Nov. 21, 1961 F. LUTZ ET AL 3,009,430

OVEREDGE SEWING MACHINES

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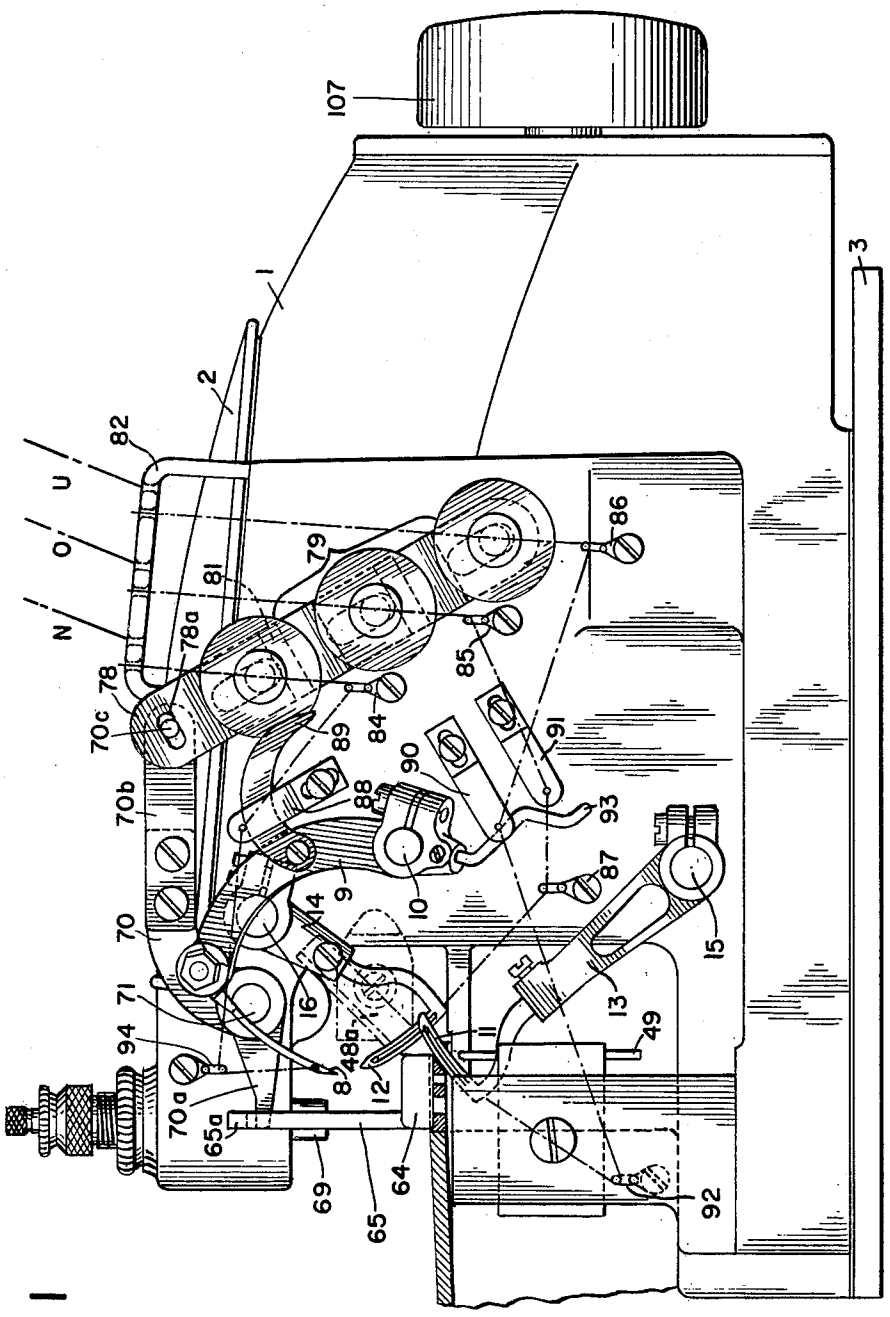


FIG. 1

OVEREDGE SEWING MACHINES

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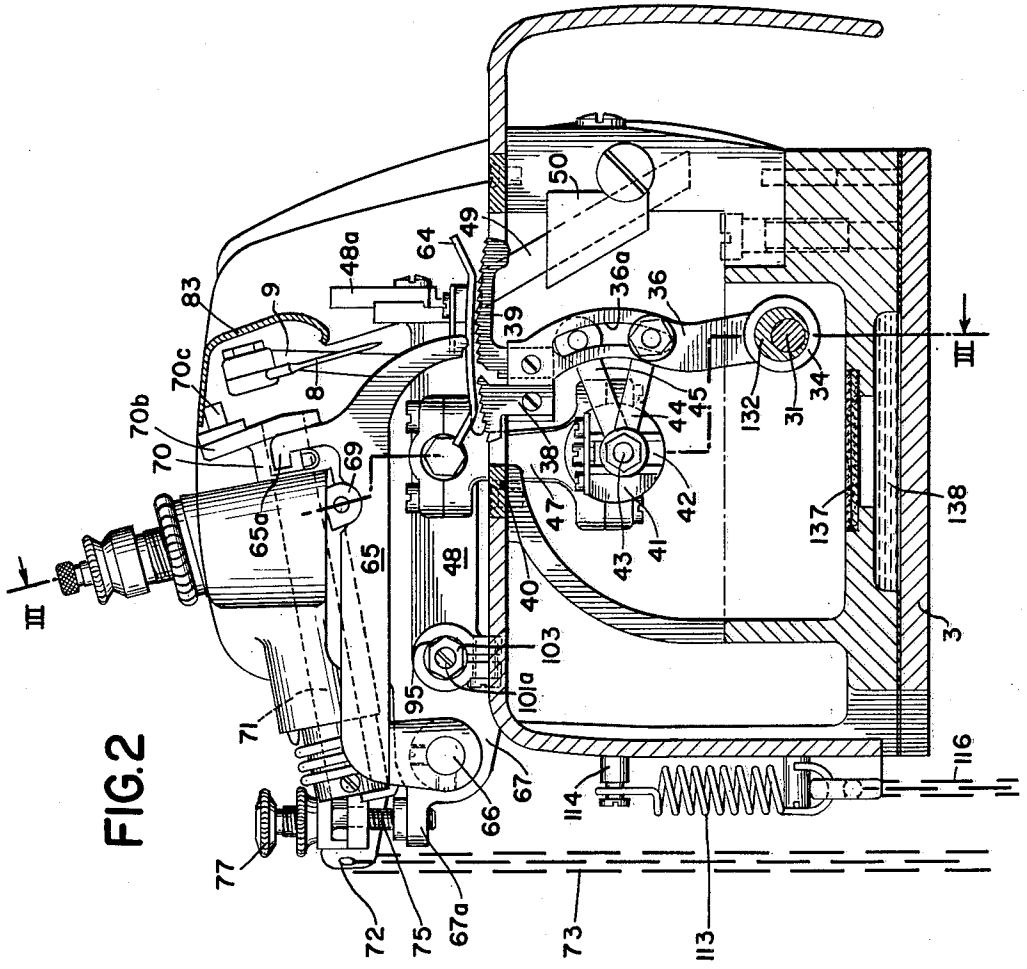


