July 12, 1955 N. W. COTTRELL 2,712,802

SEWING MACHINE

Filed Jan. 18, 1952 4 Sheets-Sheet 1

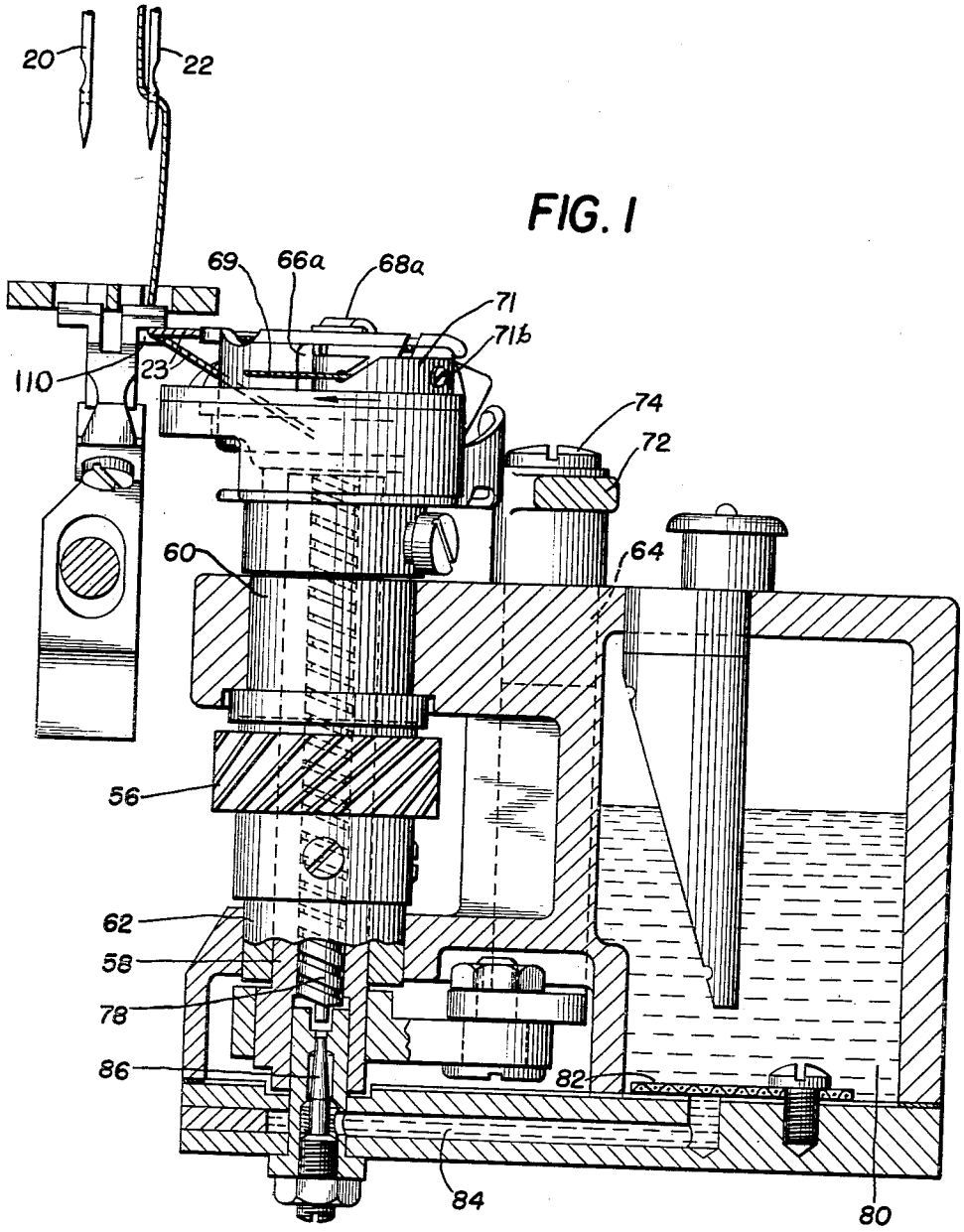


FIG. 1

