Nov. 15, 1966 W. TRETOW ETAL 3,285,210

LOOPER DRIVE FOR CHAIN STITCH SEWING MACHINES

Filed Oct. 8, 1963 5 Sheets-Sheet 1

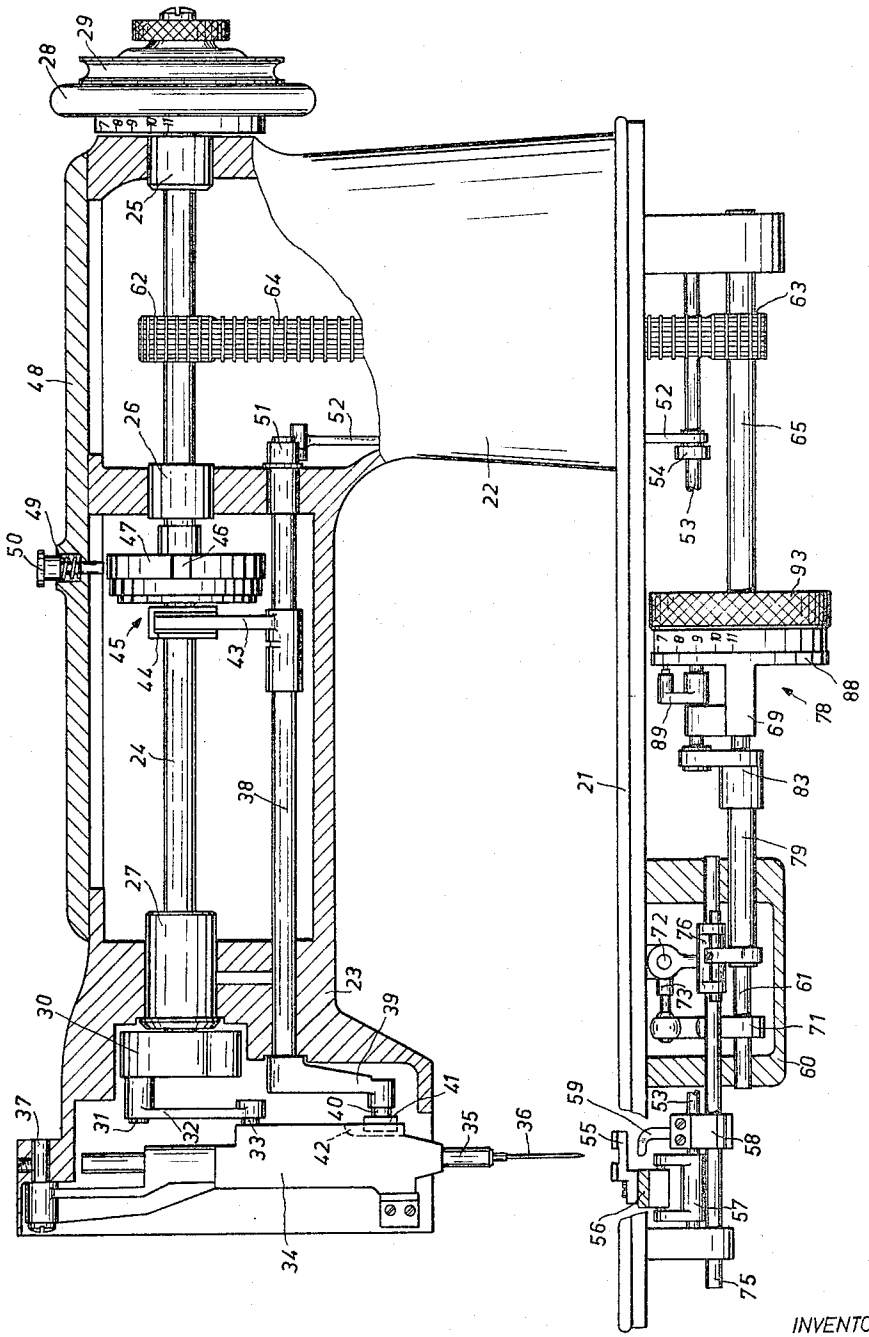

FIG. 1

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LOOPER DRIVE FOR CHAIN STITCH SEWING MACHINES

Filed Oct. 8, 1963 5 Sheets-Sheet 2

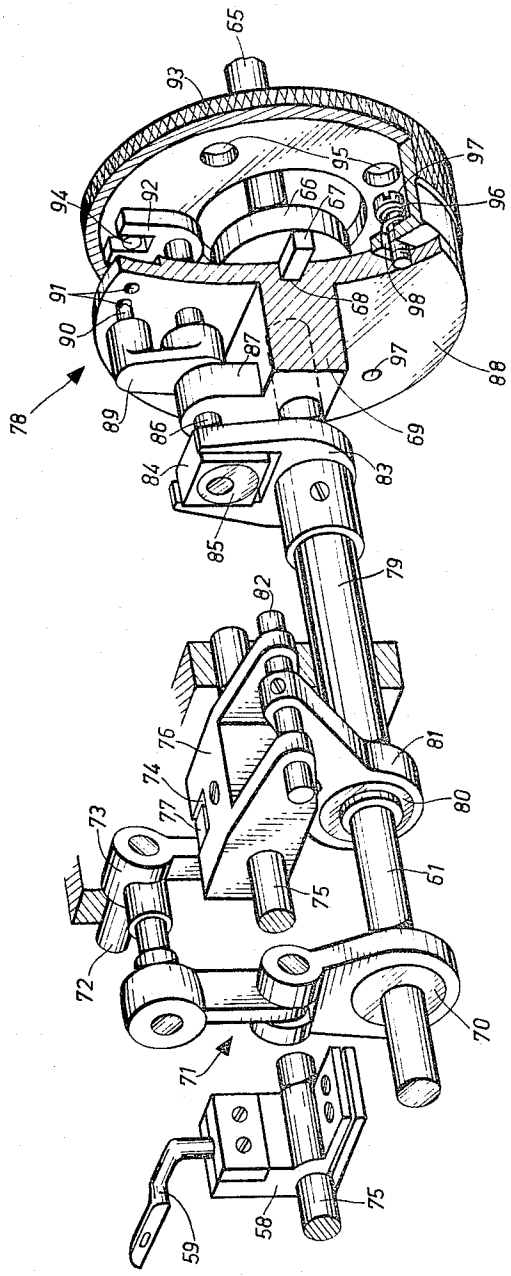

Fig. 2

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LOOPER DRIVE FOR CHAIN STITCH SEWING MACHINES

Filed Oct. 8, 1963 5 Sheets-Sheet 3

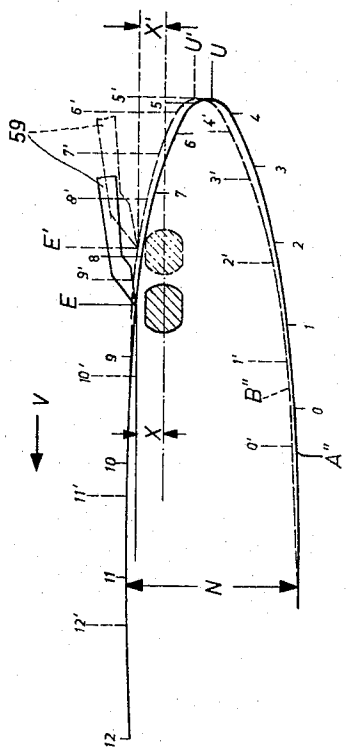

Fig. 7

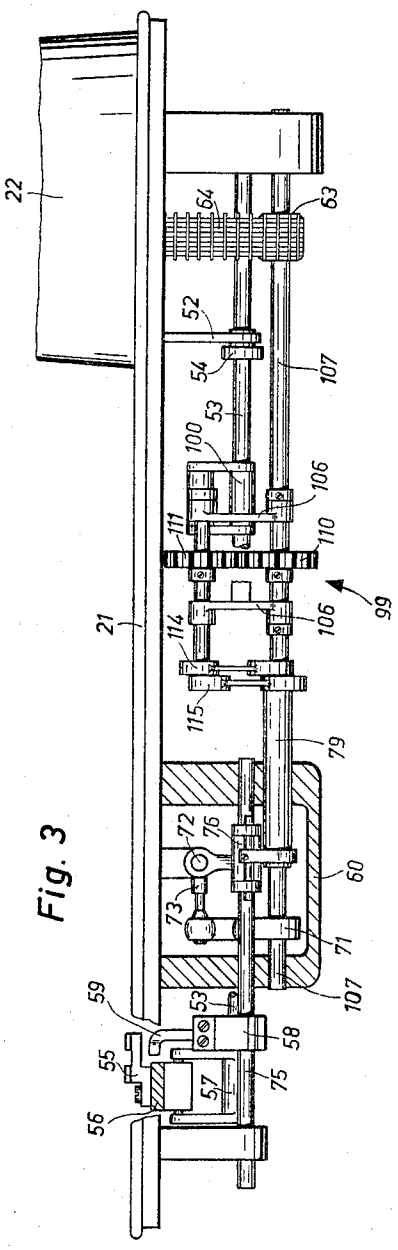

Fig. 3

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LOOPER DRIVE FOR CHAIN STITCH SEWING MACHINES

Filed Oct. 8, 1963 5 Sheets-Sheet 4

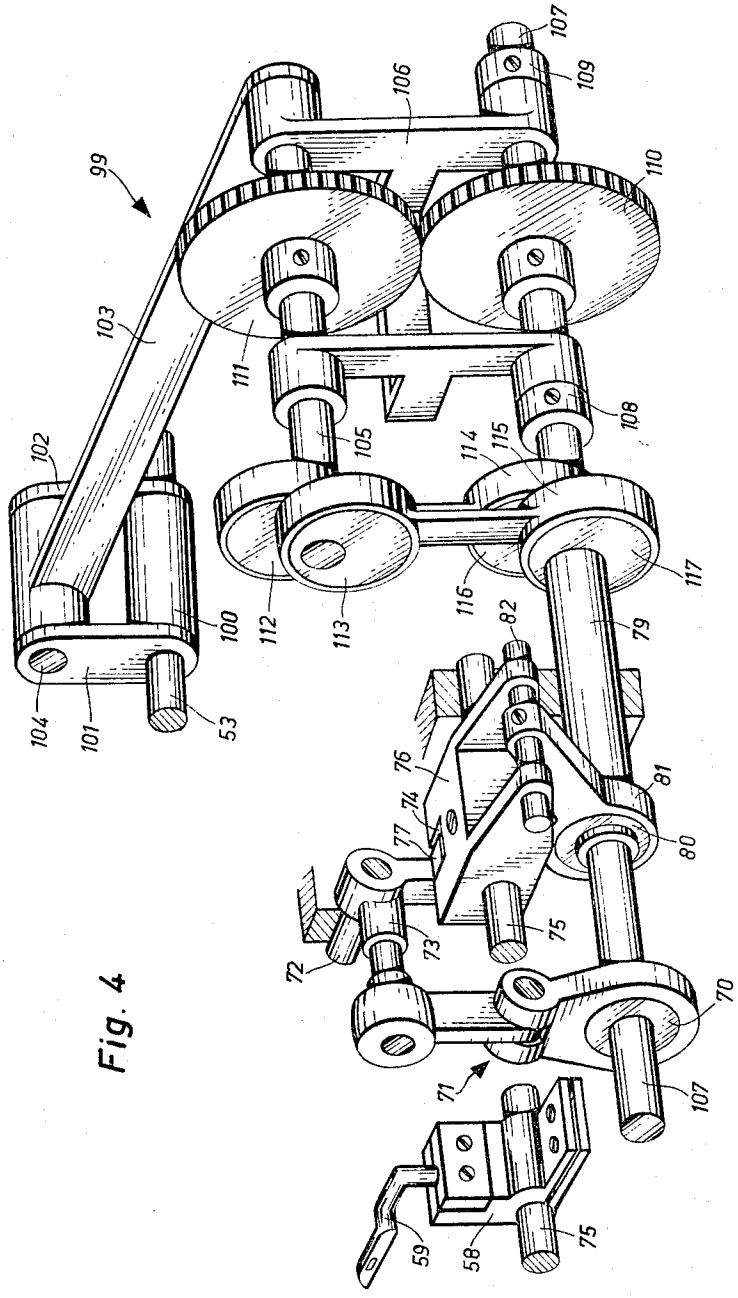

Fig. 4

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LOOPER DRIVE FOR CHAIN STITCH SEWING MACHINES

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Fig. 5

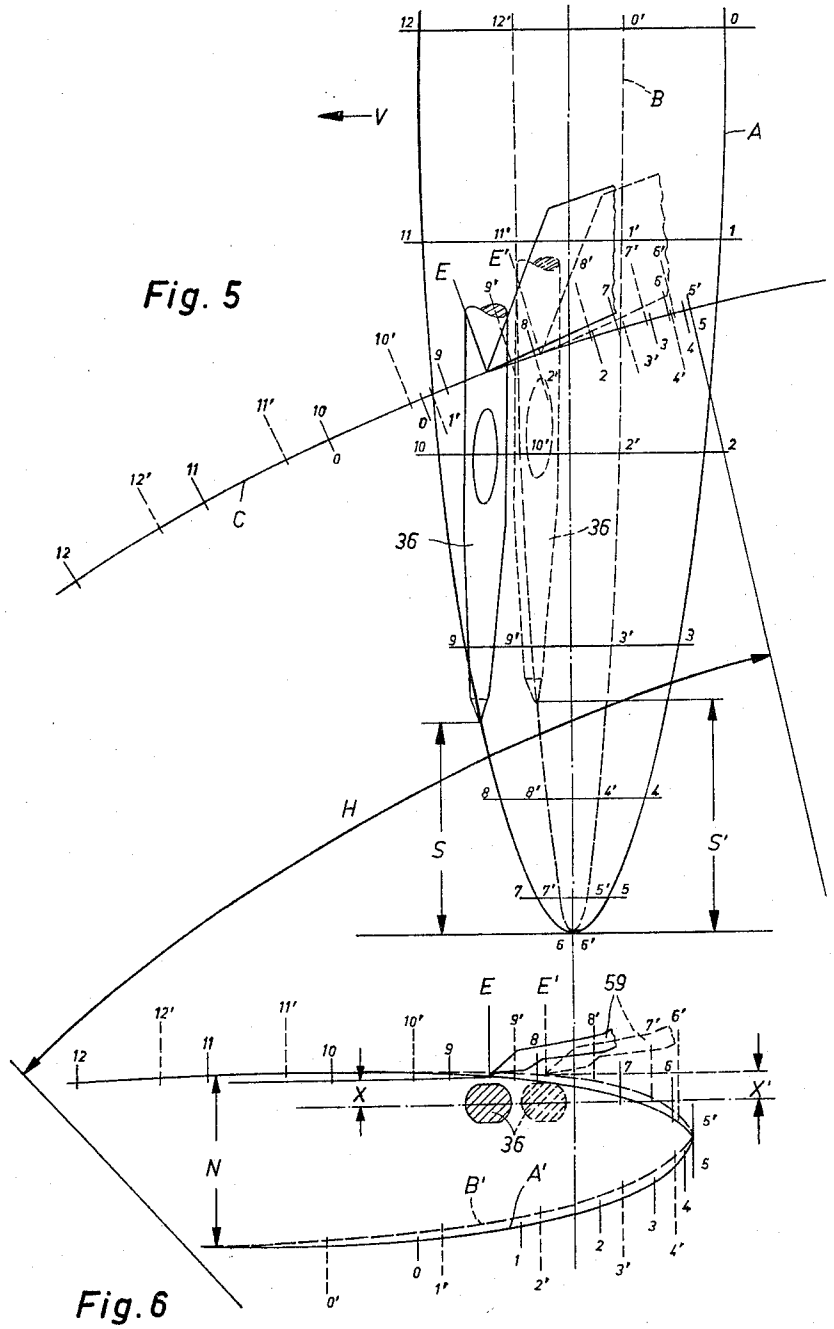

Fig. 6

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United States Patent Office 3,285,210 Patented Nov. 15, 1966

3,285,210

LOOPER DRIVE FOR CHAIN STITCH SEWING MACHINES

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Filed Oct. 8, 1963, Ser. No. 314,707
Claims priority, application Germany, Oct. 13, 1962, P 30,353
8 Claims. (Cl. 112—199)

The invention relates to sewing machines and is particularly concerned with looper drive means for sewing machines. More in particular, the invention relates to looper drive means for chain stitch sewing machines having adjustable bottom and needle feed means where the looper effects longitudinal loop seizing and dropping movements and lateral needle evading movements derived from two cams arranged upon the looper drive shaft.