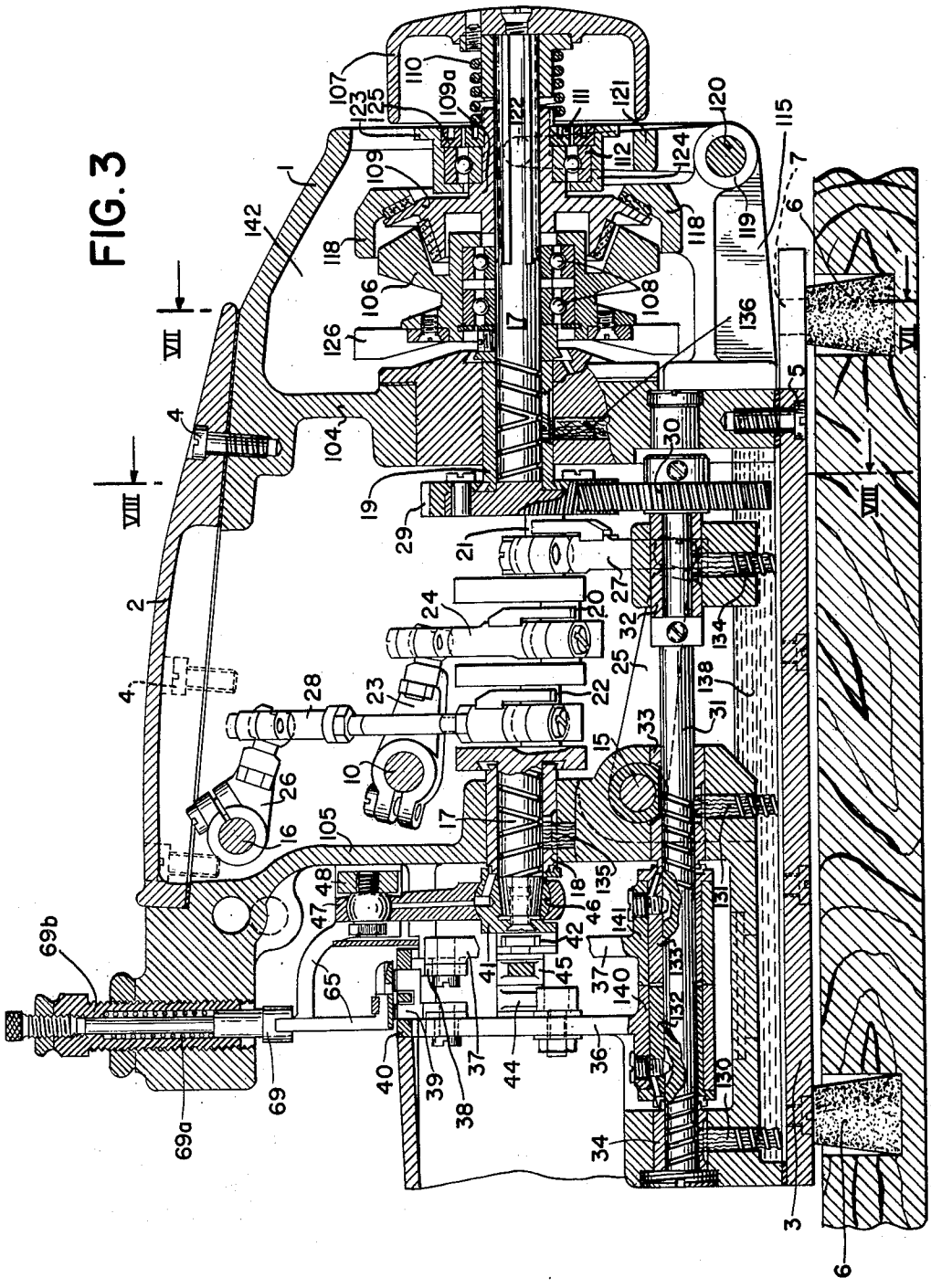
FIG.2

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FIG. 3



OVEREDGE SEWING MACHINES

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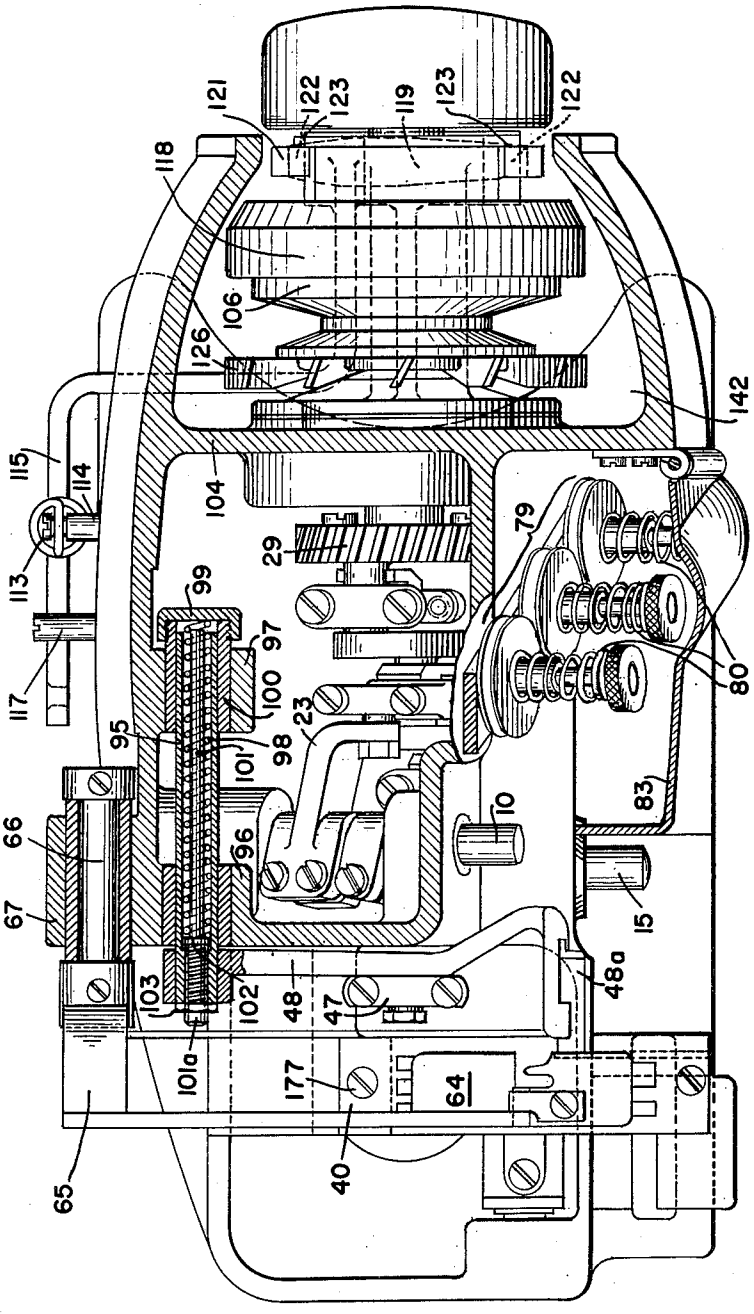


FIG.4

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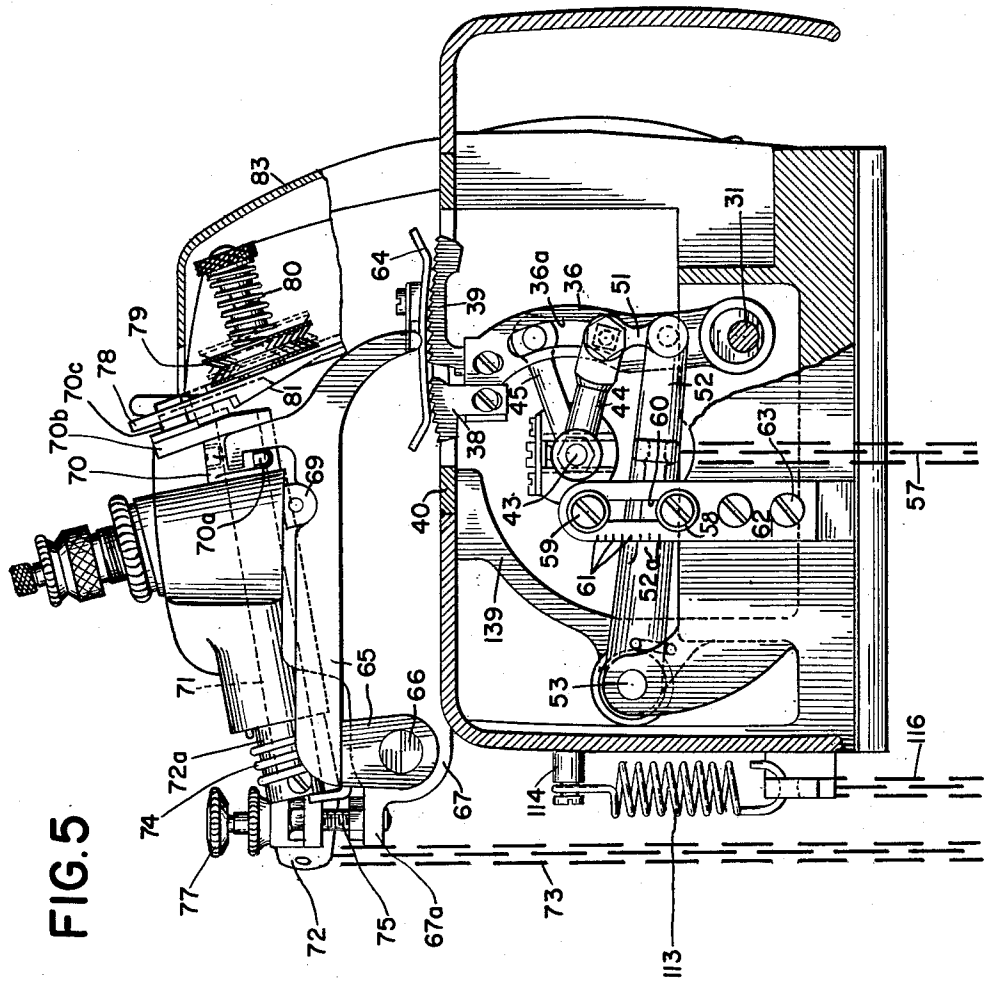