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SEWING MACHINE

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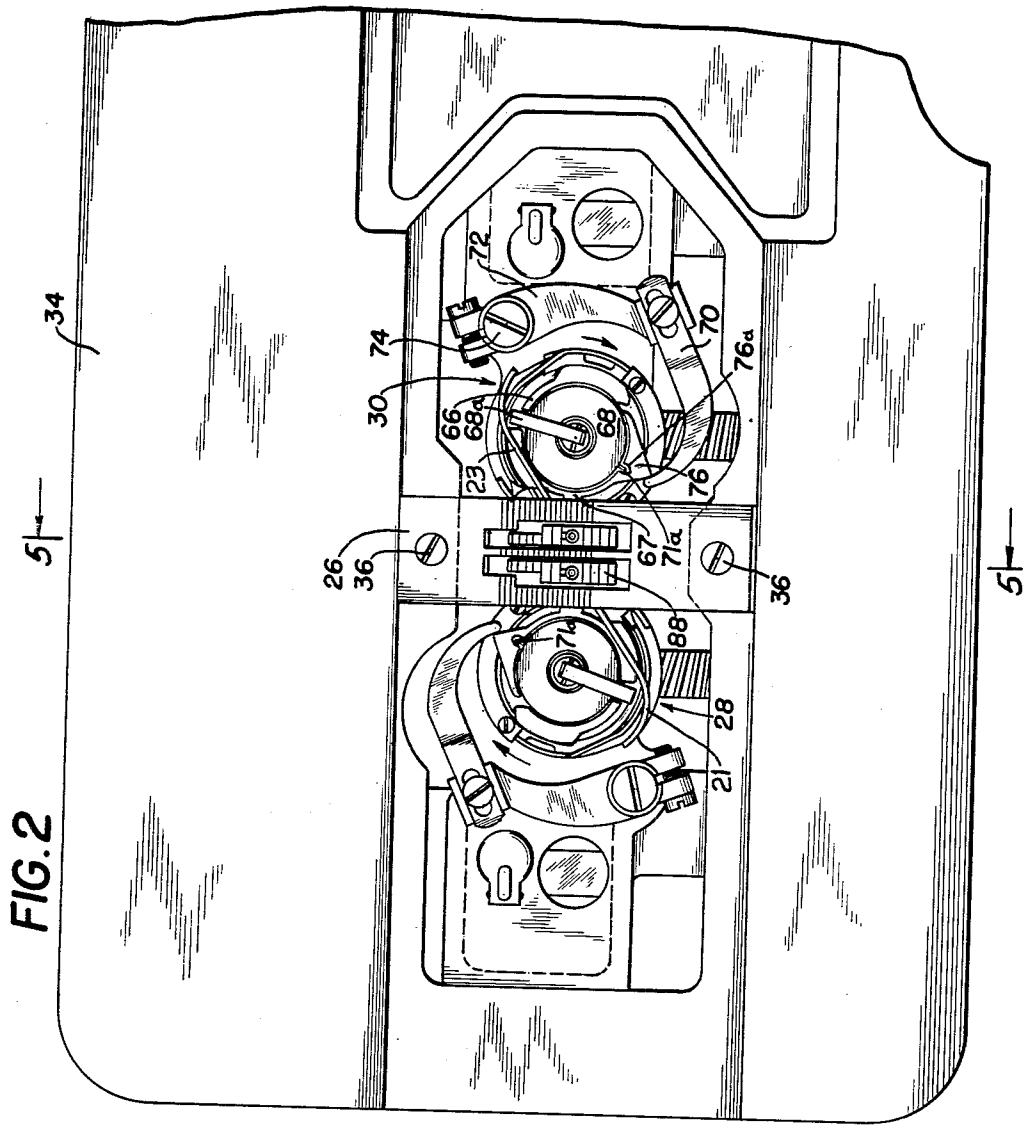


