

[54] **STITCH FRAME ACTUATING MECHANISM MOUNTABLE ON AN ORDINARY SEWING MACHINE**

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[58] Field of Search.....112/102, 103

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[57] **ABSTRACT**

A stitch frame actuating mechanism mountable on an ordinary linear sewing machine for the purpose of stitching cycloidal patterns and their modifications without using conventional pattern-cams in which a planetary gearing driven by a rotation-generating means actuated by one of the reciprocating members of the sewing machine is connected to a stitch frame holder through a parallelogramic link to displace said stitch frame holder along a cycloidal curve.

[56] **References Cited**

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8 Claims, 6 Drawing Figures

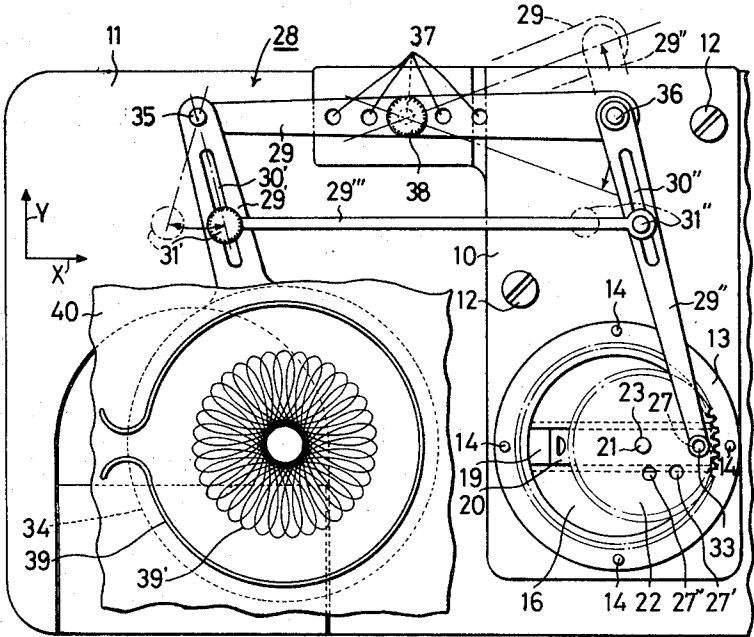


FIG. 1

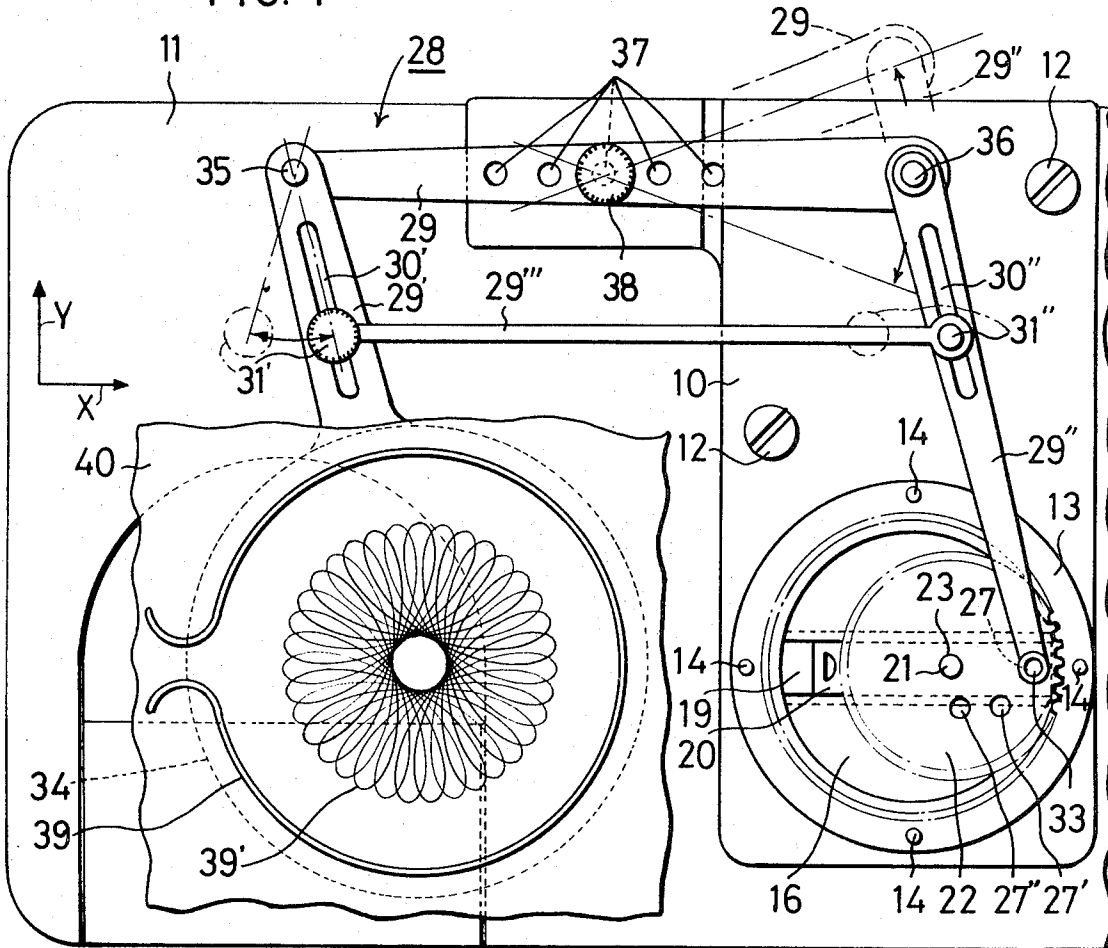
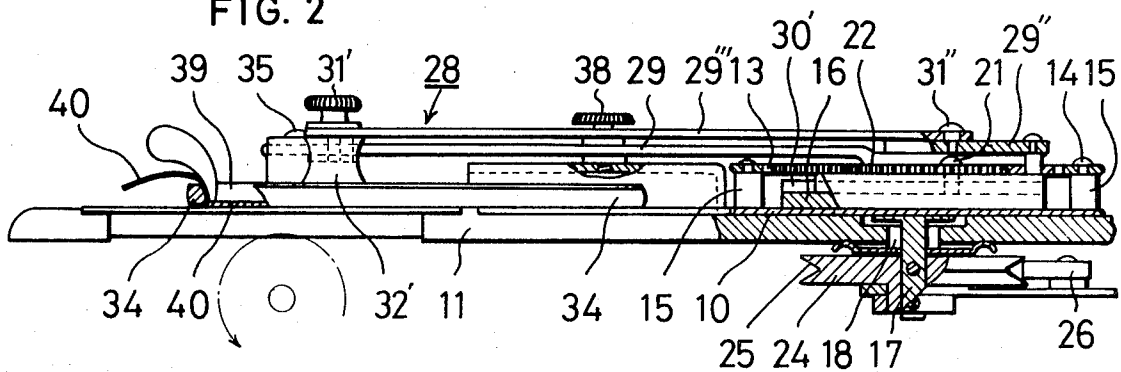