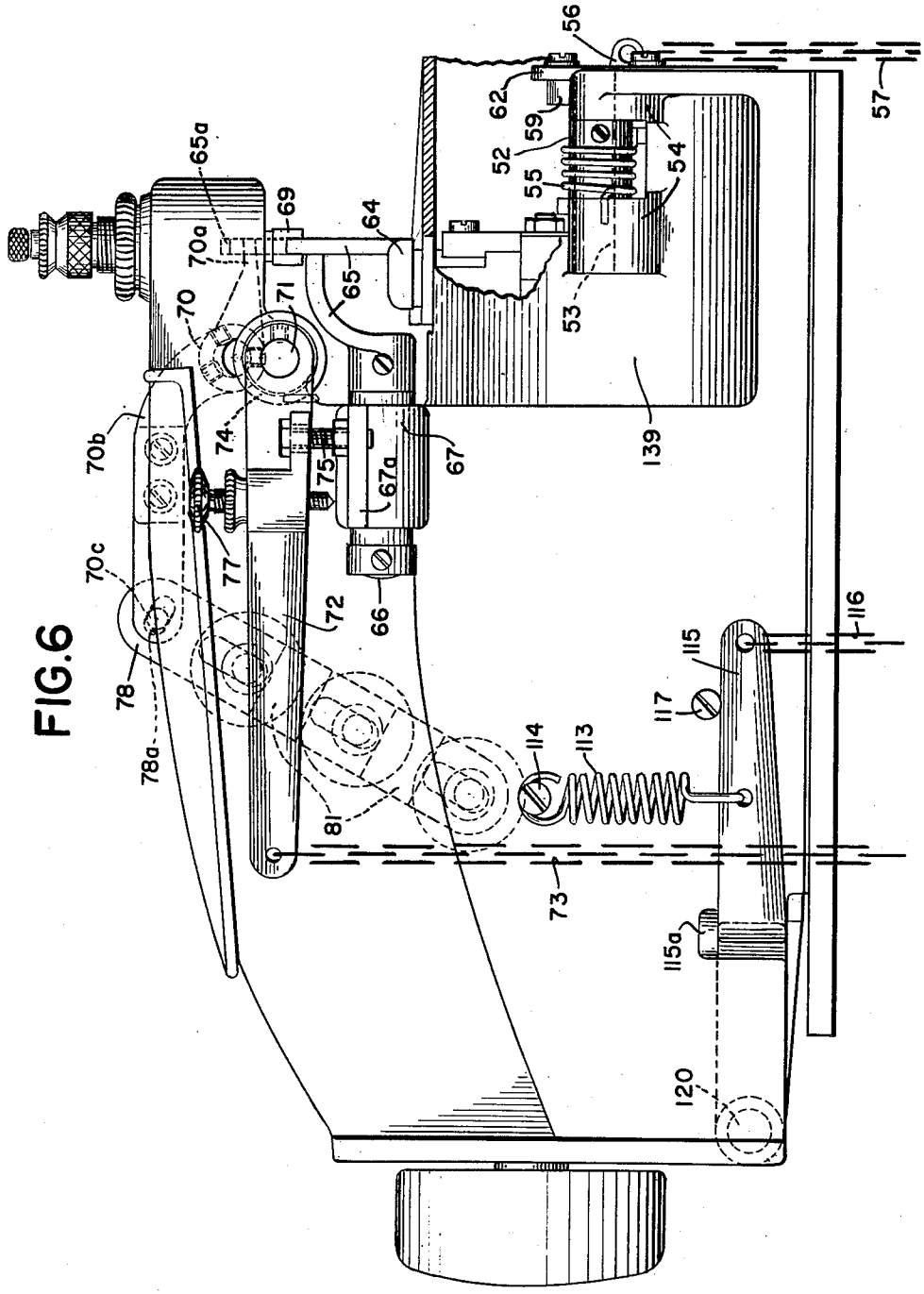
FIG. 5

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FIG.6



OVEREDGE SEWING MACHINES

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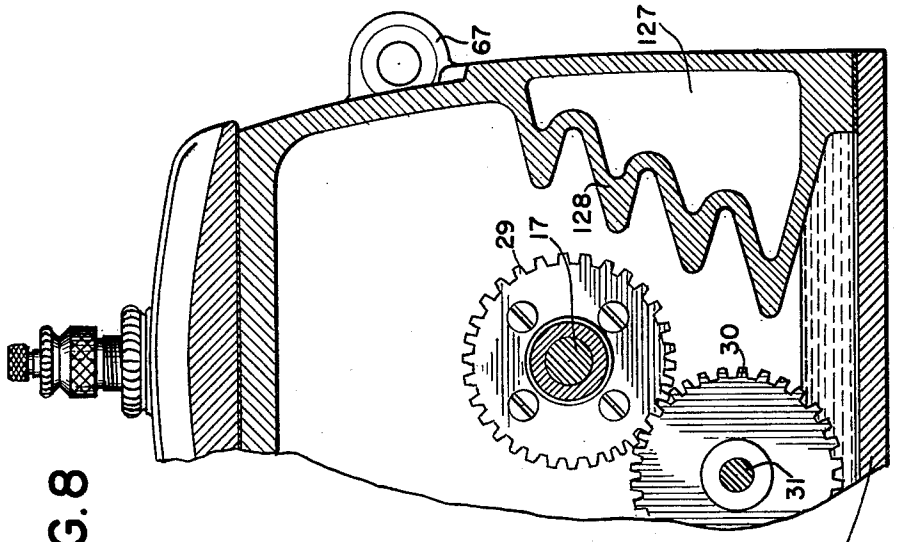