In known chain stitch machines equipped with a compound feed the looper swings parallel relative to the direction of feed. The looper point faces in the direction that is opposite to the direction of feed of the needle. A loop spreader must cooperate with the looper which is reciprocably movable perpendicularly to the direction of feed which seizes the looper thread and expands it in order to form, together with the preceding needle thread loop, the conventional thread triangle for the passage of the descending needle. The threading of the looper thread is not readily possible with this type of looper drive. The looper must first be swung aside into a position that is favorable for the needle threading operation.

The seizing of the looper thread by the loop spreader is considerably more difficult in a machine having compound feed than in a machine where the needle is moved up and down along a straight line, because the stitch hole is in the material feed dog that is moved back and forth in the direction of feed. With this type of feed dog movement a loosening occurs in the looper thread leg that is to be seized by the loop spreader, as a result of which this leg of the thread is without control and can move out of the effective range of the spreader, so that defective stitches are formed. The correct setting of the loop spreader must be carefully made by a man skilled in the art and requires considerable expenditure of time. Moreover, the thread is subject to considerable wear by the loop spreader, particularly in connection with rapidly operating sewing machines.

The forming of accurate chain stitches requires essentially that the distance of the looper from the needle and the upward movement or rise of the loop is always substantially equal during the seizing of the loop and that the forming of the thread triangle insures of accurate piercing by the needle. With sewing machines of the compound feed type and with a conventional looper drive, these stitch formation requirements differ for each stitch length.

In chain stitch machines provided with compound feed where the looper is moved in the direction opposite to the feed movement of the needle for seizing the needle thread loop, the looper and the needle move in the same direction during the loop dropping movement. Prior to the eye of the needle rising above the point of the looper, the looper must move to the end of its loop dropping thrust and then advance in a relatively short time to the loop seizing position. However, since the looper effects an unchanged, uneven oscillatory movement by means of a crank and rocking slide drive, while the advancing of the needle is varied with the change of the stitch length, the seizing of the loop by the looper

point takes place with each different stitch length at a different distance from the eye of the needle. As a result also the magnitude of the loop rise differs. In order to prevent what is referred to as "falling over" of the loop, it is necessary to provide an additional loop support on the looper.

It is therefore an object of the invention to provide a looper drive for chain stitch machines of the compound feed type where the normally complicated looper spreading means as well as the looper support are eliminated, where furthermore the cooperation of the looper with the needle is influenced by a device in a manner that the location of the entrance of the looper point into the needle thread loop formed during the upward movement of the needle is for all adjustable feed magnitudes of the needle at the same distance from the eye of the needle and from the center of the needle, while the needle loop rise is substantially equal.