FIG. 2



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FIG. 3

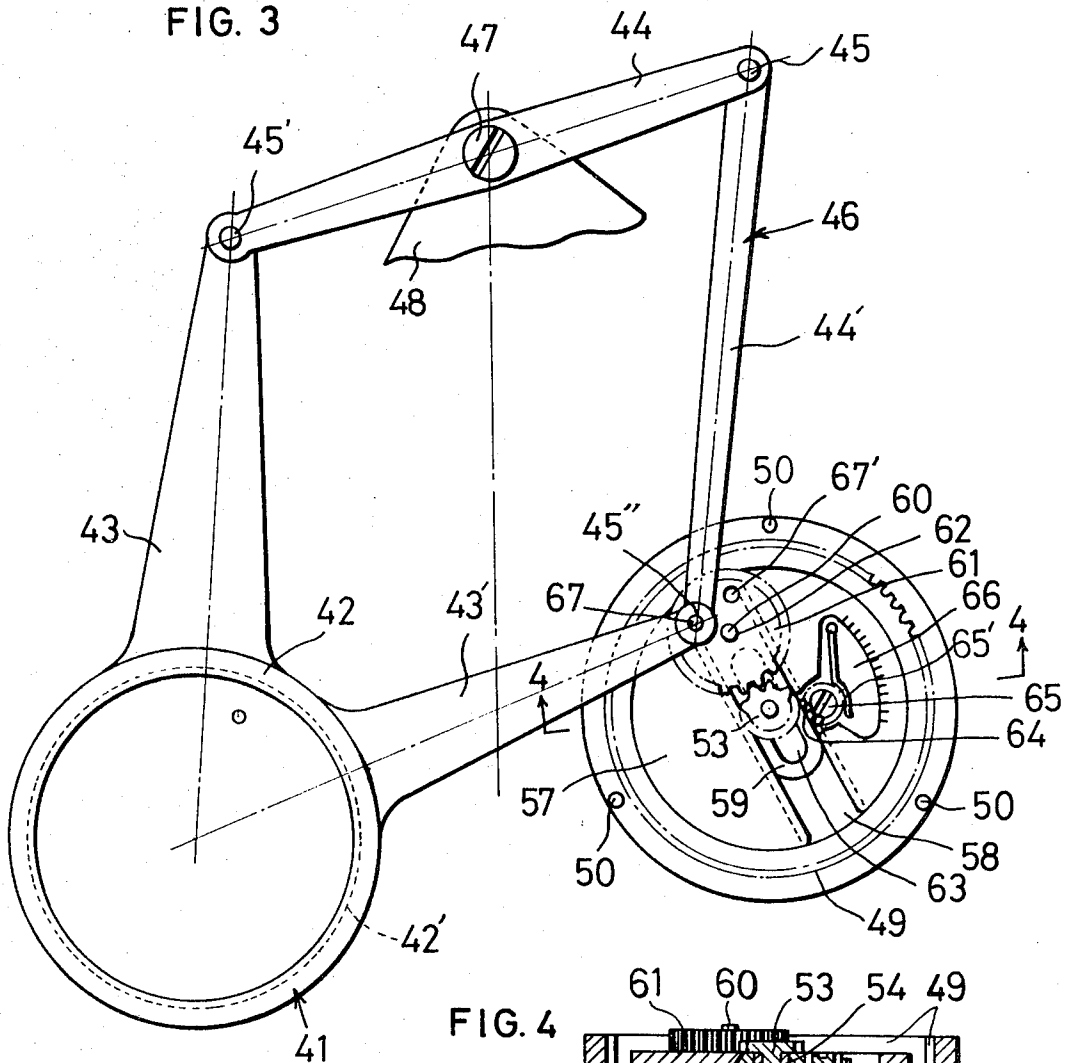


FIG. 4

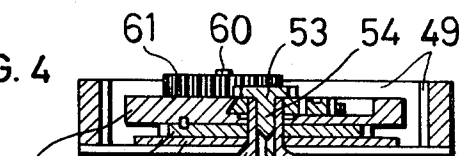


FIG. 5

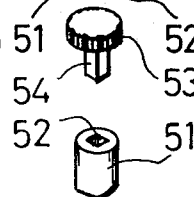
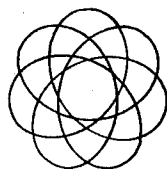


FIG. 6



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STITCH FRAME ACTUATING MECHANISM MOUNTABLE ON AN ORDINARY SEWING MACHINE

BACKGROUND OF THE INVENTION

It is common practice in stitching various patterns without using a zigzag sewing machine to mount a stitch frame actuating mechanism on an ordinary linear sewing machine. The movement of a stitch frame together with a cloth fulled thereon is controlled by cam-followers keeping contact with corresponding pattern-cams similar to those usually employed in a zigzag sewing machine. Thus, the pattern-cams are too complicated to be produced practically in cases when complicated patterns requiring a large number of stitches per unit area of the cloth are desired. In the conventional stitch frame actuating mechanism, a pair of pattern-cams are necessary in order to stitch a pattern. One is for controlling the movement of the stitch frame in one direction (x-direction) and the other in another direction (y-direction). This is because it is practically impossible to reproduce a desired movement of the stitch frame by using the combination of a single rotary pattern-cam and its cam-follower. In this type of stitch frame actuating mechanism, a synchronizing means is required in order to synthesize the two movements decomposed in the two directions whereby the stitch frame can move correctly along a desired pattern.