FIG. 8

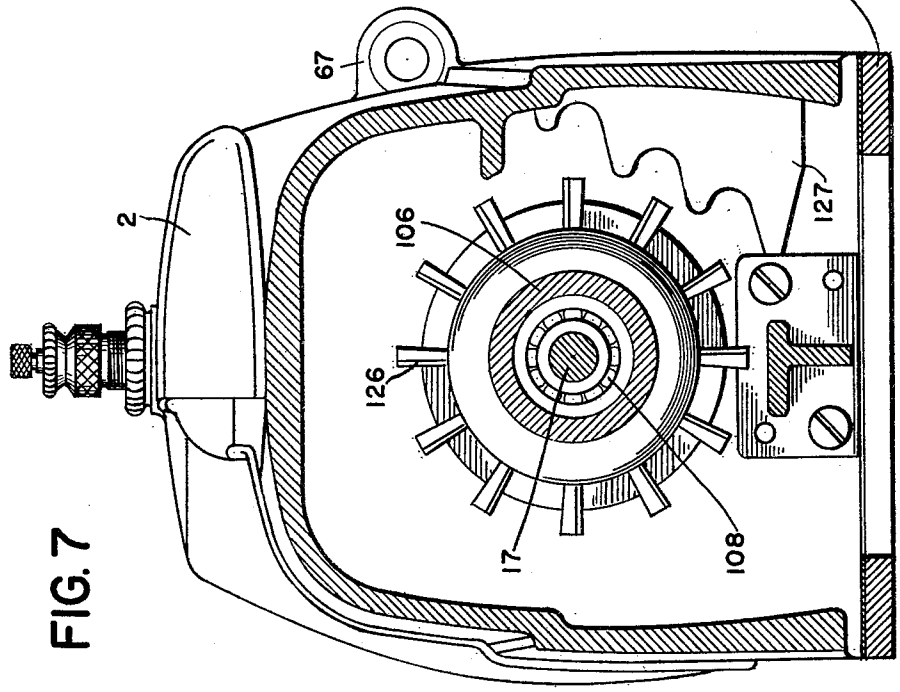


FIG. 7

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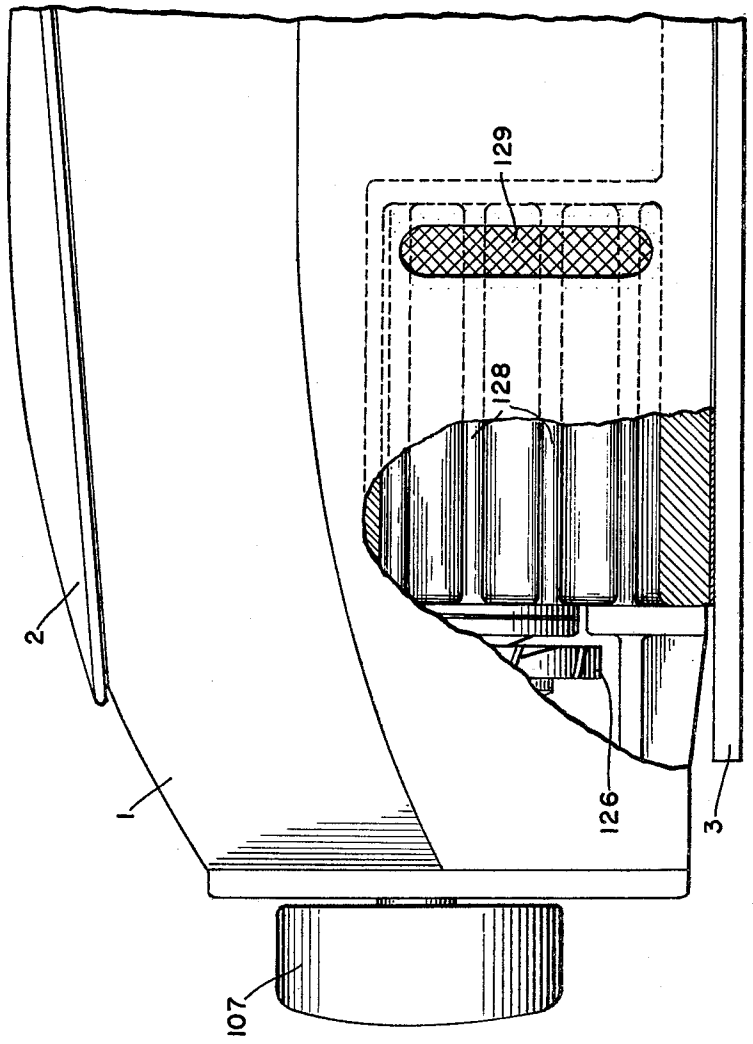


FIG.9

United States Patent Office 3,009,430 Patented Nov. 21, 1961

3,009,430

OVEREDGE SEWING MACHINES

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Filed Mar. 6, 1956, Ser. No. 569,913
Claims priority, application Germany Mar. 12, 1955
15 Claims. (Cl. 112—162)

This invention relates to a high speed everedge sewing machine and in particular to such a machine having a curved needle as one of the stitch forming devices.

A primary object of the invention has been to simplify the movements of all of the driven parts of the machine, particularly the stitch forming devices and the driving connections therefor. As a result the maximum permissible speed of operation of the machine has been considerably increased with corresponding increase in the capacity of the machine to provide a uniform and highly satisfactory overedge stitch.

Various means have heretofore been proposed for the purpose of increasing the permissible speed of overedge sewing machines. However, all of the constructions heretofore suggested or developed for this purpose have been subject to certain objections and disadvantages. One objectionable feature has been that certain of the operating elements, such as the stitch forming devices, work feeding devices, and edge trimming devices, have heretofore been given different types of movement. A number of these operating devices have been required to carry out a composite motion. In many prior overedging machines the needle has been given a reciprocatory movement along a straight line. This has required relatively complicated and heavy driving connections. While some overedge machines have been provided with a curved needle arranged to be given a simple swinging motion, these have all required a compound motion of some character to be imparted to at least one of the loopers. In some instances both loopers have been given reciprocatory movement along a straight line and, in addition, one of the two loopers has been given a swinging motion. As a result, all prior overedge sewing machines have involved relatively complicated mechanisms for imparting the necessary movements to the various stitch forming devices and because of this they have not been capable of operating at truly high speeds.

In accordance with the present invention full recognition is given to the fact that the most simple type of construction is one in which the various stitch forming devices are subjected merely to a swinging motion around a fixed axis. A construction of this character is more reliable in its action, less subject to wear, and requires a smaller expenditure of power for the operation of the devices than any other type.

An important feature of the invention has, accordingly, been to provide essentially only simple swinging motions to all of the work performing instrumentalities and particularly the stitch forming devices. In the achievement of this result it has been necessary to arrange the various stitch forming devices in a particular relationship with respect to each other. Also, the other work performing instrumentalities, such as the feed dog and moving cutter blade for the trimming of the edge of the work, have been arranged in a novel relationship to the other devices so that these instrumentalities are given essentially simply a swinging movement in performing their work.

As a result of the foregoing, there is achieved in accordance with the invention a substantial simplification of the driving connections from the main drive shaft of the machine to the various work performing instrumentalities. This has resulted in a considerable reduction in the weight of the moving parts, thereby enabling high speed operation of the machine. Moreover, it has been possible to confine the operating mechanism to a smaller space so that a smaller and lighter weight frame and enclosed housing may be employed. The elimination of various linkages and the general reduction in size and weight of the machine has also made it more economical to produce.

As a special feature of the invention the needle and the upper and under loopers are each arranged to be driven from only one crank on the main drive shaft. Each of the stitch forming devices has an arm or carrier which is arranged to swing on or about the axis of a supporting shaft and each carrier is connected with the main drive shaft, for operation thereby, through a single link or pitman connected with an arm extending from the carrier or its supporting shaft. This results in relatively short and simple connections from the main drive shaft to the stitch forming devices. Furthermore, the arrangement is such that the lubrication of all of the devices and their driving connections and bearings is greatly simplified and is readily accomplished from within the machine housing, thus eliminating the necessity of externally accessible oil holes and lubrication of certain parts by hand.

Another special feature of the invention is the provision of cranks on the main drive shaft, all of which have the same throw for operating the various stitch forming devices, thus simplifying the manufacture of the crank shaft. The three stitch forming devices, i.e., the needle and the two loopers, are given substantially the same length of movement in the course of forming a stitch. The holders or carriers for the needle and loopers are each in effect a two-armed lever, the arms of which are so proportioned that substantially the same extent of movement is imparted to each of the devices. A particular advantage of this is that substantially the same moments of inertia are provided for the driving connections for the several stitch forming devices. In prior constructions, on the other hand, the drive for the upper looper has imposed a substantially higher load on the main drive shaft than the drives for the needle and under looper. It will be appreciated that the permissible speed of operation of the machine is limited by the most heavily loaded driving connection and, therefore, by insuring substantially the same load for the various driving connections a considerably higher speed of operation is made possible with balanced operation of the machine. As a further advantage of the simple and direct driving connections for the needle and the two loopers, the arrangement is such that these devices may be adjusted more easily and more accurately than in machines having more complicated driving connections.

