The upper end of the shaft 67 penetrates into a commutator head 75, which is so designated because it houses electrical elements of the unit comprising a commutator which assures flow of current to the drive motor to be described later in any and all the possible positions of the swivel head 63. A suitable connection is provided between shaft 67 and commutator head 75 inside this latter, to assure free relative rotation but invariable vertical relationship thereof, and said connection might comprise for instance a collar on the shaft 67 and a seat therefor in the head 75.

The head 75 carries a bolt 76 the shank of which passes through a slot 77 in a plate 78 bolted to portion 72 of the bracket frame 60, whereby the head 75 is allowed to move vertically by a limited amount, but not to rotate with respect to the frame 60. The drum 73 has in its upper portion a notch 79 limited at one side by a cam surface 80. The cam follower ring 74 has thereon a follower wedge 81 adapted to cooperate with the notch 79 and cam surface 80 to produce the action which will be later explained. Ring 74 has a lever 82 rigidly connected thereto or solid therewith. The front and rear levers 82 are pivotally connected to a connecting rod 83, best shown in Fig. 7, and the rear lever 82 is reciprocably actuated through a crank 84 and connecting rod 85 by a reduced speed output shaft of a motor 86 which I will designate as the "cam motor" and which is supported by the bracket frame 60.

A helical spring 87 is interposed between the upper face of the part 65 of the motor frame 64 and the lower face of the part 68 of the swivel frame 63 to urge the two frames away from one another, and normally press the motor frame 64 with its attachments firmly downwards. A drive motor 88 is secured to each frame 64 and drives, through a suitable series of gearings constituting a reducer unit 89, a drive roller 90 journalled in a forked extension 91 of the frame 64, said drive roller 90 can be of any suitable material and have either a substantially smooth, or a scabrous or knurled surface. Both drive heads are so positioned that the driver rollers bear directly on the guide rollers 44 and 45, firmly gripping the belt 46 in cooperation therewith. The gear wheel 70 meshes with another gear 92 best shown in Fig. 6, operatively mounted on a vertical shaft 93 journalled in the frame 90, and having at the lower end thereof a bevel gear 94. The gear 94 meshes with a bevel gear 95 operatively mounted on a substantially horizontal shaft 96 journalled in the base frame 10. The shaft 96 terminates with a steering wheel 97, in the vicinity of which there are located the control switches 98 which will thus be easily accessible to the operator.

The drive heads are steered by turning the steering wheel 97, thus causing rotation of the gear wheel 70 on the rear drive head 62 which rotation is communicated to the sprocket 69 of the rear drive head, and, through the chain 71 to the sprocket 69 of the front drive head 61. Rotation of each sprocket 69 causes rotation of the corresponding swivel frame 63, motor frame 64, and shaft 67. The motor frame 64 carries with it all its attachments, particularly the drive roller 90, the shaft 99 of which therefore rotates in a horizontal plane. All the aforementioned parts rotate about the same vertical axis, which coincides with the axis of the shaft 67, and which intersects the roller 90 at the point of contact of this latter with the belt 46.

When the machine is not in operation, the drive heads 61 and 62 are raised, that is the follower edges 81 are out of the notches 79 in the position indicated in broken lines in Fig. 5. Among the control switches 98 there is a start button for the cam motor 86. This motor, however, is also provided with an automatic switch, which automatically stops it after it has operated for a time long enough to cause the crank arm 84 to rotate through an angle of 180°, and one preferred embodiment of which is illustrated in Fig. 8. In it the crank 84 is in the shape of a disc. The switch is double, consisting of two units 100 and 101 embodying spring members 102 and 103, and located at diametrically opposite positions with respect to the disc 84, that is, spaced by 180°. The disc 84 is provided at the periphery thereof with a portion 104 of increased radius, adapted to engage and depress the spring members 102 and 103 of the switch units 100 and 101. When one of the spring members, for instance the member 102, is so depressed, cam motor 86 can be started by acting on its switch among the control switches 98. As soon as the portion 104 has reached a position wherein it no longer engages the spring member 102, the circuit opens and the motor 86 is de-energized. However the length of the portion 104 is so re-

lated to the inertia of the moving parts that the crank 84 proceeds after the motor has stopped to complete a rotation of 180°, thus engaging the spring member 103 in precisely the same way in which it initially engaged the member 102. The process can then be repeated, with the two spring members in inverted roles.