In accordance with the invention this problem is solved in that for seizing the needle thread loop, the looper and the needle effect synchronized oscillatory movements in the direction of material feed and the angular position of the eccentric controlling the longitudinal movements can be changed upon the looper drive shaft by means of an adjusting device in such a manner that the looper point moves along a path which is adapted to the length of feed of the needle to provide stitch forming conditions which remain the same.

In accordance with a further object of the invention the angular position of the eccentric or cam for the longitudinal movements with respect to the eccentric for the needle evading movements is adjustable by one setting means upon the looper drive shaft in relation to the adjustable feed lengths of the needle and can be fixed in position by a latching device. By adjusting the angular position of the main eccentric or cam in relation to the feed length of the needle at any time, the peripheral line of the elliptical path of movement which is produced by the cooperation of the two drive cams is adjusted in such a manner that the distance of the needle from the looper point as it enters the thread loop corresponds to the needle distance which has been established to be correct; furthermore, by changing the angular position of the cam for the longitudinal movements the location of loop seizing by the looper point is adapted to the magnitude of feed of the needle, and finally by changing these two control points that are essential for chain stitch machines, the formation of the thread triangle is advantageously affected, so that approximately equal stitch forming conditions are created for all adjustable feed lengths of the needle.

In accordance with a further object of the invention an advantageous construction of the adjusting device that is set by means of a setting disk is obtained in that the eccentric acted upon by the adjusting device is arranged at one end of a sleeve journalled coaxially with the looper drive shaft, to the other end of which sleeve a setting fork is secured in which a sliding block is guided that is journalled upon an eccentric stud of a pivotable bolt arranged parallel at a distance with respect to the looper drive shaft, and a fork is fastened upon the rocking shaft for a detent that is rigidly connected on a setting disk arranged coaxially with respect to the looper drive shaft.

A suitable latching means for the setting device is obtained in that a lever is mounted upon the pivotable bolt which has a spring biased catch bolt for recesses in a latch disk corresponding to the adjustable feeding lengths of the needle.

In accordance with a further object of the invention the setting disk is secured on the latch disk with elastic mounting means therebetween, so that the adjusting of the

arrangement is made possible without previously loosening the setting screws.

In the further development of modern sewing machines endeavors are made to combine the setting devices in order to quickly and rapidly provide for adjusting to different types of sewing operations with a minimum of manual adjusting means on the machine. It is of particular significance in chain stitch sewing machines with compound feed where, as is well known, the deviation of the needle also changes the location of the seizing of the loop by the looper point, that simultaneously with the setting for a predetermined stitch length the looper oscillation derived from a cam is adapted to the adjusted stitch length.

In accordance with a further object of the invention this is accomplished in that the setting means is connected with the material feed shaft. In this manner the angular position of the eccentric upon the looper drive shaft is adjustable by means of the setting means to correspond to the rhythm of the needle feed movement.

From an engineering standpoint a very advantageous solution of the problem is provided in that the setting means that is coupled by means of a link to the material feed shaft has a toothed mating gear rotatably mounted upon an oscillating frame on a shaft which is in operative connection with a toothed gear upon the looper drive shaft and which, together with the rocking frame, is pivotally movable about the looper drive shaft in the manner of a planetary wheel as determined by the adjustable feed lengths of the needle and is connected by way of a parallel crank drive with the sleeve of the eccentric.

The oscillatory movement of the mating or counter wheel which depends on the material feed causes a relative movement between the two toothed gears, as a result of which an uneven rotary impulse is imparted to the drive eccentric for the looper which is reflected at the looper in a manner that an additional accelerated and delayed movement is superimposed on the uneven oscillatory movement of the looper point, while the evading or deflecting movement of the needle remains constant for all stitch lengths.

The looper drive is coordinated in such a manner that, depending on the stitch length, the looper point covers paths of different lengths for equal needle deflections during the same unit of time. As a result the needle distance remains equal for each stitch length while the loop rise is approximately equally great. In order to overcome the dead point as the unequal rotation of one toothed gear is transmitted to the sleeve of the eccentric, two eccentrics of the parallel crank drive are provided on each, the shaft and the sleeve, the phases of which are displaced.

Further objects and advantages of the invention as well as details of the structure will become apparent from the following description of two embodiments of the invention and with reference to the accompanying drawings, in which:

FIG. 1 is a front view of the machine, partly in section,

FIG. 2 is a perspective view of the looper drive in accordance with FIG. 1,

FIG. 3 shows the looper drive provided below the base plate and a different embodiment of the setting means,

FIG. 4 is a perspective view of the looper drive with the setting means illustarted in FIG. 3,

FIG. 5 and FIG. 6 illustrate to an enlarged scale a part of the courses of movement of the needle and of the looper point for greatest and smallest stitch length, and

FIG. 7 illustrates parts of the courses of movement of the looper point for greatest and smallest stitch length while using the setting means shown in FIGS. 3 and 4.

The work plate **21** of the machine supports the housing **22** which ends in a head **23**. In the housing **22** the arm shaft **24** is rotatably journalled in the arm shaft

sleeves **25**, **26**, **27**. At one end of the arm shaft **24** the balance wheel **28** and the belt pulley **29** are mounted. The arm shaft **24** is driven by motor (not shown) and a belt extending over the belt pulley **29**. At the end of the arm shaft **24** which extends into the head **23** the arm shaft crank **30** is secured which drives the needle bar **35** that is reciprocably movable in the needle bar oscillator or rocker **34** by way of the stud **31**, link **32**, and the needle bar stud **33**. At the lower end the needle bar **35** supports the needle **36**. The needle bar oscillator or rocker **34** is mounted for pivotal movement in the direction of feed on the stud **37** which is secured to the machine. The rocking shaft **38** with the rocking crank **39** is mounted in the housing **22** parallel to and at a distance from the arm shaft **24** and carries the slide block **41** on the stud **40**. The slide block **41** extends into the guide groove **42** of the needle bar oscillator or rocker **34**. The eccentric fork **43** is mounted on the rocking shaft **38** and encompasses the slide member **44** that is mounted upon an adjustable eccentric **45**. The eccentric **45** is mounted upon the arm shaft **24** and has a setting ring **47** which has a retaining groove **46**. The housing **22** is closed by means of a cover **48**. An axially displaceable retaining pin **50** for the setting ring **47** is provided in the cover **48** that is biased by the spring **49** and movable against the force of that spring. The pin **50** has a stud portion which for adjusting the eccentricity engages the groove **46** as the retaining pin **50** is pressed downwardly.