A particular feature of the machine, which makes possible the simple driving connections and movements discussed above, is the arrangement of the needle carrying lever in such a way that the curved needle swings in a direction transverse to the line of stitch formation. This arrangement, in a curved needle overedger, brings about surprising simplification of the driving connections and the movements of the several stitch forming devices. In addition ot the simplification of the driving connections the arrangement mentioned has the advantage that the needle carrying lever will be made longer than in prior constructions with the result that the needle itself need be given only a slight curvature so that it will not bend or flex as easily as curved needles employed in connection with prior constructions. Moreover, the arrangement of the present invention is such that as the needle enters the work it is stressed in a direction in which it has its greatest resistance to bending, due to the I-beam or double T cross-sectional shape of the needle. This shape, it will be understood, is due to the fact that the needle has a thread groove in the direction of stitch formation and also in the opposite direction. As a result of this

the cross-section of the needle in the direction of sewing creates a smaller moment of resistance than is created in a direction transverse thereto. In prior curved needle overedge machines, in which the needle lever swings in a plane parallel to the direction of stitch formation, the needle is already sharply bent in that direction and is subjected to stress in the direction of its weaker moment of resistance. For this reason prior curved needle overedge machines have been able to operate only upon lighter materials since the needles have not been able to withstand the strains imparted in the sewing of heavier materials. The machine of the present invention, on the other hand, is well adapted for the sewing of all types of materials at high speeds.

A further advantage of the arrangement of the needle lever in accordance with the invention is that it causes the needle to move to a certain extent toward the loopers so that the latter may be given a somewhat shorter path of movement. This is brought about by the fact that the needle swings in a plane which is not only transverse to the direction of stitch formation, but is inclined backwardly from the vertical in the direction of stitch formation so that the needle enters the work obliquely. The arrangement is such, moreover, that the needle cooperates with the upper looper and lower looper slightly to the right of the needle hole in the throat plate and, therefore, to the right of the line of stitch formation, as viewed in the direction of stitch formation. As a result, the upper looper need not be shifted forwardly along the line of stitch formation and need not be carried fully up to a point in which it intersects the vertical plane containing the line of stitch formation. Its path of movement is, therefore, shortened. Furthermore, the seizing of the needle thread loop by the lower looper takes place at a point to the right of the needle hole, due to the location of the axis of the shaft about which the needle lever rocks, and as a result the path from this point to that at which the upper looper seizes the loop of the lower looper thread is also shortened. This shortening of the looper path permits of increased speed of operation of the machine.

Another important feature of the present invention is the provision of an improved work feeding mechanism. The arrangement is such that the requirement of a separate feed rocker is eliminated. In accordance with the invention each of two feed dogs, a main feed dog and an auxiliary or differential feed dog, is carried by a single arm lever disposed vertically in the base of the machine and arranged to swing in the direction of feed about the axis of a shaft disposed below and parallel to the main drive shaft. The shaft about which the feed dog carrying levers swing carries eccentrics on which the levers are actually rocked and this shaft is driven from the main drive shaft by gear connections within the enclosed frame of the housing. The axis of the shaft is directly below the needle hole in the throat plate and is supported in a plurality of bearing sleeves. At an intermediate point the shaft carries the two eccentrics of the same size and dimension on which the hubs of the levers carrying the feed dogs are rocked. These eccentrics, it will be understood, serve to lift and lower the levers in properly timed relation to lift and lower the feed dogs as they are shifted back and forth along the line of feed. For imparting feed and return movements to the feed dogs there are provided separate links pivotally mounted on a crank pin adjustably carried by a head secured to the end of the main drive shaft. Each of the links is connected at its opposite end to one of the feed dog carrying levers. The head mentioned, which is secured to the end of the main drive shaft, is detachably mounted on a tapered portion of the shaft and is provided with a T-slot in which the crank pin can be adjusted and locked to provide for a variable feed stroke of the feed dogs. As a special feature of the invention the same detachable head is provided with a spherical eccentric portion arranged to drive the movable knife plate of the edge trimming mechanism. The construction of the work feeding and edge trimming devices, in accordance with the invention, is very compact, of lightweight and simple form, and, therefore, economical to manufacture.

Provision is made for varying the stroke of the differential feed dog independently of the main feed dog. For this purpose the lever arm which carries the differential feed dog is provided with an arcuate slot along which a pin carried by the link or pitman extending from the above mentioned operating crank may be shifted. The arrangement is such that the point of connection of the link with the differential feed dog carrier may be varied during the operation of the machine, if desired.

Another feature of the invention is the provision of simple and effective means for shortening the stitch length and increasing the thread tension on the various threads at the beginning and end of a seam in order to lock the same firmly. For this purpose, provision is made for lifting the presser foot slightly at the commencement and toward the completion of the seam so that the feed dog will cooperate with the bottom of the presser foot only during a portion of its normal feed stroke in the formation of these portions of the seam. Lifting of the presser foot for this purpose may be effected by connections from a treadle or knee-press. An adjustable stop is provided for limiting the extent to which the presser foot is lifted and by appropriate adjustment of this stop the effective length of the feed stroke of the feed dog may be varied to any extent desired. A lever or arm which is rocked by the connections from the foot treadle or the like to lift the presser foot simultaneously brings about an increase in the tension on the various threads. For this purpose, the thread tensioning device provided for each thread involves a plurality of discs between which the thread is drawn, these discs being mounted on a bolt or stud surrounded by a spring which creates a desired tension during normal stitch forming operations. The amount of tension applied by the spring may be adjusted by turning a nut or other screw threaded element to shift it axially along the supporting bolt or stud. When the presser foot is lifted an arm of the lever mentioned above shifts a slide, which is provided with camming surfaces arranged to force the tensioning disc on the side away from the spring of each tensioning device toward the other disc a predetermined extent, to increase the force applied by the spring of each tensioning device. This, as will be understood, increases the tension applied to the threads being drawn through the passage between the discs.

As a further feature of the thread tensioning means, these are located in accordance with the invention in a position easily accessible to the operator at the front of the machine but within a recessed portion of the frame so as not to extend beyond the normal profile of the frame. A protective cover or door is provided over the recessed region in which the thread tensioning devices are mounted.

The novel arrangement of the various devices incorporated in the machine of the present invention is such that the needle and loopers are readily accessible at all times for threading purposes and the like. It is unnecessary, as in prior machines, to shift the presser foot away from its normal operating position to provide access to the stitch-forming devices. Also the thread take-up devices for the needle and looper threads are located in a readily accessible position within the recessed region of the frame which carries the thread tensioning devices. Accordingly, access to all of these parts may be had by simply swinging open the cover or door mentioned above.

A still further feature of the invention, which assists in increasing the capacity of the machine and simplifies the devices for operating the machine is the provision of a special clutch arrangement within the machine itself for coupling the driving pulley with the main drive shaft of the machine. This eliminates the necessity of a special motor and clutch unit, of the type commonly designated an electric transmitter, and enables the use of a simple

electric motor. The clutch provided within the machine itself involves a combined flywheel and pulley member arranged for connection by a V-belt with the electric motor, this pulley member being freely rotatable on the main drive shaft of the machine. Cooperating with the pulley member is a friction clutch element which is keyed to the main shaft of the machine and is shiftable axially along the same to engage a friction surface on the clutch element with a friction surface on the pulley so that the clutch element and the main drive shaft will be driven from the pulley. A spring surrounding the main shaft of the machine normally urges the clutch element toward the pulley to connect the friction surfaces but a second spring, which is stronger than the first mentioned spring, serves to shift the clutch element away from the pulley and thus disconnect the friction drive. Connections from a treadle or the like are provided for overcoming the force of the second spring and thus permitting the first spring to shift the clutch element axially to bring about the frictional driving relation mentioned. The preferred arrangement is such, moreover, that the clutch engaging force is exerted solely by the first spring. When the clutch element is shifted away from the pulley by means of the second spring, it is urged into engagement with friction means carried by the frame to effect a braking action. Outwardly of the frame of the machine the main drive shaft is provided with a handwheel by which it may be turned in the conventional manner.

Still another feature of the invention is the provision of a fan or the like directly on the pulley member which is arranged to be driven at all times during the operation of the driving motor, regardless of whether or not the sewing machine is in operation. This fan serves to draw in air through an opening into a channel provided in a portion of the rear wall of the machine housing. This portion of the wall is hollow to provide the channel and is formed with large cooling fins on its inner surface which extend inwardly into the enclosed portion of the machine frame. Lubricant which is disposed within the enclosed portion of the frame, during operation of the machine, descends in part along the cooling fins and thus serves to keep the lubricant and the interior of the machine relatively cool.