The sewing head assemblies 14 comprise each a frame 105 slidable by means of wheels 106 on stationary guides 107, and the power and operating elements attached thereto, which latter, though of a general type known in the art, embody certain new and valuable features, best understood with reference to Figs. 15 and 16. Said power elements comprise a motor 108, a reducer gearing generally indicated at 109, a clutch 130, an automatic stop device 111, and relay control means, later to be described, for the clutch 130 and the stop device 111. The operating elements will not be described in detail as they are substantially conventional in this art, embodying (Fig. 1) a driving mechanism 112 and a sewing mechanism 113 similar to those of ordinary sewing machines, this latter comprising a vertically reciprocating needle and a needle bar. Driving and sewing mechanisms are operatively connected by means of a needle bar actuating shaft contained in the tubular element 114 which is steadied and supported by the bracket 115. A portion 116 of the frame 105 serves as a base of the machine and work-plate. Below the same is carried a shaft, not shown, for driving the dog feed mechanism.

The sewing machine is normally driven through the gearing 109 and the clutch 130 controlled by a solenoid 131 through lever 132 and fork 133 schematically indicated in the drawings. The automatic stop device 111 comprises a clutch 110 normally held in its inoperative position by the spring 117, through the lever 118, pivoted at 119 to the frame 105, and the fork 120. The clutch 110 is controlled by a solenoid 122. The circuits of solenoids 131 and 122 are part of the general wiring diagram of the machine, so that they operate as hereinafter described whenever the machine stops, due to the drive motor's being switched off or to the drive roller's being lifted from the belt. The sewing machine is preferably provided with a safety device, of a type known in the art for stopping it automatically whenever the thread breaks. It is merely a matter of skill so to arrange the wiring diagram of the machine that breaking of the thread will result in the stopping of the belt, for instance, through actuation of the cam motor 86.

Whenever the sewing machine is stopped, the solenoid 131 disengages the clutch 130. Concurrently the solenoid 122 engages the clutch 110. Motion is now transmitted to the sewing machine through the belt and pulley transmission generally indicated at 134 at a greatly reduced speed. Among the rotating parts, there is a wheel 123 having at the periphery thereof a single ratchet element 124. A stop pawl 125 shaped to fit the ratchet wheel 124, is carried at the end of a lever 126 hinged to the frame 105 and normally urged through the action of the pivoted link 127, the lever 118, and the spring 117 to a position where it does not interfere with the free rotation of the wheel 123. Concurrently with the engagement of the clutch 110 through the action of the solenoid 122, the link 127 is lowered, swinging the lever 126, and bringing the stop pawl 125 in the path of the ratchet element 124. This latter comes into contact with said pawl thus stopping

the wheel 123 and with it the needle bar actuating shaft, the needle bar and the needle, in a predetermined position, which is preferably chosen to be the one wherein the needle is at its highest point. Since the stopping of the wheel 123 occurs while said wheel, together with the rest of the sewing machine, is being driven at a greatly reduced speed, and further is being driven through means which are inherently capable of slippage, the shock of the contact of the pawl 125 with the ratchet element 124 is reduced to a negligible amount, and excessive wear and tear or damage to the machine are avoided. Thanks to the fact that the machine stops with the needle at its highest point, manipulation and servicing of the needle are facilitated, particularly in case of the breaking of the thread.

In order to bring into sharp focus the nature of my invention, the operation of the machine constituting a preferred embodiment thereof will be considered as comprising two distinct steps, which steps in point of fact are always concurrent and intimately related. Said steps are, first, causing the belt 46 to move in a predetermined way, and secondly, causing the upper carriages 12 to move in a corresponding manner, controlled by the motion of the belt.

It is clear that both points of the belt and points of the upper carriages or of the pieces of fabric connected thereto are capable of describing a horizontal path of any configuration, inasmuch as both the former and the latter are mounted on the lower carriage for transverse motion, and are further capable of a longitudinal translatory motion with respect thereto. Therefore, if a point of the belt is urged to undergo a horizontal displacement, the said displacement will be decomposed into a transverse and a longitudinal component, the first resulting in the lower frame 11 sliding on the guides 15, and the second causing horizontal portions of the belt 46 to travel longitudinally while its guide rollers 44 and 45 rotate.

With the machine in its completely inoperative position, the sewing head assemblies 14 may be in their outermost position on the guide rails 107, and the belt stretching devices in their loose position. The drive heads 61 and 62 are in their raised position. To operate the machine, the work frames 23 carrying the quilts or other work are mounted on the upper carriages 12, the sewing head assemblies are pushed into their operative positions, a belt having the desired master pattern defined thereon is positioned on the guide rollers 44 and 45 and looped by means of its zipper closures 47 or other substantially equivalent means, and the belt stretching devices are tightened, tensioning the spring elements 48. The drive motors are then started, and the drive heads lowered, the order of succession of these last two operations being optional, although starting the drive motors first will avoid subjecting the same to undue strain.