Furthermore the crank **51** is secured to the rocking shaft **38** to which one end of the link bar **52** is connected which at the other end is linked to the crank **54** secured to the material feed shaft **53** that is journalled below the work plate **21**.

The balance wheel **28** is provided with markings (11 different magnitudes in the first embodiment) to provide for convenient setting of the deflection of the needle **36** that may be rocked in the direction of feed. The feed dog **55** operates in synchronism with needle **36** and is mounted upon the feed bar **56** which is linked to a crank **57** that is secured to the feed shaft **53**. A raising cam (not illustrated) imparts the necessary lifting impulses to the feed bar **56**. The conventional presser foot that cooperates with the material feed dog **55** is not shown.

The drive means for the looper **59** mounted in the looper support **58** is arranged in a housing **60** below the material supporting or base plate **21**. The looper drive shaft **61** journalled in the housing **60** is driven by the arm shaft **24** by way of the cord belt pulleys **62**, **63**, the belt **64**, the shaft **65** and flange **66** which is provided with a key **67** that projects into a groove **68** in a coupling disk **69**.

The elliptical looper movement is constituted of two individual movements, i.e., the needle deflection movement and the loop seizing and dropping movement.

For producing the needle deflection movement the eccentric **70** is secured to the looper drive shaft **61**. The eccentric movement is imparted to the looper shaft **75** by way of a link bar **71**, a bell crank lever **73** pivotable about a stationary axis of rotation **72** and a block **77** extending in the sliding groove **74** of a crank **76** secured to the looper shaft **75**.

The coupling disk **69** is a part of a setting device indicated at **78** (FIGS. 1 and 2). In order to produce the loop seizing and dropping movement of the looper **59** the setting device **78** has a sleeve **79** mounted upon the looper drive shaft **61** and upon which an eccentric **80** is provided. The eccentric movement is transferred to the looper shaft **75** by way of an eccentric bar **81**, a pivot pin **82** and the crank **76** which is secured to the looper shaft **75**.

A bifurcated member **83** is secured to the sleeve **79** and engages a sliding block **84** which is rotatably journalled on an eccentric extension **85** of a pivot bolt **86**. The bolt **86** is rotatably journalled in a journal boss **87** and in the flange **88** of the coupling disk **69**. Between the journal boss **87** and the flange **88** an index crank **89** is

secured upon the pivot bolt **86** and receives a piston pin **90** which is spring biased and the conical end of which cooperates with bores **91** in the flange **88** of the coupling disk **69** in order to fix the sleeve **79** in the positions which correspond to the number of the bores **91**. A setting fork **92** is furthermore secured upon the pivot bolt **86** which cooperates with a detent pin **94** secured to a setting disk **93**. The setting disk **93** is provided with a plurality of mounting bores **95** and secured to the flange **88** by means of screws **97** with helical springs **96** interposed therebetween. In lieu of helical springs **96** other elastic inserts may be used, for example, nests of spring disks. The screws **97** extend through the arcuate slots **98** in the setting disk **93**. At the periphery of the flange 88 index marks **1–11** are provided (FIG. 1) which correspond to the adjustable stitch lengths. The setting disk **93** is provided with a scored mark for these markings.

The looper **59** is secured upon a support **58** clamped to the looper shaft **75** in a manner that the looper point faces in the direction of feed. As may be required, several loopers and needles may be provided. The drive connections of the looper **59** impart to it a rocking movement in the direction of feed and a needle evading movement essentially perpendicularly to the direction of feed. The looper **59** and the needle **36** effect synchronized rocking movements in the direction of feed for seizing the needle thread loop.

FIGS. 3 and 4 illustrate the looper drive in connection with a further embodiment of the setting means which is generally identified by numeral **99**. This setting means **99** has a crank **100** secured to the material feed shaft **53** between the bifurcated arms **101, 102** of which a link bar **103** is journalled for pivotal movement about a pin **104**. The other end of the link bar **103** is connected to a rod **105** which is journalled in a rocking frame **106**. The rocking frame **106** is mounted for pivotal movement about the looper drive shaft **107** journalled in the material carrier plate **21** and secured against axial displacement by means of collars **108, 109**. In this embodiment the looper drive shaft **107** is a unitary member which takes the place of the shafts **61, 65** in accordance with FIGS. 1 and 2. A toothed gear **110** is secured to the looper drive shaft **107** which meshes with a counter gear **111** secured to the shaft **105**.

Two eccentrics **112, 113** are secured on the shaft **105** displaced by approximately 120° and are connected by way of eccentric bars **114, 115** to two phasially displaced eccentrics **116, 117** secured to the sleeve **79**.

The looper drive as well as the remaining components of the sewing machine correspond to those illustrated in FIGS. 1 and 2.

The manner of machine operation by means of setting means **78** is first described.

For setting the desired stitch length the detent pin **50** is actuated against the force of the spring **49** into the retaining groove **46** of the setting ring **47**. By rotating the balance wheel **28** the desired stitch length is adjusted at the eccentric **45** to the corresponding amount of eccentricity. The adjusted stitch length is indicated by the markings on the balance wheel **28**. Upon release the spring **49** forces the pin **50** again out of the retaining groove **46**.

Owing to the different deflection magnitudes of the needle in connection with the different stitch lengths in compound feed machines, the location where the loops are seized by the looper (FIGS. 5 and 6) is changed for each stitch length.

The setting device **78** (FIGS. 1 and 2) which is operatively connected with the looper **59** is provided for the purpose that the angular position of the main eccentric **80** is changed in relation to the magnitude of feed of the needle in such a manner that the position of the looper point as seen in the direction of feed with respect to needle **36** is adapted to any adjusted stitch length in order to obtain for each magnitude of feed a substantially equal loop rise S, S'—FIG. 5). Furthermore, it is accomplished in this manner that the path of movement of the looper point (A', B'—FIG. 6) is likewise adapted to the particular adjusted feed distance of the needle **36** in order to obtain the same needle distance for each stitch length (x, x'—FIG. 6).

The setting of the eccentric **80** is effected by turning the setting disk **93** which is accessible by turning over the machine. It is also possible, however, to provide setting means which permit making the adjustments above the material carrier plate **21**. For this purpose a rather complicated releasable coupling is required. The detent pin **94** of the setting disk **93** which extends into the setting fork **92** imparts an angular movement to the pivot bolt **86**. The piston pin **90** of the index crank **89** engages one of the bores **91**. The angular position of the eccentric **80** secured to the sleeve **79** is changed with respect to the eccentric **70** by way of the eccentric extension **85**, the sliding block **84** and the fork member **83**, whereby the setting of the looper **59** secured upon the looper shaft **75** is changed relative to the needle **36** by way of the eccentric bar **81**, the pivot pin **82** and the crank **76**.