SUMMARY OF THE INVENTION

A stitch frame actuating mechanism mountable on an ordinary linear sewing machine according to the present invention includes principally a fixed gear, a rotary member rotatable concentrically with said fixed gear, a planetary gear in mesh circumscribingly or inscribingly with said fixed gear and supported rotatably and eccentrically on said rotary member, a stitch frame holder to carry a stitch frame thereon and a parallelogramic link with its one end being secured to said stitch frame and the other end being pivoted on said planetary gear at an eccentric position. The pivot point of the parallelogramic link on said planetary gear draws a cycloidal curve when the rotary member is rotated by a suitable rotation-generating means actuated from the looper drive shaft or the reciprocating needle bar of the ordinary linear sewing machine. The movement of the pivot point on the planetary gear is transmitted to the stitch frame through the parallelogramic link and a pattern comprising cycloidal curves is stitched if the needle bar is reciprocated simply in a vertical direction or if the looper shaft is actuated. No pattern-cam is required and the density and the curvature of curves forming a pattern can be changed easily by adjusting the gear ratio between the fixed gear and the planetary gear and the eccentric distance of the pivot point on the planetary gear. One of the four arms of the parallelogramic link is provided with plural fulcrum holes to pivot the arm. By selecting one of these fulcrum holes, enlarged or reduced cycloidal patterns of a basic one can be stitched with a specified combination of the gear ratio and the eccentric distance of the pivot point on the planetary gear. Even such modifications of the basic cycloidal pattern as distorted in a certain direction are obtained by reforming the parallelogramic link into parallelogramic one.

The salient relationship of the present invention and the objects accomplished by it have been described and it will be understood that cycloidal patterns and various modifications of them can be stitched without using pattern-cams.

IN THE DRAWINGS

FIG. 1 is a plane view of a stitch frame actuating mechanism mounted on the bed of an ordinary linear sewing machine,

FIG. 2 is a partially sectional vertical view of the mechanism shown in FIG. 1,

FIG. 3 is a plane view showing another embodiment of the stitch frame actuating mechanism,

FIG. 4 is a vertical section taken on line 4—4 of FIG. 3,

FIG. 5 is a perspective view of an externally toothed fixed gear and a hollow stud and

FIG. 6 is a plane view showing an example of cycloidal patterns stitched by using the mechanism according to the present invention.

Referring to FIGS. 1 and 2, a base plate 10 is detachably mounted on the bed 11 of an ordinary linear sewing machine by fastening screws 12. An internally toothed gear 13 provided with mounting holes 14 is set at its mounting holes on four pin-studs 15 secured on the bed 11. A disk-shaped rotary member 16 is attached on the upper end of a shaft 17 which is journaled for rotation through the base plate 10 at the position concentric with the gear 13 and extends downwards through an opening 18 formed in the bed 11. The rotary member 16 is provided with a narrow groove 19 along a diameter of the rotary member 16. In the groove 19 a sliding plate 20 is slidably mounted on which a mounting stud 21 is fixed. A planetary gear 22 capable of being in mesh with the internally toothed gear 13 and provided with a center opening 23 is rotatably disposed around the mounting stud 21. Any planetary gear that is smaller than the internally toothed gear 13 can be in mesh with the latter by displacing the sliding member 20. The sliding member 20 is then fastened by usual means such as screws. A wheel 24 with a peripheral bezel 25 is secured on the downwards extending end of the shaft 17. Near the wheel 24, a lengthwise reciprocable piston rod 26 is provided. The piston rod 26 is connected to the looper shaft of the sewing machine to be reciprocated along a line off the center of the wheel 24 and rotates the wheel 24 in a certain direction. The rotating speed of the planetary gear 22 is, therefore, adjustable by adjusting the looper speed dial of the sewing machine. Pivot holes 27, 27' and 27'' are formed on the planetary gear 22 at different distances from the center opening 23. When the planetary gear 22 revolves around the shaft 17 and rotates around the mounting stud 21, the center of any one of the pivot holes 27, 27' and 27'' draws a cycloidal curve characteristic to it. A parallelogramic link 28 comprises four arms 29, 29', 29'' and 29''' connected pivotally to one another in the form of a parallelogram. The arms 29' and 29'' are provided with longitudinal slots 30' and 30'' respectively. In these slots 30' and 30'', adjusting screws 31' and 31'' are inserted and are threadably adapted in nuts 32' and 32'' at the other sides of the arms 29' and 29''. The both ends of the arm 29''' are pivoted by the adjusting screws 31'