With the rollers 90 in their operative position and with their axes parallel to those of the guide rollers, rotation of the drive rollers will cause the belt to travel in a direction longitudinal with respect to the lower frame 11 and will cause the guide rollers 44 and 45 to rotate so that their periphery travels by a distance equal to that traveled by points of the belt 46. There is practically no slippage in the device either between drive rollers and belt or between belt and guide rollers. Among the control switches 98 there is provided a switch whereby the drive motors can

be stopped or reversed. When they are reversed, the sense of rotation of the drive rollers 90 is inverted thus reversing the longitudinal motion of the belt 46. The drive motors cannot be reversed without being stopped for an instant, during which the sewing machines also stop.

However, if the axes of the drive rollers are not parallel to the axes of the guide rollers, the displacement of a point of the periphery of each drive roller, which displacement is transmitted without slippage to the belt, will not be longitudinal with respect to the lower frame. Therefore, said displacement will, as heretofore set forth, become automatically decomposed into two component elements and result in a transverse displacement of the lower frame with respect to the base frame, in addition to the longitudinal displacement of the belt with respect to the lower frame. If the orientation of the axes of the drive rollers remains constant, then the ratio of the longitudinal component to the transverse component hereinbefore set forth will be constant. Each drive roller will describe on the belt a straight line, which straight line could have any desired direction. By rotating the axes of the drive rollers with respect to the belt the direction of the said straight line can be varied and a zigzag or polygonal line can be obtained.

A considerable variety of means which I will call "steering means" could be provided for controlling the orientation of the axis of the drive rollers 90. In the preferred embodiment shown in the drawings, the steering means consist of the steering wheel and the gearing connections herebefore described which act on the gear wheel 70 to rotate the swivel head of the rear drive head 62, and thence through the sprockets 69 and the chain 71 to rotate the swivel head of the front drive head 61 by exactly the same amount. It is, of course, immaterial what particular steering means may be chosen, as long as a connection is maintained between the two drive heads to insure synchronism and equality of the rotation of their swivel heads, which combined to the synchronism and equality of their vertical displacements, obtained through the means hereinbefore described, renders the rear drive head an exact reproduction in position and operation of the front drive head, and therefore allows an operator to control the machine by watching and steering the front drive head only.

It is now clear that if the drive rollers can be caused to follow a broken line on the surface of the belt, the sides of said broken line can be reduced at will to such an extent to render them practically infinitesimal. Then the path described by the drive rollers will be a curve. The expression "path of the drive rollers" is to be taken relatively. In reality, the drive rollers do not have a translatory motion, inasmuch as the intersection of the axis of each drive roller with the axis of the respective swivel head, and the point of contact of the periphery of each drive roller with the belt, are fixed in space, or at least fixed with respect to the base frame. It is the belt which has a translatory motion. Therefore what I call the "path of the drive rollers" can be precisely defined as the locus of the points of contact of the front drive roller with the belt, which locus when the machine is in operation is to be rendered equal and superimposed to the master pattern defined on the belt. The locus of the points of contact of the rear drive roller with the belt defines of course a figure equal but not necessarily superimposed to the master pattern.

If the drive motors are running, the belt 46 starts to move as soon as the drive rollers 90 have been lowered into contact therewith. The operator stands next to and watches the front drive roller. By steering it, he causes the belt to move under it in the way he desires. Generally the front drive roller will not contact a point of the master pattern when it is first lowered. Therefore the operator will so manipulate the steering device as to bring a desired starting point of the master pattern in contact with the front drive roller—an operation which could not be carried out otherwise than manually in the machines of the prior art. When this has been done, the sewing heads are started, and the stitching operation begins.

Throughout said stitching operation, the operator's position does not vary. He stands next to the front drive roller, which he must guide over the pattern, and has the steering wheel and switch control within easy reach. Thanks to the use of a looped flexible element as a base for the master pattern, and to the position of the front drive roller directly above the front guide roller, there is no encroachment of any mechanical part on the space reserved for the operator, and this latter is allowed to remain constantly in the immediate vicinity of the point he must observe. Such a feature is absolutely novel in the art, and is not found either in hand operated machines or in the automatic or semi-automatic machines, which embody a pattern board. So easy is the control and operation of a machine according to my invention, that an experienced operator, as I have found in practice, need not even always have the complete master pattern physically defined on the belt. Often it is sufficient to mark a number of suitably chosen points or arc segments or portions of the pattern, and the operator can then connect the same by eye. In so doing, and whenever desired, he can introduce variations in the pattern. Thus the operation of my machine has a flexibility hitherto unknown in the art.