The markings on the balance wheel **28** and on the flange **88** of the setting device **78** have corresponding index numbers (**1** to **11**) so that for each adjusted feeding length of the needle **36** a corresponding looper position can be conveniently and readily undertaken.

When the setting of the desired feed length of the feed dog, the needle **36** and a corresponding setting of the looper **59** have been completed, it is possible to sew. The belt pulley **29** secured upon the arm shaft **24** is driven by a motor (not shown) by way of a belt. The arm shaft crank **30** moves the needle bar **35** up and down by way of pin **31**, link **32** and the needle bar stud **33**. The rocking shaft **38** has imparted to it rocking movements in the direction of feed by way of the eccentric **45**, the slide member **44** and the fork member **43**, which movements are transmitted by way of crank **39** and the stud **40** upon the slide block **41** onto the needle bar rocker **34**. Simultaneously also the material feed shaft **53** receives the same rocking movement by way of the crank **51**, secured to rocking shaft **38**, link bar **52**, and crank **54**. As a result the needle **36** and the feed dog **55** execute feed movements of equal magnitude.

The coupling shaft **65** is operatively connected to the arm shaft **24** by way of belt pulleys **62, 63** and the chain belt **64**. The coupling shaft **65** operates at the same number of rotations as the arm shaft **24** and by way of coupling **66, 67, 68** moves along the looper drive shaft **61** with the setting means **78**.

The eccentric **80** secured to the sleeve **79** imparts a rocking movement C in the feed direction V (FIG. 5) to the looper **59** secured upon looper shaft **75** by way of eccentric bar **81**, pivot pin **82** and crank **76**. Besides this rocking movement C a needle deflection movement is imparted to the looper which is derived from the eccentric **70** by way of link bar **71**, bell crank lever **73**, slide block **77** and crank **76**. Owing to the combined effect of both movements C and N, the looper **59** is moved along a path A', B' of elliptic configuration.

The paths of movement of the needle **36** and of the looper eye are graphically illustrated in FIGS. 5 and 6 for greatest and smallest stitch length to a considerably enlarged scale.

In FIG. 5 the direction of feed is indicated by the arrow V. The curved line indicated at A shows the path of movement of the needle point for the largest stitch length, and the curved line B indicates the path of movement of the needle point for the smallest stitch length. A part of the needle rise is subdivided from **0–12** (Graph A) and **0'–12'** (Graph B). In order to illustrate the cooperation of the looper **59** with the needle **36** for largest and smallest stitch lengths, the points **1** to **12** for largest

stitch length and the points 1' to 12' for smallest stitch length are marked on the graph C. The individual points indicate the locations where the looper point is located when the needle point is at the location identified by the same number along graphs A or B. The rocking width of looper **59** is indicated at H.

In FIG. 6 the elliptic path of movement of the looper point for greatest stitch length is indicated at A', and the path of movement of the looper point for smallest stitch length at B'. N is the magnitude of the needle deflection movement.

Along the graph A' (FIG. 6) numerals **1–12** indicate the positions where the looper point is located when the needle point indicated in graph A (FIG. 5) is in the position identified by the same numeral. In graph B' numerals **1'–12'** indicate the positions where the looper point is located when the needle point is in the position identified in graph B (FIG. 5) by the same numeral.

The points E and E' in FIGS. 5 and 6 identify the locations of the loop seizing by the looper point for the greatest and smallest stitch length.

FIGS. 5 and 6 reflect that for stitch lengths of different magnitude the looper point is in different positions relative to the center of the needle bar (center axis of the stud screw **37**) along the elliptical path (A', B'). This setting of the looper **59** is effected with the setting means **78** by rotating the setting disk **93**. In this manner it is accomplished that the loop rise (indicated in FIG. 5 at S for largest stitch length and at S' for smallest stitch length) will be almost equal for all stitch lengths. The difference between the loop rise for largest and for smallest stitch length amounts only to fractions of a millimeter and is practically of no consequence because normally the sewing is in the central region of the stitch length.

Furthermore, this adjustment also causes changes in the elliptic path of movement of the looper point for each stitch length (in FIG. 6 indicated at A' for largest and B' for smallest stitch length), in such a manner that the distance between the looper point with respect to the center of the needle (x for largest, x' for smallest stitch length, FIG. 6) is always of the same magnitude. By the phase displacement of the looper **59** with respect to the stitch length, the entrance of the needle **36** into the thread triangle (which is known and therefore not shown), as related to the looper blade and the looper eye, contrary to other chain stitch machines with compound feed where the needle entrance as related to the looper eye is displaced for different stitch lengths, takes place with all stitch lengths provided by the sewing machine in accordance with the invention always at the same location between legs of the thread triangle which are formed by the needle thread loop, beginning with the last stitch entrance and extending around the neck of the looper, and the looper thread extending from the last stitch entrance to the looper eye. As a result, reliable needle entrance into the thread triangle is safeguarded for all stitch lengths without a loop spreader requiring its own operating means for holding open the thread triangle.

While the setting means **78** must be changed manually as the stitch length is changed, the setting means **99** is connected by the link bar **103** directly with the feed dog **55**. In this manner the setting means **99** adjusts itself automatically to the magnitude of feed of the feed dog **55** and of the needle **36**, in which connection it should be noted that the feed dog and needle effect feed movements of equal magnitude.

When the arm shaft **24** rotates, the rocking shaft **38** has a rocking movement imparted to it by way of eccentric **45**, the slide block **44** and the eccentric **43** which is transmitted to the rocking frame **34** by way of the rocking crank **39**, the stud **40**, and the slide block **41**. Simultaneously also the material feed shaft **53** has imparted to it the same rocking movement by way of the crank **51** secured to the rocking shaft **38**, the link bar **52** and the crank **54** which is transmitted by way of the connecting bar **103** to the rocking frame **106**, having as a pivot axis the looper drive shaft **107**. The toothed gear **111** mounted on the shaft **105** is angularly displaced thereby in the manner of a planet wheel about the toothed gear **110** secured to the shaft **107** operatively connected thereto by way of the chain wheels **62, 63** and the cord chain **64** and has in this manner imparted to it an accelerated rotary movement in one direction of rotation and a retarded rotary movement in the other direction of rotation. This rotary movement is transmitted by eccentric **112, 113** secured to the shaft **105**, eccentric bars **114, 115** and the eccentrics **116, 117** onto the sleeve **79** by means of the drive eccentric **80** mounted thereon. The angular position of the eccentric **80** is thereby changed with resepct to the rhythm of the feed movement. The eccentric **80** imparts to the looper **59** secured on the support **58** an uneven rocking movement in the direction of feed which is accelerated and retarded depending on the magnitude of feed by way of eccentric bar **81**, pivot stud **82** and the crank **76** mounted upon the looper shaft **75**. The needle deflecting movement of the looper derived from eccentric **70** which is perpendicular to the direction of feed remains constant in this connection.