FIG. 2

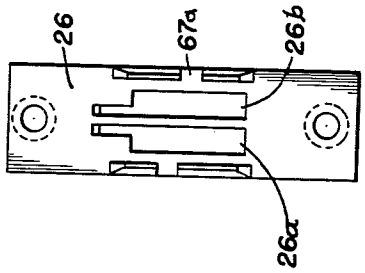


FIG. 3

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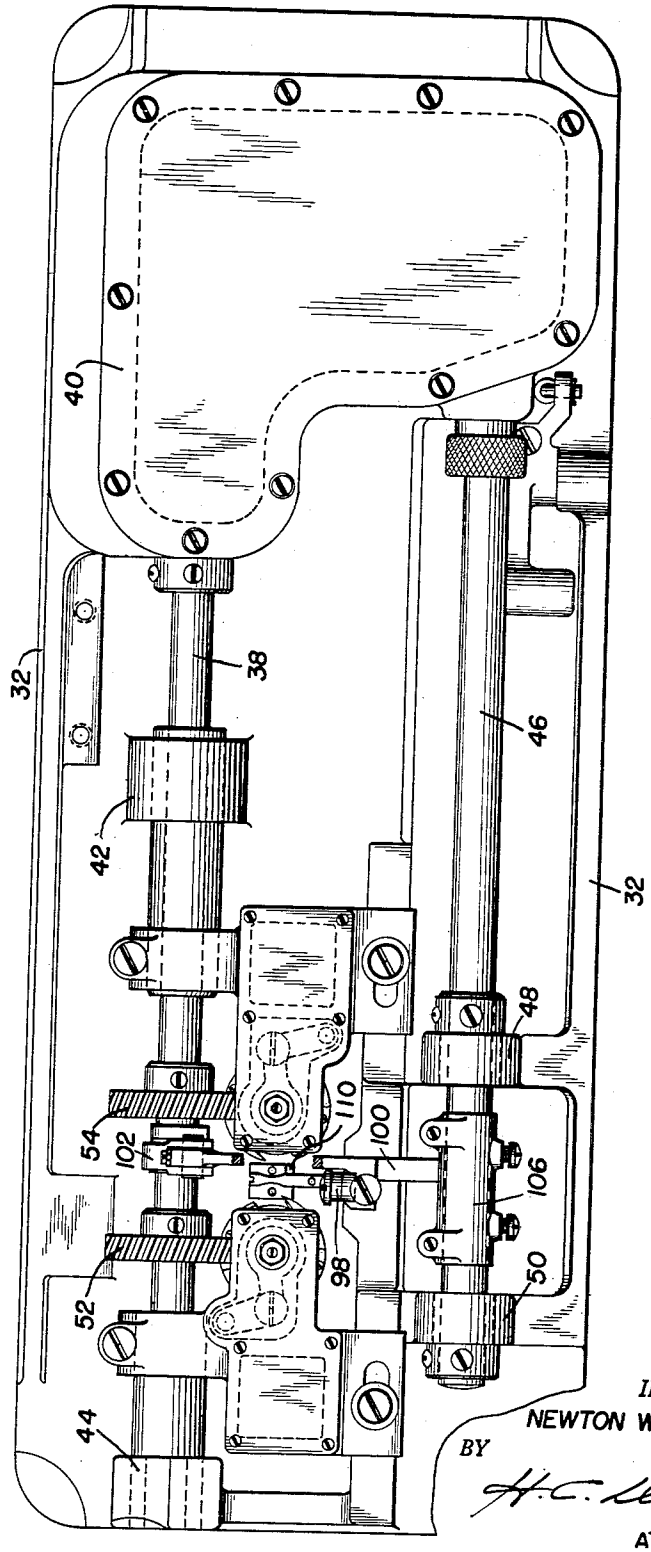
July 12, 1955 N. W. COTTRELL 2,712,802