An advantage of the foregoing built-in clutch arrangement over the conventional arrangement, involving a transmitter having a clutch in the motor unit is that it considerably lessens the mass of the parts which need to be accelerated and stopped at the beginning and end of a seaming operation. Only the mass of the clutch element and the handwheel are involved, in addition to the drive shaft and driven parts, in the inertia forces to be overcome in starting and stopping the machine. In the conventional arrangement, on the other hand, the relatively heavy clutch member of the transmitter and also the relatively heavy belt connecting the latter with the machine form part of the masses which must be accelerated and decelerated. However, in the construction of the invention the inertia of the continuously rotating pulley and flywheel, and the continuously moving driving belt, is such as to insure smooth operation of the clutch element and the machine, without vibration, immediately upon engagement of the clutch element with the pulley and to bring the machine rapidly to its highest speed of operation. Thus the improved machine has a much lower starting torque than machines as heretofore constructed. Also, since the inertia of the parts to be stopped is less, the machine may be stopped rapidly.

Other objects, features, and advantages of the invention will appear from the detailed description of an illustrative embodiment of the same which will now be given in conjunction with the accompanying drawings, in which:

FIG. 1 is a front elevational view of the machine with a protective cover or door for the thread takeup devices removed and with some parts shown in section;

FIG. 2 is a view partly in end elevation, as viewed from the left in FIG. 1, and partly in transverse section through the machine in the region of stitch formation;

FIG. 3 is a longitudinal vertical sectional view through the machine taken along line III—III of FIG. 2;

FIG. 4 is a horizontal sectional view through the machine taken above the work supporting surface of the machine;

FIG. 5 is a view similar to FIG. 2, with portions of the section taken along a different vertical plane and with certain parts removed for clarity of illustration of other parts;

FIG. 6 is a rear view of the machine with a part of the frame cut away;

FIG. 7 is a transverse vertical sectional view through the machine taken along the line VII—VII of FIG. 3;

FIG. 8 is a vertical sectional view through a portion of the machine, taken along the line VIII—VIII of FIG. 3; and

FIG. 9 is a rear view of a portion of the frame of the machine with the rear wall partially broken away to disclose the cooling air channels and fan.

Referring now to the drawings, the machine has a frame **1** providing an enclosed housing for certain of the main operating devices of the machine and a partially enclosed housing for other operating parts of the machine. At the top of the frame there is provided a cover **2** and at the bottom there is provided a plate **3** for completely enclosing the housing for the main operating devices of the machine. Cover **2** is secured to the frame by screws **4** and bottom plate **3** is secured by screws **5** (FIG. 3). Preferably gaskets are provided between the frame and the cover and between the frame and the plate **3** to effect oil tight seals. The machine may be supported in any suitable way on a table top or the like. Preferably vibration isolating cushions **6**, formed of rubber or the like, are secured to the bottom plate **3** and arranged to fit into recesses in the table top, these cushions having upwardly extending pins **7** inserted in suitable openings in the bottom plate.

The stitch forming devices of the machine include a curved needle **8**, fixedly mounted at the upper end of an arm **9** (FIGS. 1 and 2) clamped upon a rock shaft **10**, the axis of which is disposed in a vertical plane parallel with the line of stitch formation. The axis of rock shaft **10** is inclined slightly to the horizontal in a direction downwardly from the front to the rear of the machine. As a result of this arrangement the needle is reciprocated along an arcuate path in a plane transverse to the line of stitch formation but inclined slightly to the vertical. Cooperating with the needle **8** is an under looper **11** and an overedge looper **12**. Looper **11** is mounted on a carrier arm **13** secured to a rock shaft **15**, while looper **12** is mounted on a carrier arm **14** secured to a rock shaft **16**. Rock shafts **15** and **16** have their axes disposed in vertical planes parallel with the line of stitch formation and they extend in a strictly horizontal direction. The paths of the two loopers intersect at approximately 90°, as shown in FIG. 1. Each of the loopers **11** and **12** may be arranged to carry a thread for the production of a three thread overedge seam or one or both of the loopers may, if desired, be replaced by a spreader so that only a two-thread or a single thread overedge seam is produced. For driving the three stitch forming devices **8**, **11** and **12**, suitable connections are provided from a main drive shaft **17** which extends longitudinally of the frame of the machine and is supported in bearings **18** and **19** (FIG. 3). Within the fully enclosed housing portion of the sewing machine frame the main drive shaft **17** is provided with three spherical cranks for driving the stitch forming devices. The intermediate crank **20** (FIG. 3) is connected by a pitman **24** with an arm **23** secured to the rock shaft **10** for imparting the desired movements to the needle. The right crank **21** is connected by a pitman **27** with the end of an arm **25** secured to the rock shaft **15** for operating the under looper **11**, while the left crank

22 is connected by an extensible link or pitman 28 with the outer end of an arm 26 secured to the rock shaft 16 for operating the upper or overedge looper. Ball pins carried by the arms 23, 25 and 26 cooperate with spherical strap portions of the pitmen 24, 27 and 28, respectively, to provide the necessary freedom of movement of the parts in the operation of the machine. It will be seen that during rotation of the main drive shaft 17, the rock shafts 10, 15 and 16 will be oscillated and thus impart to the needle 8 and loopers 11 and 12 reciprocating movements along arcuate paths. Simple swinging motions are imparted to each of the arms 23, 25 and 26 which carry the several stitch forming elements. All of the cranks 20, 21 and 22 preferably have the same eccentricity or throw in relation to the shaft 17 and through the proper proportioning of the arms 9 and 23, 13 and 25, and 14 and 26 the appropriate extents of movement are imparted to the three stitch forming elements to effect proper stitch formation. The arrangement is such that the arcs of movement of all of the stitch forming devices are nearly the same. As a result the forces involved in the driving of the several stitch forming elements are substantially the same. Moreover, the construction and arrangement of the parts results in more uniform operation of the sewing machine at high speeds than is the case with machines as heretofore constructed. In prior machines the upper looper has been subjected to considerably higher loads due to the unfavorable linkages required and the ratio of the operating arms or levers as compared with those for the needle and the under looper. The more uniform operation of the several stitch forming elements in accordance with the present invention enables higher speed operation of the machine.

Also within the enclosed housing portion of the machine frame there is secured to the main drive shaft 17 a gear 29 which meshes with a mating gear 30 on a shaft 31 (FIG. 3). This shaft is supported by three bearing sleeves 32, 33, and 34. As will be explained, it serves to impart the lifting and lowering movements to the feed dogs. For this purpose it is provided between the bearing sleeves 33 and 34 with two broad or elongated eccentrics 132 and 133, preferably of the same size and eccentricity. These eccentrics are secured to the shaft 31 in any suitable manner as, for example, by means of sets crews which are accessible upon removal of screw plugs in certain surrounding hubs to be described. The eccentrics 132, 133 are surrounded, respectively, by hubs 140, 141 of a pair of feed dog carrying arms 36, 37 which, at their upper ends, carry an auxiliary or differential feed dog 39 and a main feed dog 38, respectively (FIGS. 2 and 3.) The longitudinal axis of shaft 31 is arranged substantially directly below the needle hole in a throat plate 40 provided in the work supporting surface of the machine. Due to the length of the eccentrics 132, 133 and the corresponding length of the two hubs 140, 141, the feed dog carriers 36, 37, and thus also the feed dogs 38, 39, are given their movements in a quite dependable and accurate manner. Work advancing and return movements are imparted to the feed dogs by connections from the main driving shaft 17 directly to the carrying arms 36, 37. For this purpose, as best shown in FIG. 3, the left end of the shaft 17 is tapered and carries a head 41 having a corresponding internal taper. The head is firmly secured to the end of the shaft by means of the screw shown. In its outer or left end face (FIG. 3) the head is provided with a T-slot 42 (FIGS. 2, 3, and 5) arranged to receive a slide carrying a bolt or pin 43 which may be adjusted in a radial direction with respect to the axis of the shaft 17 to a desired extent and locked in set position in a manner well known in the art. Pivotally mounted on the pin 43 is one end of each of two links 44, 45 preferably of the same size. The opposite end of link 44 is connected with a feed dog carrying arm 36 for the auxiliary or differential feed dog 39. Similarly the opposite end of link 45 is connected with the feed dog carrying arm 37 for the main feed dog 38. As will be understood, displacement of the pin 43 in the T-slot 42 varies the eccentricity of the pin in relation to the axis of the shaft 17 and thereby changes the feed stroke imparted to the two feed dogs.