A further important feature of my invention is the cheapness of the master pattern, due to the nature of the flexible element used as a base therefor, and to the fact that the pattern itself is defined merely by a line, and not by structurally complex elements such as tracks, rails, or combinations thereof. To trace a pattern on a belt according to my invention is an extremely simple, quick, and easy operation. As a matter of fact the same belt can be used for a number of different master patterns successively, or even concurrently.

As stated before, there are two ways of stopping the motion of the belt: One is to switch off the drive motors, the other is to raise the drive rollers by acting on the cam motor. The second way results in a practically instantaneous arrest of the motion of the belt due to the great inertia and slow speed of the moving parts. It is so quick a stop that in practice no extra stitches are added and it will therefore be preferably employed, whenever stops must occur during the stitching operation. With the machine at a standstill, the swivel heads may be turned completely around without the drive rollers changing their point of contact with the belt. This is due to the fact that the proportions of the drive heads are naturally such that, as stated before, the center of rotation of the swivel heads is in

direct vertically superimposed relationship to the points of contact of the drive rollers with the belt. In this fashion, cusps may be followed whenever they are present in the pattern, by stopping the machine and steering the swivel heads around at the same spot. Crossings and angles in the pattern can likewise be followed without lifting the drive rollers from the belt.

From the foregoing there follows an outstanding feature of my invention. This is the fact that, contrary to what obtains in machines of the prior art, there are no mechanical limits to the sharpness of curvature of a master pattern usable in my machine, nor to the number, sharpness and intricacy of any convolutions of the pattern itself. The actual curvature of the stitch pattern is of course a function of the ratio of the rotary speed of the drive rollers to the speed of steering. The first speed is a matter of judicious choice. It is well within the province of this invention to provide mechanical means whereby said speed of the drive rollers may be changed during the operation of the machine, for instance by providing one or more high speeds of the drive motor to be used when following substantially straight or moderately curved portions of the mastern pattern, and one or more low speeds to be used when following sharply curved portions, small loops, circles, intricate convolutions, cusps, and the like. When varying the speed of the drive motor, the speed of the sewing machines must vary in correspondence to preserve the same length of the stitches. Said length depends in general on the ratio of sewing speed to driving speed, and can thus be controlled by varying said ratio.

The speed of steering is determined in relation to the speed of the drive rollers largely by a human factor, that is by the ability of the operator to coordinate sight and manual action. I have found that a relatively inexperienced operator is aided in steering if the steering device has an overall gear ratio of 1:1. In this fashion if the steering wheel is rotated by a certain angle, the axes of the drive rollers rotate by exactly the same number of degrees. The correspondence between action and result is then the simplest possible. On the other hand, if a demultiplication is introduced in the steering device, the operation thereof requires less strength, but becomes slower. This drawback may be compensated, in the case of a machine provided with several speeds of the drive rollers, by using a low speed whenever sharp curvatures of the pattern are encountered, and corresponding sharp steering is needed, thereby giving the operator more time for said steering. A multiplication in the steering device would, of course, make the steering quicker and harder. It is seen therefore in general that the overall gear ratio of the steering device can vary within wide limits; and should the steering device become too hard to operate at the speed desired, it would be a mere matter of design and well within the spirit of the invention to embody therein a source of power. Therefore in conclusion the only upper limit to the sharpness of curvature of a master pattern usable in my machine is the operator's skill, and experience shows that this upper limit is well above what is practically needed in the art. This was not the case with the machines heretofore known.

While the drive rollers are being guided on the pattern traced on the belt by the operator, the motion of the belt causes a correlated similar motion of the upper carriages. As above stated, each rectilinear displacement of the drive rollers with respect to the belt, and in the case of a curve, each practically infinitesimal rectilinear displacement is decomposed into two components. The transversal component is rigidly transmitted to the upper carriages, inasmuch as both these latter and the drive rollers are mounted for this purpose on the lower carriage. The longitudinal displacement of points of the belt becomes transformed into an exactly equal displacement of points of the periphery of the guide rollers and thence to a displacement of points of the periphery of the pinions **38** and **39** which is equal to the first mentioned displacement in the embodiment illustrated wherein the diameter of the pinions is the same as that of the guide rollers. The displacement of points of the periphery of the pinions is transformed into an equal longitudinal displacement of the rack **37**. The upper carriages **12** and the work-carrying frames **23** attached thereto receive this longitudinal displacement in composition with the transverse displacement transmitted thereto from the lower carriage **11**. The result of said composition is obviously a displacement equal to the finite or practically infinitesimal displacement of the front drive rollers with respect to the belt, which is an element of the master pattern. The work moves with respect to the stitching points which are fixed in space, and thus receives a stitch line equal to the master pattern.