SEWING MACHINE

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FIG. 4



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SEWING MACHINE

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FIG. 5

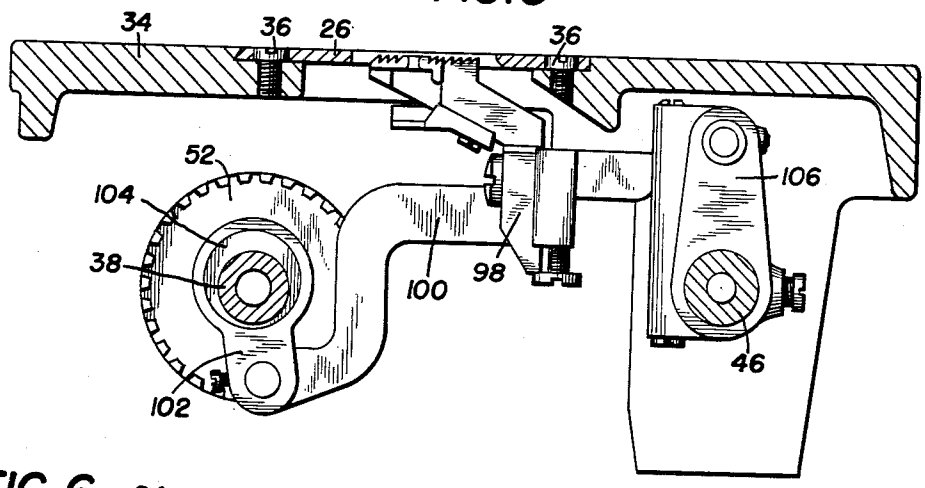


FIG. 6

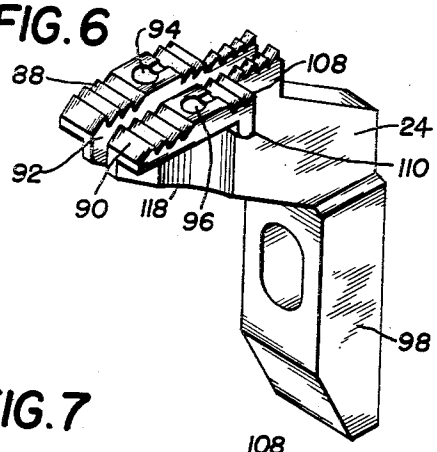


FIG. 8

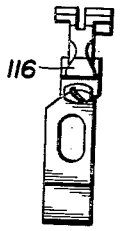


FIG. 9

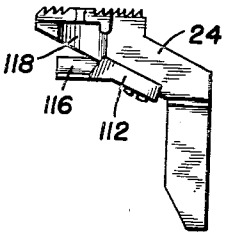


FIG. 7

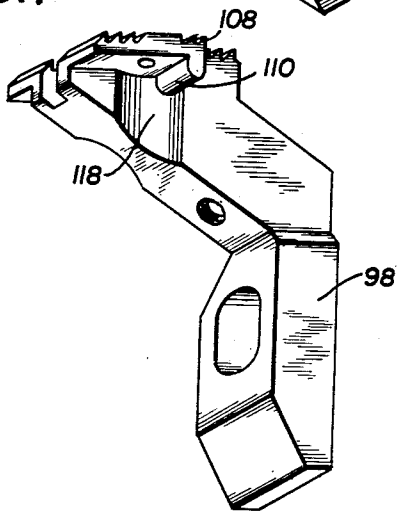
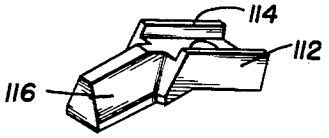


FIG. 10



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United States Patent Office 2,712,802
Patented July 12, 1955

2,712,802

SEWING MACHINE

Newton W. Cottrell, South Bend, Ind., assignor to Union Special Machine Company, Chicago, Ill., a corporation of Illinois

Application January 18, 1952, Serial No. 267,179

6 Claims. (Cl. 112—184)

This invention relates to sewing machines and more particularly to a thread guard for use in a lock-stitch machine of the general type having one or more threaded needles movable through the work and a feed dog which reciprocates with the needle in the line of feed, and a rotary hook cooperating with each needle supported to turn on a vertical axis. It relates especially to a machine of this character in which the needles are oscillated in the line of feed to assist in advancing the work.

The invention is herein disclosed in a preferred form as embodied in a two-needle, needle feed, lock-stitch machine which is in many respects similar to that illustrated in the patent to Quist No. 2,329,484, dated September 14, 1943. In this machine the two needles are moved with the feed dog in the line of feed to assist in feeding the work, and two rotary hooks are disposed one at each side of the needle group and are arranged to rotate in the same clockwise direction about vertical axes. With this arrangement of the needles and rotary hooks, one of the hooks is arranged to engage and draw a loop of needle thread from the needle in the direction of feed, while the other hook engages and draws the loop of needle thread forwardly in a direction opposed to the direction of feed. The machine is constructed and arranged to operate at a recommended maximum speed of about 4,000 stitches per minute and, since the hooks are given two revolutions to each needle reciprocation, each hook will be driven at a speed of about 8,000 revolutions a minute. At this speed of operation, difficulty has been encountered with breakage of the needle thread associated with the right hand needle and its cooperating rotary hook which seizes the loop from the needle and throws it rearwardly in the direction of feed. It has been found that the breakage referred to is caused by the unconfined movement of the thread in the needle loop which tends to balloon outwardly as it is thrown at very high speed by the hook as an incident to being seized and drawn around the thread casing. The upper leg of the thread loop is frequently caught on the rear corner of the work engaging surface of the feed dog. Then as the thread is suddenly taken up by the take-up devices, after the loop has been carried half way around the bobbin case, it is drawn across and against the relatively sharp edge of the engaged tooth of the feed dog and is severed thereby.

It is a primary object of the present invention to provide a novel and improved construction and arrangement of the feed dog which, in relation to its associated rotary hook, will positively control and confine the needle loop, as it is drawn by the rotary hook at high speeds, to avoid engagement of the thread with the toothed or serrated work engaging surface of the feed dog and thus prevent cutting or breaking of the thread.