Provision is also made for varying the feed stroke of the auxiliary or differential feed dog independently of the main feed dog. For this purpose the arm 36 is provided with an arcuate slot 36*a* extending lengthwise of the arm and along which may be shifted a pin or bolt providing the pivotal connection between the link 44 and the arm 36. If desired the pin mentioned may be adjusted to any selected position along the arcuate slot 36*a* and locked in set position by means of known character. It will be apparent that with a given throw of the eccentrically mounted pin 43 carried by the main shaft 17, the differential feed dog 39 will be given its greatest movement when the pin at the opposite end of link 44 is at the lower end of the slot 36*a* and will be given its smallest movement when this pin is at the upper end of the slot 36*a*. In the latter setting it will be apparent from FIG. 5 that the feed dog 39 will receive substantially the same feed stroke as the main feed dog 38. If desired the slot 36*a* may be extended upwardly sufficiently to enable a further shortening of the stroke of the differential feed dog so that it becomes less than that of the main feed dog.

As best shown in FIG. 5 provision may be made for varying the stroke of the auxiliary feed dog 39 during operation of the machine. For this purpose the pin in the outer end of the link 44, which cooperates with the slot 36*a*, is permitted to slide freely in the slot 36*a* and is connected by a link 51 with the outer end of an arm 52 secured to a rock shaft 53 mounted in bearings 54 (FIG. 6) carried by the machine frame. A torsion spring 55 has one end engaged with one of the bearings 54, or some other portion of the frame, and its other end engaged beneath the arm 52 and serves to rock the latter upwardly, or in a counterclockwise direction (FIG. 5). On one face of the arm 52 is a protruding rib 52*a* and also a perforated lug 56 to which a chain 57 may be connected. The opposite end of chain 57 may be connected with a treadle or a knee-press lever. Torsion spring 55, as indicated, urges the lever 52 into its uppermost position corresponding with the shortest feed stroke of the differential feed dog. Upon pulling downwardly on the chain 57, however, the arm 52 is drawn downwardly and this, through the link 51, draws the link 44 downwardly to a lower position thus lengthening the feed stroke of the auxiliary feed dog. Rib 52*a* on the arm 52 cooperates with two adjustable stops 58, 59 (FIG. 5) which may be set in any desired position along a vertically disposed opening or slot 60 in a bracket 62 secured to the machine frame by means of screws 63. A scale 61 may be provided along the slot 60 to indicate the setting of the stops 58 and 59. By proper adjustment of these stops the auxiliary or differential feed dog may be arranged to have a normal predetermined feed stroke of desired length, when the arm 52 is shifted upwardly by the spring 55 to the maximum extent permitted by stop 59. But the feed stroke may be altered to increase its length by a downward pull on the chain 57 to rock the arm 52 against the lower stop 58.

Cooperating with the feed dogs 38 and 39 is a presser foot 64 (FIG. 5) mounted on the end of an arm 65 which extends substantially horizontally from front to rear of the machine. Arm 65 is secured to a rock shaft 66 journaled in a bearing lug 67 projecting from the rear wall of the machine frame. The shaft is held against axial displacement by means of a collar secured to one end of the shaft and by the hub of the arm 65 at the other end. Arm 65 is urged downwardly by a compression spring 69*a* (FIG. 3) retained within a recess or opening in a projecting head of the machine frame. At its lower end the spring engages an enlarged portion of a pin 69 which

is forked at its lower end to straddle the arm **65** at an intermediate point. Spring **69***a* fits within a sleeve **69***b* having screw threaded engagement with the frame and bears at its upper end against a shoulder within the sleeve. Sleeve **69***b* has a knurled head by which it may be turned to cause it to shift axially within the frame and thereby vary the compression of the spring **69***a*. The presser foot carrying arm **65** also has an upwardly directed portion terminating in a finger or projection **65***a* (FIGS. 2 and 6) which cooperates with the free end **70***a* of one arm of a two-armed lever **70**. The latter is secured to the forward end of a rock shaft **71** supported in the upper portion of the machine frame and disposed transversely of the same, i.e., from front to rear, at a small angle to the horizontal. Secured to the lower or rearward end of the rock shaft **71** is the hub **72***a* (FIGS. 5 and 6) of a lever **72** which is arranged to be connected in a well known manner, by means of a pull member such as a chain **73**, with any suitable operating means arranged for operation by the operator, such as a treadle or knee-press member. The hub **72***a* is surrounded by a torsion spring **74** which urges the lever **72** constantly in an upward direction, i.e. in a clockwise direction (FIG. 6) until a laterally extending projection on the lever abuts against the head of a stop screw **75**, the shank of which passes through an opening in the lever **72** and has screw threaded engagement with a shelf **67***a* on the bearing lug **67** for the rock shaft **66**. When the lever **72** is held in its normal upward position, the two armed lever **70** is in the position shown in FIG. 6. However, when the lever **72** is pulled downwardly the shaft **71** is rocked in a counterclockwise direction (FIG. 6). At this time the two armed lever **70** also swings in a counterclockwise direction so that its arm **70***a*, which extends below the projection **65***a* of the arm **65**, raises the latter and hence the presser foot **64**. When the downward pull on the lever **72** is released the latter is again swung upwardly by the torsion spring **74** into its uppermost position as determined by the stop screw **75**. At the same time the presser foot **64** will be urged downwardly by the spring **69***a* against the throat plate or the work advancing over the latter.

To enable the machine to be controlled readily for the production of shortened stitches at the beginning or end of a seam, or both, for the purpose of locking the seam, provision is made for lifting the presser foot **64** to only a certain limited extent which may be adjusted, if desired. The arrangement is such that when the presser foot is lifted to the limited extent for which the mechanism is adjusted, the feed dogs **38**, **39** will cooperate with the presser foot only during a portion of the work advancing stroke of the feed dogs. It will be noted in this connection that the feed dogs in their normal operation pass upwardly through openings in the throat plate of the machine to engage the work and force it against the bottom of the presser foot. The latter is normally lifted a slight extent by the feed dogs in the course of the lifting and feeding movements of the feed dogs. However, when the presser foot is lifted slightly away from the throat plate the feed dogs will urge the work against the presser foot only during a portion of the normal feed stroke and thus produce shorter stitches. To limit the lifting of the presser foot to the extent desired to provide a predetermined shorter stitch length, the lever **72** is provided with an adjustable stop screw **77** having a knurled head. The shank of this screw, cooperating with a threaded opening in the lever **72**, projects below the bottom surface of the lever and is arranged to engage the shelf **67***a* of the bearing **67**. The further the screw **77** projects below the bottom of the lever **72** the less the arm **72** will be able to swing downwardly in response to the downward pull on the chain **73** in the manner explained. Accordingly, the presser foot **64** will be raised to a correspondingly limited extent. This will bring about only a slightly shorter stitch length than is normally provided for the particular setting of the pin **43**. However, if the screw **77** is raised, by turning of the knurled head of the same to carry the lower end of the screw further away from the shelf **67***a*, the lever **72** may be swung downwardly by a pull on the chain **73** to a greater extent so that the presser foot will be lifted somewhat higher and thus bring about a correspondingly shorter stitch length.