It is within the scope of my invention to vary the relationship of the moving parts above described so as to cause the work to receive a stitch line determined by, but not equal to the master pattern. It is seen immediately that by making the diameter of the pinions **38** and **39** different from that of the guide rollers, the longitudinal component of the motion of the work can be made different from the corresponding component of the motion of the master pattern. In this fashion a stitch line can be obtained which is compressed or elongated longitudinally with respect to the master pattern.

However, in general, such a relationship will not be desirable. What may well be desirable is to have the stitch line an exact reproduction on a different scale of the master pattern. This is accomplished by introducing the same multiplication or demultiplication, as the case may be, in both the longitudinal and the transverse components of the motion of the belt during the process of transmitting these to the work. For the longitudinal component, it suffices to vary the diameter of the pinions **38** and **39** with respect to that of the guide rollers, as hereinbefore set forth. For the transverse component, a number or arrangements may be employed.

For instance, the guide roller support may be mounted, instead of on the lower carriage **11**, on another carriage also transversely on the base frame and carrying a transverse rock meshing with a pinion, keyed to a shaft, journalled in the base frame. A second pinion may be keyed to the same shaft, and mesh with a transverse rack rigid with the lower carriage which carries the upper carriages **12**. Transverse motion of the belt will then cause the first mentioned transverse rack to rotate the first mentioned pinion. The second mentioned pinion will also rotate therewith, thus causing transverse motion of the second mentioned transverse rack of the lower carriage, and ultimately of the work. By varying the ratio of the diameters of the two pinions,

the transverse component of the motion of the belt can be transmitted to the work with a multiplication or demultiplication equal to that imparted to the longitudinal component. Stitch lines will result which are an exact reproduction on an enlarged or reduced scale of the master pattern. Other equivalent means for achieving the same result could obviously be devised through the exercise of mechanical ingenuity within the scope of my invention.

It is thus apparent that my invention eliminates all the drawbacks and attains all of the objects set forth at the beginning of this specification.

A preferred embodiment has been described and shown for purposes of illustration. It is to be understood however that many variations and adaptations may be made therein which involve more mechanical skill or touch on matters of design and judicious choice, without departing from the spirit of the invention or exceeding the scope of the appended claims.

I claim:

1. In a stitching machine, a base, movable carriages having means for attaching thereto fabrics to be stitched, a movable member defining a flexible surface, means for successively bringing points of said member defining together any desired figure to a point fixed with respect to said base and means controlled by the movement of said member acting on said carriages for concurrently bringing points of said fabrics defining together figures corresponding to the aforementioned desired figure to stitching points fixed with respect to said base.

2. In a stitching machine, a base, movable carriages having means for attaching thereto fabrics to be stitched, a movable looped member defining a flexible surface, power driven means for bringing any point of a portion of said looped member to a point fixed with respect to said base, means controlled by the movement of said member for concurrently imparting to said carriages a motion controlled by the motion of said looped member, and means fixed in their operative position with respect to said base for stitching said fabrics during said motion of said carriages.

3. In a stitching machine, a base, movable carriages having means for attaching thereto fabrics to be stitched, a movable member defining a flexible surface, means for successively bringing points of said member defining together a predetermined master pattern to a point fixed with respect to said base frame, and means operatively connecting said member to said carriages and controllable by the movement of said members for successively bringing points of said fabrics defining together a pattern corresponding to said mastern pattern to stitching points fixed with respect to said base.

4. In a stitching machine, a base, movable carriages having means for attaching thereto fabrics to be stitched, a flexible member, guide rollers for said flexible member, said guide rollers having supports movable with respect to said base in a direction parallel to the axes of said guide rollers, driving means for causing said flexible member to travel over said guide rollers and for concurrently causing said supports to move with respect to said base, whereby successively to bring points of said flexible member defining together any desired figure to a point fixed with respect to said base, and means operatively connecting said flexible member to said carriages for concurrently bringing points of each of said fabrics defining together a figure corresponding to said desired figure to a stitching point fixed with respect to said base.