With this and other objects in view as may hereinafter appear, a feature of the invention consists in the improved construction and arrangement of the feed dog associated with the rotary hook which takes its needle loop from the needle rearwardly in the direction of feed, said dog having formed on the underside and at the rear edge of the laterally extending serrated cloth engaging portion thereof a downwardly projecting lug, which acts to confine and to direct the needle thread loop, that is formed at the beginning of the upward movement of the needle for seizure by the rotary hook, in a path away from and substantially below the level of the cloth engaging surface of the feed dog.

Other objects and corresponding advantages of my invention will appear from the following detailed description of the drawings, in which:

Fig. 1 is a detail view, in vertical section, taken transversely of the line of feed through the axis of the vertical hook unit looking toward the rear of the machine, illustrating particularly the arrangement of the needles, feed dog and the right hand rotary hook assembly, including the hook which takes its loop from the needle while traveling rearwardly in the direction of feed;

Fig. 2 is a plan view of the machine but with the cover plates removed to illustrate particularly the arrangement of the feed dog and cooperating rotary hook assemblies;

Fig. 3 is a bottom plan view of the throat plate of the machine shown in Fig. 2;

Fig. 4 is a bottom plan view of the machine base, illustrating particularly the rotary hook and feed dog actuating mechanisms;

Fig. 5 is a vertical sectional view, taken substantially along the line 5—5 of Fig. 2, illustrating particularly the feed dog and the actuating mechanism therefor largely in elevation;

Figs. 6 and 7 are isometric views on an enlarged scale of the feed dog as seen from different angles;

Fig. 8 is a detail view in front elevation, on the scale of Fig. 5, of the feed dog and needle guard associated therewith;

Fig. 9 is a view in right side elevation of the feed dog and needle guard assembly shown in Fig. 8; and

Fig. 10 is an isometric view of the needle guard on a somewhat larger scale.

Referring specifically to the drawings in which only so much of the machine is shown as is believed necessary to illustrate the connection of the present invention therewith, the machine comprises two needles **20** and **22**, Fig. 1, which operate in unison and are passed downwardly through apertures formed in a feed dog **24** which is given a four-motion movement with respect to a stationary throat plate **26**. Separate work engaging portions of the feed dog pass upwardly through openings **26***a* and **26***b* in the throat plate. Two rotary hooks **28** and **30** are provided slightly beneath the plane of the under face of the throat plate, these being supported to turn on vertical axes and arranged respectively at the left and right of the feed dog assembly to cooperate with the needles **20** and **22**, respectively. In accordance with the disclosure of the patent to Quist above referred to, the work is preferably advanced by the cooperative movement of the needles and feed dog which are moved forward and back in the line of feed. The rotary hooks are driven in unison in a clockwise direction, as shown in Fig. 2, at a two-to-one ratio with the needle reciprocation. The rotary hooks **28** acts to take the loop **21** of needle thread from the needle **20** as the loop seizing beak of the hook is moving forwardly in a direction opposed to that of the work feed. The rotary hook **30** rotated in the same direction takes its loop **23** of needle thread from the needle **22** while the needle seizing beak of this hook is moving rearwardly in the direction of work feed. It will be understood that this seizing of the needle loops takes place as the needle threads are slack and bowed outwardly by the slight upward movement of the needles.

A portion of the machine base, including the driving connections for the feed dog and rotary hooks, is shown

in the drawings and comprises a framework **32**, Fig. 4, providing a work supporting plate **34**, on which is mounted the throat plate **26** held in place by screws **36**. The driving connections including a horizontally disposed drive shaft **38** which projects from a gear housing **40**, generally indicated in Fig. 4, that is supported along its length by suitable bearing lugs **42** and **44**. It will be understood that the shaft **38** may be driven, through suitable gearing, from a main driving shaft in the overhanging arm of the machine, as shown in said patent to Quist. A rock shaft **46** is mounted in the base, in parallel relation to shaft **38**, and is driven from the upper main shaft by connections similar to those disclosed in said Quist patent. It is supported toward its outer end in bearing lugs **48** and **50** carried by the framework **32**. The rotary hooks **28** and **30** are continuously driven from the shaft **38** by means of two identical spiral gears **52** and **54** secured to said shaft. Spiral gear **54** meshes with a spiral gear **56**, Fig. 1, carried on a vertically disposed shaft **58** in the hook unit from which is driven the rotary hook **30**. It will be understood that hook unit **28** is of opposite hand but is driven in the same manner and is of substantially the same construction.