and 31'' respectively. One end of the arm 29'' is detachably pivoted on the planetary gear 22 by a pivot pin 33 inserted in one of the pivot holes 27, 27' and 27''. One end of the arm 29' is provided with an integral stitch frame holder 34. The other ends of the arms 29' and 29'' and both ends of the arm 29 are connected pivotally by pins 35 and 36. The arm 29 is provided with fulcrum holes 37 arranged lengthwise. Through one of the fulcrum holes 27, a fulcrum screw 38 is inserted to be secured in the base plate 10 for the pivotal support of the arm 29. Thus, the stitch frame holder 34 and a stitch frame 39 set there on are capable of being displaced along a cycloidal curve similar to that drawn by the pivot point of the arm 29'' on the planetary gear 22. With the arms 29 and 29'' being parallel, the similarity ratio between the cycloidal curves drawn by a fixed point on the stitch frame 39 and by the pivot pin 33 is the larger, the more right one of the fulcrum holes 37 is selected for the pivotal support of the arm 29. Strictly speaking, fixed points on a cloth 40 fulled on the stitch frame 39 draw cycloidal curves similar but of different sizes. However, if the distance between the pin 35 and a representative point of the pattern to be stitched is much larger than the dimension of said pattern, the pattern is cycloidal in effect. Thus, when the needle of the sewing machine is actuated along a fixed vertical line as in an ordinary linear sewing machine, a pattern 39' can be stitched on the cloth 40. If the nut 32' and adjusting screw 31' are shifted towards the pin 35 by loosening them and refastening them at the displaced position, the link 28 becomes in the form of a trapezoid, the cycloidal pattern stitched is distorted in such a manner that the pattern is more enlarged in the direction X than Y. As the rotary member 16 is constructed to be actuated by the looper shaft, the rotational speed of the planetary gear 22 can be adjusted by operating the looper dial of the sewing machine.

Referring to FIGS. 3-5, a different embodiment is described. A stitch frame holder 41 comprises a pair of circular frames 42 and 42' assembled for mutual rotation. These circular frames 42 and 42' are provided with integral stems 43 and 43'. These integral stems and other two arms 44 and 44' are connected pivotally by pins 45, 45' and 45'' at their ends to form a parallelogramic link 46. The arm 44 is pivoted by a fulcrum screw 47 on a base plate 48. An internally toothed gear 49 is fixed on the base plate 48 by fastening screws 50. A hollow stud 51 provided with a rectangular axial hole 52 is fixed in the base plate 48 at a position concentric with the internally toothed fixed gear 49. An externally toothed gear 53 with an integral rectangular shaft 54 is inserted in the rectangular axial hole 52. Around the hollow stud 51, a ratchet wheel 55 and a swinging member 56 with a projection engageable with the ratchet wheel 55 are rotatably disposed. The swinging member 56 cooperates with the vertically reciprocating needle bar of the sewing machine to be swung whereby the ratchet wheel 55 is rotated intermittently in a certain direction. Around the hollow stud 51 is disposed a disk-shaped rotary member 57 united with the ratchet wheel 55 for the rotation concentric with the fixed gears 49 and 53. The rotary member 57 is provided with a narrow groove 58 along a diameter of the rotary member 57. In the groove 58 a sliding plate 59 is

slidably mounted on which a mounting stud 60 is fixed. A planetary gear 61 capable of being in mesh with either of the fixed gears 49 and 53 and provided with a center opening 62 is rotatably disposed around the mounting stud 60. The sliding plate 59 is provided with a longitudinal slot 63 of a width slightly larger than the diameter of the hollow stud 51 for the easy movement of the sliding plate 59. The sliding plate 59 is provided with a rack 64 on a longitudinal side of it. A positioning gear 65 is rotatably mounted in a recess 66 formed in the rotary member 57 and is in mesh with the rack 64. The positioning gear 65 is always biased towards the rack 64 by a spring 65' to prevent the accidental longitudinal movement of the sliding plate 59. The planetary gear 61 is provided with pivot holes 67 and 67' at different distances from the center opening 62 in one of which the pin 45'' connecting the arm 44' and the stem 43' is inserted rotatably. Thus the planetary gear 61 can be in mesh selectively with either of the fixed gears 49 and 53 by turning the positioning gear 65 to move the sliding plate 59 lengthwise. When the rotary member 57 is rotated by the swinging member 56 actuated by the needle bar, any fixed point on the circular frame 42 draws a cycloidal curve and a cycloidal pattern comprising cycloidal curves can be stitched on a cloth fulled on a stitch frame, which is set fixedly on the circular frame 42, similarly as in the case of the embodiment described referring to FIGS. 1-2. The cycloidal pattern stitched on the cloth can be modified by exchanging the fixed gear 53 with another of a different radius or by exchanging the planetary gear 61 with another of different radius. However, with a specified combination of the planetary gear 61 with the fixed gear 49 or 53, the cycloidal pattern stitched is modified by inserting the pivot pin 45'' in the other pivot hole 67'.