5. In a stitching machine, a base, movable carriages having means for attaching thereto fabrics to be stitched, a flexible member, guide rollers for said flexible member, said guide rollers having supports movable with respect to said base in a direction parallel to the axes of said guide rollers, driving means for causing the part of said flexible member located between said guide rollers to travel in a direction perpendicular to the axes of these latter and for concurrently causing said supports to move with respect to said base in a direction parallel to the axes of said guide rollers, whereby successively to bring points of said flexible member defining together any desired figure to a point fixed with respect to said base, and means operatively connecting said flexible member to said carriages for concurrently bringing points of each of said fabrics defining together a figure corresponding to said desired figure to a stitching point fixed with respect to said base.

6. In a stitching machine, a base, movable carriages having means for attaching thereto fabrics to be stitched, a flexible member, guide rollers for said flexible member, means for looping said flexible member over said guide rollers, said guide rollers having supports movable with respect to said base in a direction parallel to the axes of said guide rollers, driving means for causing said flexible member to travel over said guide rollers and for concurrently causing said supports to move with respect to said base, whereby any point of a portion of said flexible member can be brought to a point fixed with respect to said base, steering means for controlling the ratio of the speed of travel of said flexible member to the speed of movement of said supports, whereby successively to bring points of said portion of said flexible member defining together any desired figure to a point fixed with respect to said base, and means operatively connecting said flexible member to said carriages for concurrently bringing points of each of said fabrics defining together a figure corresponding to said desired figure to a stitching point fixed with respect to said base.

7. In a stitching machine, a base frame, a lower carriage reciprocably movable in one direction with respect to said base frame, upper carriages reciprocably movable perpendicularly to said first mentioned direction with respect to said lower carriage, means for attaching fabrics to be stitched to said upper carriages, guide rollers freely mounted with their axes parallel to said first mentioned direction in supports reciprocably movable in said first mentioned direction with respect to said base frame, a belt mounted over said guide rollers, the points of said belt located between said guide rollers describing a path relative to said supports perpendicular to said first mentioned direction when said guide rollers rotate, means for displacing said lower carriage with respect to said base frame by an amount controlled by the motion of said supports, means for displacing said upper carriages with respect to said lower carriage by an amount controlled by the displacement of said points of said belt with respect to said supports, and means for causing said belt in its motion to bring points thereof defining a predetermined pattern successively to a point fixed with respect to said base frame, whereby stitching points fixed with re-

spect to said base frame will describe a corresponding predetermined pattern on fabrics attached to said upper carriages.

8. In a stitching machine, a base frame, a lower carriage reciprocable in one direction with respect to said base frame, upper carriage reciprocable perpendicularly to said first mentioned direction with respect to said lower carriage, supports for fabrics to be stitched, means for attaching said supports to said upper carriages, guide rollers freely mounted in said lower carriage with their axes parallel to said first mentioned direction, a belt mounted in tension over said guide rollers, the points of said belt located between said guide rollers describing a path relative to said lower carriage perpendicular to said first mentioned direction when said rollers rotate, means for displacing said upper carriages relative to said lower carriage by an amount equal to the displacement of said points of said belt with respect to said lower carriage, and means for causing said belt in its motion to bring points thereof defining a predetermined pattern successively to a point fixed with respect to said base frame, whereby stitching points fixed with respect to said base frame will describe the same predetermined pattern on said fabrics.

9. In a stitching machine, a base frame, a lower carriage reciprocably movable in one direction with respect to said base frame, upper carriages reciprocably movable perpendicularly to said first mentioned direction with respect to said lower carriage, means for attaching fabrics to be stitched to said upper carriages, guide rollers freely mounted with their axes parallel to said first mentioned direction in supports reciprocable in said first mentioned direction with respect to said base frame, a belt mounted over said guide rollers, the points of said belts located between said guide rollers describing a path relative to said supports perpendicular to said first mentioned direction when said guide rollers rotate, means for displacing said lower carriage with respect to said base frame by an amount controlled by the motion of said supports, means for displacing said upper carriages with respect to said lower carriage by an amount controlled by the displacement of said points of said belt with respect to said supports, at least one drive roller cooperating with one of said guide rollers frictionally to engage said belt, manually controlled means for rotating the axis of said drive roller by any desired angle with respect to that of said guide roller, power means for rotating said drive roller about the axis thereof, whereby said belt is forced to travel over said guide rollers and said supports of said guide rollers to move so as to bring points of said belt defining a predetermined pattern successively in contact with said drive roller, whereby stitching points fixed with respect to said base frame will describe a pattern corresponding to said predetermined pattern on the fabrics attached to said upper carriages.