Inasmuch as the driving and supporting assemblies for each of the rotary hooks **28** and **30** are substantially identical, the supporting and driving assembly for the hook **30** only will be described. As shown in Fig. 1, the vertically disposed drive shaft **58** is mounted within a pair of bushed bearings **60**, **62** carried by a bracket **64** suitably secured to the base of the machine. Within the rotating component of the hook, at the upper end of the assembly, is mounted the usual thread case **66** (Fig. 2) which is held in position axially within the rotary component of the hook by the usual rib and groove construction and is prevented from rotating by cooperation of a projection **67** with a notch **67***a* in the underface of the throat plate. A bobbin **68** carrying the stitch locking thread is mounted on a spindle at the center of the thread-case and is retained therein by a spring arm **68***a*. Conventional hook opener means are provided for shifting the thread case in a counterclockwise direction at the appropriate time in a stitch forming cycle to facilitate passage of the needle thread between the cooperating faces of the projection **67** and the notch **67***a*. This comprises a finger **70** adjustably mounted on an arm **72** secured to a rock shaft **74** that is rocked at an appropriate time in the cycle. The free end of the finger **70** cooperates with a projection **76** of the thread case to accomplish the indicated purpose.

As the needle loop **23** is carried around the thread case by the rotary component of the hook it incorporates within the loop a portion of the stitch locking thread **69** supplied from the bobbin **68**. This bobbin thread is drawn from the bobbin under a suitable tension that is provided in one or both of two ways. It passes outwardly through a suitable aperture in the thread case and then passes a slight distance circumferentially of the outer face of the thread case beneath a spring element **71**. The outer end of this element is bent inwardly through an opening **66***a* in the thread case and is provided with a finger **71***a* that is extended upwardly into a position in which it bears upon the periphery of the upper disk or flange of the bobbin **68**. Projection **76** of the thread case is notched at **76***a* to accommodate the upper end of the finger **71***a*. By means of the usual adjustment screw **71***b* the friction force upon the bobbin provided by the finger **71***a* at the end of the spring element **71** may be varied as desired to provide an appropriate braking action for the bobbin. If desired, the spring element **71** may also impart direct frictional resistance to the bobbin thread as it passes between the element and the outer face of the thread case.

As generally indicated in Fig. 1, lubrication of the hook assembly is effected by means of a spirally grooved core pin **78** mounted within an axial bore in the hook drive shaft **58**, oil being forced upwardly through the bore of the hook shaft by the viscous pump action of the core pin and the wall of the shaft bore. The lubricant is fed by gravity from a lubricant reservoir **80** through a filter **82** secured to the bottom of the reservoir, thence through a conduit **84**, and past a restriction provided by a throttling valve **86** disposed immediately below the grooved core pin **78**. Inasmuch as the details of the hook assembly and of the lubricating devices therefor are known in the art, and form specifically no part of the present invention, no further description or illustration thereof is believed necessary.

The feed dog **24** of the illustrated construction, as best shown in Figs. 6 and 7, comprises a body portion which extends obliquely upwardly and forwardly in the direction of feed and is formed with two spaced, toothed, cloth engaging portions **88** and **90** that are separated by a slot **92**. These toothed portions of the dog are flanged outwardly from the body portion of the feed dog **24**. The flanged cloth engaging portions **88** and **90** of the feed dog are provided, respectively, with needle receiving apertures **94** and **96** through which the needles are passed into cooperating relation with the respective hooks during each reciprocation of the needles. The toothed cloth engaging portions **88** and **90** of the feed dog **24** are constructed and arranged to pass upwardly through the slots **26***b* and **26***a*, respectively, provided in the throat plate **26**.

The feed dog **24** is formed with a downwardly extending shank portion **98** which is secured to a vertically extending portion of a horizontally disposed feed-bar **100** that is, in turn, supported and actuated to impart a four-motion feeding movement to the feed dog. As best shown in Fig. 5, the feed-bar **100** is pivotally connected at its forward end to a downwardly extending eccentric strap **102** carried on an eccentric **104** on the drive shaft **38**. At its rear end the feed-bar **100** is pivotally connected with an upstanding feed rocker **106** carried by the rock shaft **46**. Reference may be had to said Quist patent for further details as to the feed-bar actuating means.

It will be understood that the motion imparted to the feed dog by the connections above referred to are synchronized with the needle actuating mechanism, not specifically illustrated, to cause the feed dog **24** to move in a forward and back direction with the needles, the downward and forward movements of the feed dog taking place while the needles are withdrawn from the work and while the hooks are engaged in drawing the needle thread loops around the respective thread cases **66**.