It will be appreciated from the foregoing description that a basic cycloidal pattern and various modifications thereof can be stitched very easily without using conventional pattern-cams only if the stitch frame actuating mechanism according to the present invention is mounted on an ordinary linear sewing machine. Modifications of a basic cycloidal pattern are obtained abundantly by changing the pivot point of the parallelogramic link 28 on the planetary gear 22 and reforming the parallelogramic link 28 into a trapezoidal one. It should be understood that many variations and modifications are possible without departing from the spirit of the present invention and the scope of the accompanying claims.

What I claim is:

1. A stitch frame actuating mechanism mountable on an ordinary sewing machine including a base plate mountable on the bed of said sewing machine, a stitch frame holder to carry the stitch frame thereon, a rotation-generating means provided with a shaft and actuated by one of the reciprocating members of said sewing machine, said shaft extending rotatably through said base plate, a rotary member attached on the extending end of said shaft, an internally toothed gear fixed on said base plate at the position concentric with said shaft, an externally toothed planetary gear provided with plural pivot holes, said planetary gear being in mesh with said internally toothed gear, and being disposed rotatably on said rotary member at a

position eccentric with said shaft and a parallelogramic link having four arms connected pivotally in the form of a parallelogram, a first of said arms being pivoted on said base plate by a fulcrum pin intermediate its ends, one end of each of the second and third arms being connected to the opposite ends of said first arm, the second arm being connected fixedly to said stitch frame holder the other end of said third arm being pivoted in one of said pivot holes of said planetary gear at an eccentric position and the fourth arm of said four arms being adjustably connected to and extending between said second and third arms.

2. A stitch frame actuating mechanism described in claim 1 in which said rotation-generating means comprises a wheel provided with a peripheral bezel and secured to said shaft and a piston rod disposed near said wheel and periodically engaging said wheel whereby said piston rod can rotate said wheel intermittently when said piston rod is connected to and actuated by the needle bar of said sewing machine.

3. A stitch frame actuating mechanism described in claim 1 in which said first arm is provided with plural fulcrum holes arranged lengthwise thereof and said fourth arm which is opposite to said first arms is adjustably pivoted to said second and third arms by means of two adjusting screws whereby said four arms can form not only a parallelogram but also a trapezoid.

4. A stitch frame actuating mechanism described in claim 1, including a groove formed in said rotary member, a sliding plate adapted slidably in said groove and a mounting stud secured on said sliding plate, with said planetary gear being mounted rotatably around said mounting stud.

5. A stitch frame actuating mechanism mountable on an ordinary sewing machine including a base plate mountable on the bed of said sewing machine, a stitch frame holder comprising a pair of stems integral with said circular frames, a rotation-generating means provided with a hollow stud having a noncircular axial hole, said rotation-generating means being actuated by one of the reciprocating members of said sewing machine, said hollow stud extending fixedly through

said base plate, a rotary member mounted rotatably around the extending end of said hollow stud, a groove formed in said rotary member along a diameter of it, a positioning gear provided rotatably on said rotary member, an internally toothed gear fixed on said base plate at the position concentric with said hollow stud, an externally toothed gear with an integral noncircular shaft inserted in said noncircular axial hole, a sliding plate provided with a mounting stud, a longitudinal slot and a rack at one of its longitudinal sides meshing with said positioning gear, said sliding plate being adapted slideably in said groove and said hollow stud extending through said longitudinal slot, an externally toothed planetary gear provided with plural pivot holes, said planetary gear being mounted rotatably around said mounting stud and being selectively in mesh with either said externally toothed fixed gear or said internally toothed gear and a pair of arms pivotally connected to each other and each to one of said integral stems by pivot pins to form a parallelogramic link with said stems, one of said arms being pivoted on said base plate intermediate its length and the pivot pin connecting the other of said arms and one of said integral stems being rotatably inserted in one of said pivot holes of said planetary gear at an eccentric position.

6. A stitch frame actuating mechanism described in claim 5 in which said rotation-generating means comprises a ratchet wheel mounted rotatably around said hollow stud for rotation unitary with said rotary member and a swinging member provided with a projection engageable with said ratchet wheel, said swinging member being actuated by the needle bar of said sewing machine to rotate said ratchet wheel intermittently in a certain direction.

7. A stitch frame actuating mechanism described in claim 5 in which said noncircular axial hole and shaft are rectangular.

8. A stitch frame actuating mechanism described in claim 5, including a spring provided on said rotary member to bias said positioning gear towards said rack of said sliding plate.

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