10. In a stitching machine, a base frame, a lower carriage reciprocably movable in one direction with respect to said base frame, upper carriage reciprocably movable perpendicularly to said first mentioned direction with respect to said lower carriage, means for attaching fabrics to be stitched to said upper carriages, guide rollers freely mounted with their axes parallel to said first mentioned direction in supports reciprocably movable in said first mentioned direction with respect to said base frame, a belt mounted over said guide rollers, the points of said belt located between said guide rollers describing a path relative to said supports perpendicular to said first mentioned direction when said rollers rotate, means for displacing said lower carriage with respect to said base frame by an amount controlled by the motion of said supports, means for displacing said upper carriages with respect to said lower carriage by an amount controlled by the displacement of said points of said belt with respect to said supports, a number of drive rollers normally cooperating with said guide rollers frictionally to engage said belt, means for maintaining the axes of said drive rollers in constant parallelism to one another, hand-controlled means for rotating the axes of said drive rollers by any desired angle with respect to those of said guide rollers, power means for rotating said drive rollers about the axes thereof, whereby said belt is forced to travel over said guide rollers and said supports of said guide rollers to move so as to bring points of said belt defining a predetermined pattern successively in contact with a predetermined one of said drive rollers, the points of contacts of said drive rollers with said belt being fixed with respect to said base frame, whereby stitching points fixed with respect to said base frame will describe a pattern corresponding to said predetermined pattern on the fabrics attached to said upper carriages.

11. In a stitching machine, a base frame, a lower carriage reciprocably movable in one direction with respect to said base frame, upper carriages reciprocably movable perpendicularly to said first mentioned direction with respect to said lower carriage, means for attaching fabrics to be stitched to said upper carriages, guide rollers freely mounted with their axes parallel to said first mentioned direction in supports reciprocably movable in said first mentioned direction with respect to said base frame, a belt mounted over said guide rollers, the points of said belt located between said guide rollers describing a path relative to said supports perpendicular to said first mentioned direction when said guide rollers rotate, means for displacing said lower carriage with respect to said base frame by an amount controlled by the motion of said supports, means for displacing said upper carriages with respect to said lower carriage by an amount controlled by the displacement of said points of said belt with respect to said supports, at least one drive roller cooperating with one of said guide rollers frictionally to engage said belt, said drive roller being mounted in a support member vertically reciprocable with respect to a swivel member, said swivel member being rotatable with respect to said base frame about a vertical axis passing through the point of contact of said drive roller with said belt, means for reciprocating said support member to engage and disengage said drive roller from said belt, steering means for rotating said swivel frame to control the orientation of said drive roller, power means for rotating said drive roller about the axis thereof in any orientation thereof, whereby said belt is forced to travel over said guide rollers and said supports of said guide rollers to move so as to bring points of said belt defining a predetermined pattern successively in contact with said drive roller, whereby stitching points fixed with respect to said base frame will describe a pattern corresponding to said predetermined pattern on fabrics fixed to said upper carriages.

12. In a stitching machine, a base frame,

movable carriages, guide rollers freely mounted in supports reciprocably movable with respect to said base frame, a belt mounted over said guide rollers, at least one drive roller cooperating with one of said guide rollers frictionally to engage said belt, said drive roller being mounted in a support member vertically reciprocable with respect to a swivel member, said swivel member being rotatable with respect to said base frame about a vertical axis passing through the point of contact of said drive roller with said belt, cam means operatively connected to said support member, said cam means having a position wherein said drive roller engages said belt and another position wherein said drive roller is disengaged from said belt, power-operated switch-controlled crank and connecting-rod means for actuating said cam means to either of the aforementioned positions as desired, steering means for rotating said swivel frame to control the orientation of said drive roller, power means for rotating said drive roller about the axis thereof in any orientation thereof, whereby said belt is forced to travel over said guide rollers and said supports of said guide rollers to move so as to bring points of said belt defining a predetermined pattern successively in contact with said drive roller, and means for concurrently imparting to said carriages a motion-controlled by the motion of said points of said belt, whereby stitching points fixed with respect to said base frame will describe a pattern corresponding to said predetermined pattern on fabrics fixed to said upper carriages.