By the cooperation of the looper drive connections and the setting means **99** the looper point is moved in this embodiment along an elliptic path indicated in FIG. 7 at A'' for maximum feed legth and at B'' for minimum feed length.

As shown in FIG. 7 the path which is described by the looper point from its forward reversing position (U, U') to the loop seizing position (E, E') is greater with a large feed movement (U–E) than for a small stitch (U'–E'). When the needle distance x or x' and the loop rise (S–S') are to be approximately of the same magnitude, the looper point must pass through these different stretches (U–E, U'–E') during the same period of time. This is made possible in that the looper **59** is in operative connection with the setting means **99** by means of which, depending on the magnitude of feed, the acceleration of the looper **59** is also changed. In FIG. 7, O–**12** or O'–**12'** indicate those points where the looper point is disposed when the needle point is at the points indicated in FIG. 5 at O–**12** or O'–**12'**.

Having now described our invention with reference to the embodiments illustrated in the drawings, we do not wish to be limited thereto, but what we desire to protect by Letters Patent of the United States of America is set forth in the appended claims.

We claim:

1. In a chain stitch sewing machine having a machine arm, a base plate and adjustable bottom and needle feed means of the type in which the looper effects longitudinal thread seizing and dropping movements and lateral needle deflecting movements derived from eccentrics, a looper drive mechanism including synchronizing means and setting means for imparting adjustable movements to the looper to synchronize the looper with the needle, said synchronizing means comprising an arm shaft journalled in said machine arm, a needle bar supporting a needle disposed endwise of said arm shaft, a rocker for guiding said needle bar, a rocking shaft, means operatively linking said rocking shaft to said arm shaft and to said rocker, a looper drive shaft disposed below the base plate, means operatively connecting said looper drive shaft to said arm shaft, a looper shaft, a looper connected to said looper shaft and disposed below said needle and linkage means including a first adjustable eccentric mounted on said looper drive shaft for effecting longitudinal thread seizing and dropping movements, said first eccentric linking said looper shaft to said looper drive shaft, and a second eccentric mounted on said looper drive shaft and operatively associated with said looper shaft for controlling deflecting movements of said looper, and said setting means including adjustable means mounted con-

centrically with said looper drive shaft, said adjustable means being operatively interconnected with the first adjustable eccentric operative to change the angular position of said first eccentric for coordinating the longitudinal movements and the deflecting movement of said looper to establish coincidence of looper movements with respect to the adjustable needle feed means for different stitch lengths.

2. In a chain stitch sewing machine having a machine arm, a base plate and adjustable bottom and needle feed means of the type in which the looper effects longitudinal thread seizing and dropping movements and lateral needle deflecting movements derived from eccentrics, a looper drive mechanism including synchronizing means and setting means for imparting adjustable movements to the looper to synchronize the looper with the needle, said synchronizing means comprising an arm shaft journalled in said machine arm, a needle bar supporting a needle disposed endwise of said arm shaft, a rocker for guiding said needle bar, a rocking shaft, means operatively linking said rocking shaft to said arm shaft and to said rocker, a looper drive shaft disposed below the base plate, means operatively connecting said looper drive shaft to said arm shaft, a looper shaft, a looper connected to said looper shaft and disposed below said needle and linkage means including a first adjustable eccentric mounted on said looper drive shaft for effecting longitudinal thread seizing and dropping movements, said first eccentric linking said looper shaft to said looper drive shaft, and a second eccentric mounted on said looper drive shaft and operatively associated with said looper shaft for controlling deflecting movements of said looper, and said setting means including adjustable means mounted concentrically with said looper drive shaft, said adjustable means being operatively interconnected with the first adjustable eccentric operative to change the angular position of said first eccentric for coordinating the longitudinal movements and the deflecting movement of said looper to establish coincidence of looper movements with respect to the adjustable needle feed means for different stitch lengths, and said setting means including a pair of disks movable relative to one another and detent means for retaining said disks in adjusted position.

3. In a chain stitch sewing machine having a machine arm, a base plate and adjustable bottom and needle feed means of the type in which the looper effects longitudinal thread seizing and dropping movements and lateral needle deflecting movements derived from eccentrics, a looper drive mechanism including synchronizing means and setting means for imparting adjustable movements to the looper to synchronize the looper with the needle, said synchronizing means comprising an arm shaft journalled in said machine arm, a needle bar supporting a needle disposed endwise of said arm shaft, a rocker for guiding said needle bar, a rocking shaft, means operatively linking said rocking shaft to said arm shaft and to said rocker, a looper drive shaft disposed below the base plate, means operatively connecting said looper drive shaft to said arm shaft, a looper shaft, a looper connected to said looper shaft and disposed below said needle and linkage means including a first adjustable eccentric mounted on said looper drive shaft for effecting longitudinal thread seizing and dropping movements, said first eccentric linking said looper shaft to said looper drive shaft, and a second eccentric mounted on said looper drive shaft and operatively associated with said looper shaft for controlling deflecting movements of said looper, and said setting means including adjustable means mounted concentrically with said looper drive shaft, said adjustable means being operatively interconnected with the first adjustable eccentric operative to change the angular position of said first eccentric for coordinating the longitudinal movements and the deflecting movements of said looper to establish coincidence of looper movements with respect to the adjustable needle feed means for different stitch lengths, said setting means including a pair of disks movable relative to one another and detent means for retaining said disks in adjusted position, and a sleeve mounted around said looper drive shaft, said adjustable eccentric being mounted on one end of said sleeve and the other end of said sleeve being operatively connected to said disks by means including a first bifurcated member, a sliding block in engagement with said first bifurcated member, a pivot bolt extending parallel to the looper drive shaft having one end in engagement with said disks and having an eccentric member in engagement with said sliding block, a second bifurcated member mounted at the other end of said pivot bolt and a detent on one said disk in sliding engagement with said second bifurcated member.