An important feature of the present invention consists in the provision on the feed-dog of positively acting means for controlling and for directing the upper leg of the loop **23** of needle thread, that is seized by the rearwardly moving beak of the hook **30**, in a path away from the rear edge of the toothed work engaging face of the feed dog. In the operation of the machine it appears that the needle thread engaged by the rapidly moving rotary hook, is ballooned outwardly and upwardly at the same time that the feed dog moves downwardly and in the return direction opposed to the direction of travel of the hook beak. These relative movements of the hook and feed dog, as the needle loop is drawn rearwardly by the hook, taken in connection with the fact that the feed dog at this time occupies one of its lowest positions with relation to the work support, causes the upper leg of the needle loop to be brought into engagement with the toothed rear edge of the surface **90** of the feed dog, particularly at the corner indicated at **108** in Figs. 6 and 7, when the special guard means of the present invention are not provided. Whenever the needle loop is thus caught on the corner of the feed dog, the thread is subjected to wear and a severe strain as the loop is quickly drawn from the thread case by the usual take-up devices. This occurs after the loop has passed slightly more than half way around the thread case and

is drawn up by the take-up means to form and tighten the stitch. Breakage frequently occurs as the part of the loop engaged with the feed dog is suddenly pulled tight.

To confine the thread within closer limits and to direct the ballooning tendency thereof away from the upper edge of the feed dog **24**, a lug **110** is formed on the underside of the flanged portion **90**, this lug extending transversely along the rear edge of the portion **90** and beneath the corner designated at **108**. The needle thread when engaged by the hook beak now travels from the underside of the aperture **96** in the work engaging surface **90** around or beneath the lug **110** and thence to the hook along the horizontal path shown in Fig. 1, thus eliminating any tendency of the thread to balloon upwardly, and at the same time causing the thread to be positively retained in a position substantially below the level of the rear corner **108** of the work engaging surface.

No comparable difficulty has been encountered in the operation of the left hand rotary hook **28**, due to the fact that the needle thread loop for this hook is carried forwardly by the beak of this hook as the loop is seized. The distance from the needle opening **94** to the forward end of the part **88** of the feed-dog appears to be great enough to prevent catching of the needle thread loop on the forward corner of part **88**. However, a corresponding needle loop guard may be provided, if desired, on the flanged portion **88** of the feed-dog. It will be understood that, if this is done, a lug similar to the lug **110** will be applied to the forward underedge of the outwardly flanged portion **88** of the feed dog, which would similarly control the ballooning of the thread loop taken by the beak of hook **28**.

The illustrated machine is further provided with an improved needle guard generally designated at **112**. This needle guard is channeled at **114** to fit snugly against the underedge of the inclined body portion of the feed dog **24** to which it is secured, and is provided with a forwardly extending wedge-shaped projection **116** which is located between the paths of the two needles **20**, **22** and acts to prevent lateral displacement of the needles toward one another, and to insure the correct positioning of the needles with relation to the beaks of the hooks for the seizing of the needle thread loops. As shown at **118**, each face of the body portion of the feed-dog is provided with a concave recess to supply adequate clearance for the needles and their threads as the needles pass through the openings **94** and **96** into cooperation with the hooks.

It will be understood that the machine embodying the foregoing improvements will be provided with the customary mechanisms and adjuncts to be found in machines of the character disclosed to render the same capable of functioning properly. Thus, mechanism of the type disclosed in said Quist patent will be provided to impart the up and down movements of the needles and to impart the desired needle-feed movements thereto along the line of feed. All of the operative devices of the machine which serve to form the lock stitches and to advance the work are driven in coordinated relation by suitable connections from the main driving shaft which preferably extends longitudinally of the overhanging arm of the machine and is driven through the usual combined handwheel and pulley. For further details as to the construction and operation of the machine as a whole, reference may be had to the application of Norman V. Christensen, Serial No. 695,426, filed September 7, 1946, and the patent to Sauer No. 2,386,349, granted October 9, 1945.

While a preferred embodiment of the invention in a sewing machine has been described in some detail, it will be understood that various changes may be made in the construction and arrangement of the several parts within the scope of the appended claims.

What is claimed is:

1. In a needle feed lockstitch sewing machine having a machine frame including a work supporting surface, a thread carrying needle reciprocable through the work supporting surface, a feed dog having a four-motion feed and return movement, said feed dog being formed with a supporting shank and a toothed work engaging portion extending laterally from said shank and longitudinally in the direction of feed and apertured to receive the needle, a vertical axis rotary hook disposed beneath the work supporting surface at one side of the line of feed rotating in a direction to seize and to throw a loop of needle thread from the needle rearwardly in the direction of feed in the region of said work engaging portion of the feed dog, and means for confining the needle loop drawn rearwardly from the needle by the hook which comprises a downwardly projecting thread engaging lug formed on the underside of the work engaging portion of the feed dog in rear of the needle receiving aperture therein and in the path of movement of said needle thread loop.