13. In a stitching machine, a base frame, movable carriages, guide rollers freely mounted in supports reciprocably movable with respect to said base frame, a belt mounted over said guide rollers, a number of drive rollers normally cooperating with said guide rollers frictionally to engage said belt, each of said drive rollers being rotatably mounted in a support member vertically reciprocable with respect to said base frame, the axis of each of said drive rollers being swingable with respect to said base frame about a vertical axis passing through the point of contact of said drive roller with said belt, power-operated switch-controlled means for vertically reciprocating said drive rollers synchronically and by the same amount between a position wherein said drive rollers frictionally engage said belt and a position wherein they are disengaged therefrom, steering means for swinging the axes of said drive rollers with respect to said base frame synchronically and by the same amount, to control the orientation of said drive rollers while maintaining the same in constant parallelism, and power means for rotating said drive rollers about the axis thereof in any orientation thereof, whereby said belt is forced to travel over said guide rollers and said supports of said guide rollers to move so as to bring points of said belt defining a predetermined pattern successively in contact with said drive rollers, and means for concurrently imparting to said carriages a motion controlled by the motion of said points of said belt, whereby stitching points fixed with respect to said base frame will describe a pattern corresponding to said predetermined pattern on fabrics fixed to said upper carriages.

14. In a stitching machine in combination with a base, movable carriages, a member defining a flexible surface, power driven means for bringing any point of a portion of said member to a point fixed with respect to said base, means for concurrently imparting to said carriages a motion controlled by the motion of said member, and stitching means fixed in their operative position with respect to said base; supports for fabrics to be stitched, said supports comprising pairs of opposite guide rails and means for regulating the distance between the two opposite guide rails of each pair, means for gripping the fabrics adjacent the periphery thereof, means linking said gripping means to said guide rails whereby the fabrics may be tensioned by suitably distancing the opposite guide rails of said pairs, said linking means being freely movable longitudinally of said guide rails in response to any inequalities in the tension of the fabrics whereby to eliminate the same, and means for rigidly attaching said supports to said carriages in suitable positioned relationship with respect to said stitching devices.

15. In a machine for stitching fabrics in a predetermined pattern, a base frame, a lower carriage movable in one direction with respect to said base frame, upper carriages reciprocably movable perpendicularly to said first mentioned direction with respect to said lower carriage supports for pieces of fabric to be stitched, means for attaching said supports to said upper carriages, guide rollers freely mounted in said lower carriage with their axes parallel to said first mentioned direction, a belt mounted in tension over said guide rollers, the points of said belt located between said guide rollers describing a path relative to said lower carriage perpendicular to said first mentioned direction when said rollers rotate, pinions operatively mounted coaxially with said guide rollers, racks rigid with said upper carriages and meshing with said pinions, the diameter of said pinions being substantially equal to the diameter of said guide rollers whereby said upper carriages are displaced relative to said lower carriage by an amount equal to displacement of said points of said belt with respect to said lower carriage, and means for causing said belt in its motion to bring points thereof defining a predetermined pattern successively to a point fixed with respect to said base frame, whereby stitching points fixed with respect to said base frame will describe the same predetermined pattern on the basis of fabric fixed to said upper frames.

16. In a stitching machine, a base frame, a carriage reciprocably movable in one direction with respect to said base frame, supporting carriages for fabrics to be stitched reciprocably movable perpendicularly to said first mentioned direction with respect to said carriage, means for attaching fabrics to be stitched to said supporting carriages, guide rollers freely mounted with their axes parallel to said first mentioned direction in supports reciprocably movable in said first mentioned direction with respect to said base frame, a belt mounted over said guide rollers, the points of said belt located between said guide rollers describing a path relative to said supports perpendicular to said first mentioned direction when said guide rollers rotate, means for displacing said carriage with respect to said base frame by an amount controlled by the motion of said supports, means for displacing said supporting carriages with respect to said carriage by an amount controlled by the displacement of said points of said belt with respect to said supports, and means for causing said belt in its motion to bring points thereof defining a predetermined

pattern successively to a point fixed with respect to said base frame, whereby stitching points fixed with respect to said base frame will describe a corresponding predetermined pattern to fabrics attached to said supporting carriages.

17. In a stitching machine, a base, movable carriages having means attaching thereto fabrics to be stitched, a movable member defining a flexible surface, guide means for said member, said guide means being movable with respect to said base, driving means for causing said member to travel flexibly over said guide means and for concurrently causing this latter to move with respect to said base, whereby successively to bring points of said member defining together any desired figure to a point fixed with respect to said base, and means operatively connected to said carriages controllable by the movement of said member for concurrently bringing points of each

of said fabrics defining together a figure corresponding to said desired figure to a stitching point fixed with respect to said base.

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