4. In a chain stitch sewing machine having a machine arm, a base plate and adjustable bottom and needle feed means of the type in which the looper effects longitudinal thread seizing and dropping movements and lateral needle deflecting movements derived from eccentrics, a looper drive mechanism including synchronizing means and setting means for imparting adjustable movements to the looper to synchronize the looper with the needle, said synchronizing means comprising an arm shaft journalled in said machine arm, a needle bar supporting a needle disposed endwise of said arm shaft, a rocker for guiding said needle bar, a rocking shaft, means operatively linking said rocking shaft to said arm shaft and to said rocker, a looper drive shaft disposed below the base plate, means operatively connecting said looper drive shaft to said arm shaft, a looper shaft, a looper connected to said looper shaft and disposed below said needle and linkage means including a first adjustable eccentric mounted on said looper drive shaft for effecting longitudinal thread seizing and dropping movements, said first eccentric linking said looper shaft to said looper drive shaft, and a second eccentric mounted on said looper drive shaft and operatively associated with said looper shaft for controlling deflecting movements of said looper, and said setting means including adjustable means mounted concentrically with said looper drive shaft, said adjustable means being operatively interconnected with the first adjustable eccentric operative to change the angular position of said first eccentric for coordinating the longitudinal movements and the deflecting movements of said looper to establish coincidence of looper movements with respect to the adjustable needle feed means for different stitch lengths, said setting means including a pair of disks movable relative to one another and detent means for retaining said disks in adjusted position, and a sleeve mounted around said looper drive shaft, said adjustable eccentric being mounted on one end of said sleeve and the other end of said sleeve being operatively connected to said disks by means including a first bifurcated member, a sliding block in engagement with said first bifurcated member, a pivot bolt extending parallel to the looper drive shaft having one end in engagement with said disks and having an eccentric member in engagement with said sliding block, a second bifurcated member mounted at the other end of said pivot bolt and a detent on one said disk in sliding engagement with said second bifurcated member, and a lever member mounted on said pivot bolt including a spring biased piston pin, the other said disk being a flange having a plurality of recesses for engagement with said piston pin.

5. In a chain stitch sewing machine having a machine arm, a base plate and adjustable bottom and needle feed means of the type in which the looper effects longitudinal thread seizing and dropping movements and lateral needle deflecting movements derived from eccentrics, a looper drive mechanism including synchronizing means and setting means for imparting adjustable movements to the looper to synchronize the looper with the needle, said synchronizing means comprising an arm shaft journalled in said machine arm, a needle bar supporting a needle disposed endwise of said arm shaft, a rocker for guiding

said needle bar, a rocking shaft, means operatively linking said rocking shaft to said arm shaft and to said rocker, a looper drive shaft disposed below the base plate, means operatively connecting said looper drive shaft to said arm shaft, a looper shaft, a looper connected to said looper shaft and disposed below said needle and linkage means including a first adjustable eccentric mounted on said looper drive shaft for effecting longitudinal thread seizing and dropping movements, said first eccentric linking said looper shaft to said looper drive shaft, and a second eccentric mounted on said looper drive shaft and operatively associated with said looper shaft for controlling deflecting movements of said looper, and said setting means including adjustable means mounted concentrically with said looper drive shaft, said adjustable means being operatively interconnected with the first adjustable eccentric operative to change the angular position of said first eccentric for coordinating the longitudinal movements and the deflecting movements of said looper to establish coincidence of looper movements with respect to the adjustable needle feed means for different stitch lengths, said setting means including a pair of disks movable relative to one another and detent means for retaining said disks in adjusted position, and a sleeve mounted around said looper drive shaft, said adjustable eccentric being mounted on one end of said sleeve and the other end of said sleeve being operatively connected to said disks by means including a first bifurcated member, a sliding block in engagement with said first bifurcated member, a pivot bolt extending parallel to the looper drive shaft having one end in engagement with said disks and having an eccentric member in engagement with said sliding block, a second bifurcated member mounted at the other end of said pivot bolt and a detent on one said disk in sliding engagement with said second bifurcated member, and a lever member mounted on said pivot bolt including a spring biased piston pin, the other said disk being a flange having a plurality of recesses for engagement with said piston pin, and elastic means including a screw and a spring securing said one disk to said flange.

6. In a chain stitch sewing machine having a machine arm, a base plate and adjustable bottom and needle feed means of the type in which the looper effects longitudinal thread seizing and dropping movements and lateral needle deflecting movements derived from eccentrics, a looper drive mechanism including synchronizing means and setting means for imparting adjustable movements to the looper to synchronize the looper with the needle, said synchronizing means comprising an arm shaft journalled in said machine arm, a needle bar supporting a needle disposed endwise of said arm shaft, a rocker for guiding said needle bar, a rocking shaft, means operatively linking said rocking shaft to said arm shaft and to said rocker, a looper drive shaft disposed below the base plate, means operatively connecting said looper drive shaft to said arm shaft, a looper shaft, a looper connected to said looper shaft and disposed below said needle and linkage means

including a first adjustable eccentric mounted on said looper drive shaft for effecting longitudinal thread seizing and dropping movements, said first eccentric linking said looper shaft to said looper drive shaft, and a second eccentric mounted on said looper drive shaft and operatively associated with said looper shaft for controlling deflecting movements of said looper, and said setting means including adjustable means mounted concentrically with said looper drive shaft, said adjustable means being operatively interconnected with the first adjustable eccentric operative to change the angular position of said first eccentric for coordinating the longitudinal movements and the deflecting movements of said looper to establish coincidence of looper movements with respect to the adjustable needle feed means for different stitch lengths, said sewing machine including a feed dog shaft and said setting means including a link bar pivotally connected to said feed dog shaft.

7. A looper drive mechanism for use in a chain stitch sewing machine in accordance with claim **3**, wherein said setting means comprises a gear on said looper drive shaft, a rocking frame, a pivot rod mounted on said rocking frame supporting a counter gear in engagement with said gear on said looper drive shaft and movable in the manner of a planet gear in accordance with the feed magnitudes to which said feed dog shaft and said needle are adjusted, and linkage means including eccentrics connecting said pivot rod to said sleeve.

8. A looper drive mechanism for use in a chain stitch sewing machine in accordance with claim **3**, wherein said setting means comprises a gear on said looper drive shaft, a rocking frame, a pivot rod mounted on said rocking frame supporting a counter gear in engagement with said gear on said looper drive shaft and movable in the manner of a planet gear in accordance with the feed magnitudes to which said feed dog shaft and said needle are adjusted, and linkage means including eccentrics connecting said pivot rod to said sleeve, said linkage means being in the form of a parallel phase displaced parallel crank drive and comprising a pair of eccentrics on said pivot rod and a pair of eccentrics connected to said sleeve.

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