2. In a needle feed lockstitch sewing machine having a machine frame including a work supporting surface, a thread carrying needle reciprocable through said work supporting surface, a vertical axis rotary hook disposed below the work supporting surface rotating in a direction to seize and to throw a loop of needle thread from the needle rearwardly in the direction of feed, and a feed dog formed with a supporting shank and a toothed outwardly flanged work engaging portion extending longitudinally in the direction of feed and apertured to receive the needle, means for rotating the hook to cause it to seize the needle thread loop and carry it rearwardly beneath said work engaging portion of the feed dog, means imparting a four-motion feed and return movement to the dog synchronized with the movement of said hook, and means for confining a needle loop drawn rearwardly in the direction of feed from the needle by the associated hook which comprises a downwardly projecting thread engaging lug formed on the underside of and adjacent the rear edge of the associated outwardly flanged portion of the feed dog in the path of movement of the needle thread loop.

3. In a needle feed lockstitch sewing machine having a machine frame including a work supporting surface, a thread carrying needle reciprocable through the work supporting surface, a vertical axis rotary hook disposed below the work supporting surface at one side of the line of work feed to seize and to throw a loop of needle thread from the needle initially in the line of work feed, a feed dog formed with a supporting shank and a toothed work engaging portion extending laterally from said shank and longitudinally in the line of work feed and apertured to receive the needle, means for rotating the hook and for imparting a four-motion feed and return movement to the dog synchronized with the rotation of the hook, and means for confining the needle loop drawn from the needle and thrown in the direction of work feed by the hook which comprises a downwardly projecting thread engaging lug having a rounded lower edge and formed on the underside of and adjacent the end of said work engaging portion toward which the loop is drawn from the needle and thrown.

4. In a two-needle, needle feed lockstitch sewing machine having a machine frame including a work supporting surface, two thread carrying needles reciprocable through said work supporting surface, a pair of vertical axis rotary hooks disposed below the work supporting surface, means rotating said hooks in unison in the same direction, a feed dog comprising a main body having parallel toothed work engaging portions flanged outwardly from each side at the top of the main body and apertured to receive the needles, means imparting a four-motion feed and return movement to the dog synchronized with the rotation of the hooks, each of said hooks being arranged to seize a loop of needle thread from one of said needles and throw the same in a direction along the line of feed, one of said hooks serving to throw its needle loop in the direction of feed, and means for confining the

needle loop thrown in the direction of feed from one of said needles by the associated hook which comprises a downwardly projecting thread engaging lug having a rounded lower edge and formed on the underside of the associated outwardly flanged portion of the feed dog in rear of the needle receiving aperture therein and disposed in the path of the loop so thrown.

5. In a two-needle, needle feed lockstitch sewing machine having a machine frame including a work supporting surface, two thread carrying needles reciprocable through said work supporting surface, a pair of vertical axis rotary hooks disposed below the work supporting surface at opposite sides of the respective needles continuously rotating in the same direction, a feed dog formed with a supporting shank and spaced work engaging portions associated with the two needles and extending laterally from said shank and longitudinally in the direction of feed, each of said portions being apertured to receive the associated needle, means for rotating the hooks and actuating the feed dog in timed relation, each of said hooks being arranged to seize a loop of needle thread from one of said needles and throw the same in a direction along the line of feed, one of said hooks serving to throw its needle loop in the direction of feed, and means for confining needle loop thrown by said one of said hooks from the associated needle which comprises a downwardly projecting thread engaging lug formed on the underside of and at that end of the associated work engaging portion of the feed dog toward which the needle loop is thrown by the hook and disposed in the path of the loop so thrown.

6. In a needle feed lockstitch sewing machine having a machine frame including a work supporting surface, a thread carrying needle reciprocable through the work supporting surface, a feed dog having a four-motion feed and return movement, said feed dog being formed with a supporting shank and a toothed work engaging portion extending laterally from said shank and longitudinally in the direction of feed and apertured to receive the needle, a vertical axis rotary hook disposed beneath the work supporting surface at one side of the said feed dog, means for rotating said hook in a direction to seize and to throw a loop of needle thread from the needle rearwardly in the direction of feed, and guard means disposed in the path of said needle loop and associated with said feed-dog at the underside of said work engaging portion for confining the needle loop as it is thrown rearwardly from the needle by the hook and directing it away from the toothed upper surface at the rearward end of said portion.

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