Means are provided for simultaneously increasing the tension on the sewing threads as the stitch length is shortened by the lifting of the presser foot in the manner described. The needle thread N, overedge looper thread O, and under-looper thread U (FIG. 1) are led from suitable cones or other sources of supply to a thread guide **82** from which each thread is lead to a thread tensioning device of a general character well known in the art. The three thread tensioning devices are indicated generally at **79**. Each comprises a pair of discs, as best shown in FIG. 5, between which the related thread is drawn. These discs are urged into frictional engagement with each other and the thread by means of a spring **80** surrounding a post on which the discs are freely mounted. A knurled wheel at the outer end of the post, having screw-threaded engagement with the post, may be turned to vary the force of the spring and thus vary the normal tension applied to the thread by the discs **79**. The inner disc of each thread tensioning device bears against the outer face of a slide **78** (FIGS. 1, 5 and 6) having elongated openings therein surrounding the posts of the thread tensioning devices. The inner face of this slide has wedge shaped formations thereon cooperating with corresponding wedge shaped formations **81** on the frame of the machine. Slide **78** at its upper end is provided with a slot **78***a* (FIG. 1) arranged to receive a pin **70***c* carried by an arm **70***b* of the two-armed lever **70** above mentioned. Lever **70**, it will be recalled, is rocked in a counterclockwise direction (FIG. 6) when the lever **72** is drawn downwardly by the chain **73** and the presser foot is raised. Arm **70***b* of lever **70**, therefore, depresses the slide **78** and causes the wedge shaped surfaces to shift the slide simultaneously outwardly, or toward the right (FIG. 5), thereby forcing the thread tensioning discs **79** toward the right and increasing the force of the spring **80**. As will be understood, the extent to which the tension of the springs **80** is so increased will depend upon the extent to which the lever **72**, and hence lever **70**, is rocked. Therefore, the more the stitches are shortened by the lifting of the presser foot the greater will be the thread tension, as is desired to assure a dependable binding of the stitches in the material.

Now returning to the path of the threads N, O and U, it will be noted that the needle thread N passes from the eyelets in the guide **82** between the uppermost of the sets of thread tensioning discs, then successively through a fixed guide **84**, an adjustable guide **88** and a fixed guide **94**, all carried by the frame, down to the eye of the needle. The adjustable guide **88** is provided with a pair of spaced arms with aligned eyelets so that the thread passes across the top of a curved arm **89** secured to the needle carrying arm **9** and disposed between the arms of guide **88**. This provides a desirable takeup action as the needle carrying arm swings. The extent of the takeup depends upon the curvature of the arm **89** and the angle at which it projects from arm **9**.

The overedge looper thread O passes from the eyelets in the guide **82** to and between the thread tensioning discs forming the middle group and downwardly to a fixed guide **85**, then through the spaced arms of an adjustable guide **91** secured to the frame, the latter being of the same general character as the guide **88** described above. From the guide **91** the thread passes to a fixed guide **87** carried by the frame and then upwardly to the overedge looper. An arm **93** extending downwardly from the needle carrying arm **9** cooperates with the over-

edge looper thread in its passage between the arms of the guide **91** to effect a desired takeup action on this thread. The underlooper thread U passes from the eyelets in the guide **82** to and between the lowermost set of thread tensioning discs **79** and downwardly to a fixed guide **86** carried by the frame, then to an adjustable guide **90**, similar to the guides **88** and **91**, carried by the frame, then downwardly to a fixed guide **92** and from the latter upwardly to the under looper. The arm **93** extending downwardly from the needle carrying arm **9** imparts a desired takeup action to the under looper thread in its passage between the arms of the adjustable guide **90**. Independent adjustment of the takeup on the three threads may be effected by appropriate adjustment of the guides **88**, **90**, and **91**.

A desirable feature of the machine in accordance with the present invention is that the various thread guides, the takeup members **89** and **93**, the needle carrying lever **9**, and the thread tensioning devices **79**, are mounted in a readily accessible position behind a protective, hinged door or cover **83** carried by the front wall of the machine frame. All of the devices mentioned are set into a cavity provided in the front wall so that they do not protrude beyond the normal profile of the machine and the devices are normally concealed by the hinged door or cover but may be made accessible by swinging the latter open.

The head **41** secured to the end of the shaft **17**, in the manner explained, in addition to providing an adjustable crank pin for swinging the feed dog carrying arms provides a spherical eccentric **46** which serves to drive an edge-trimming mechanism. For this purpose a pitman **47** having a spherical strap at its lower end cooperates with the eccentric **46**, the upper end of the pitman having a spherical strap which cooperates with a ball pin projecting from an arm or beam **48** which carries a movable upper cutter blade **48***a* (FIG. 2) of the trimming mechanism. Cutter blade **48***a* cooperates with a lower stationary cutter blade **49** which is clamped upon a guide block **50** adjustably mounted on the machine frame.

Arm or beam **48**, as best shown in FIG. 4, is secured to a hollow rock shaft **95** journaled in bushings carried by bearing lugs **96** and **97** within the enclosed portion of the machine frame. A helical compression spring **98** within the shaft **95** bears at one end against a closure cap **99** having screw threaded engagement with the end of a bearing bushing **100** carried by the bearing lug **97**. At its other end the spring **98** bears against a collar or flange **102** carried by a pin **101** extending longitudinally through the spring **98** and hollow shaft **95**. Pin **101** has screw threaded engagement with rock shaft **95** and its axial position in relation to the latter may be adjusted by turning the pin **101** by inserting a screw driver or the like in a slot **101***a* provided in the outer end of the pin. A lock nut **103** may be provided to lock the pin in set position. It will be apparent that as the pin is turned in one direction the force of the spring **98** will be increased, while if it is turned in the other direction the force of the spring will be lessened because of the corresponding movement of the collar or flange **102**. The spring **98** serves to urge the shaft **95**, and hence the arm or beam **48** toward the left (FIG. 4) to hold the movable cutter blade in yielding engagement with the stationary cutter blade. It will be understood that the movable cutter blade is provided with a finger which is at all times engaged with one face of the stationary cutter blade to maintain these blades in proper relation.

In the seaming of relatively stiff or heavy material it is found that the movable cutter blade tends to move laterally away from the stationary blade, due to the high resistance to cutting, so that a clean cut is not produced. In order to avoid this, provision is made in accordance with the invention to increase the force of the spring **98** in the manner explained when heavier or stiffer materials are being sewn. Moreover, the arrangement is such that if exceptionally heavy or stiff material is being seamed the yielding action of the spring **98** may be eliminated completely. For this purpose it is simply necessary to turn the pin **101** in the appropriate direction to carry its inner end against the inner surface of the cap **99**. When this is done the shaft **95** is no longer capable of shifting toward the right (FIG. 4) in response to forces created in the trimming of heavy work. It is, however, urged toward the left by a relatively strong force exerted by the spring **98** thus maintaining the movable and stationary cutter blades in good cooperative relation.

The machine may, if desired, be driven in the conventional way from an electric transmitter having a built-in clutch for starting and stopping the machine. In this event the machine could be provided with a conventional combined handwheel and pulley. However, there is preferably incorporated in the machine itself a special clutch which makes possible the driving of the machine from a simple motor and enables higher speed operation of the machine with quicker acceleration and deceleration of the parts. For this purpose there is provided a chamber **142** within the frame at the right side (FIGS. 3 and 4) of a partition wall **104** which forms one end of the fully enclosed housing of the frame. The chamber **142** is open toward its bottom and also in the axial direction toward the right along the main drive shaft **17**. Within the chamber **142** there is mounted on the shaft **17**, for free rotation with respect thereto, a belt pulley **106** which constitutes the driving element of a friction clutch. It is supported on the shaft **17** by means of two ball bearing units **108**. Outwardly of the machine frame there is secured to the shaft **17**, at its right end, a cup shaped handwheel **107**. Belt pulley **106** is arranged for connection, by means of a V-belt, with a continuously rotating electric motor of ordinary type which is not provided with a clutch. In this way the pulley **106** is continuously driven so long as the motor is in operation, regardless of whether or not the machine is in operation. Toward the handwheel end of the main drive shaft **17** the latter is splined and on the splined portion there is mounted a driven clutch element **109**, this being slidable axially along the shaft but connected with the shaft for positive rotation thereof whenever the clutch is engaged. A relatively strong coil compression spring **110**, surrounding the shaft **17**, has one end abutting against the inner face of the handwheel **107** and its other end abutting against an annular nut **111** having screw threaded engagement with a hub portion of the driven clutch member **109** surrounding the shaft **17**. Nut **111** serves to retain on the hub of clutch element **109** the inner member of a ball bearing unit **112** and serves to transmit the force of the spring **110** to the clutch element **109** to urge it into engagement with the pulley member **106**. As best shown in FIG. 3 the member **109** is provided with friction lining on a frusto-conical portion thereof arranged for engagement with a corresponding frusto-conical surface on the pulley member **106** to effect a driving relation between these parts. In the preferred arrangement, the clutch engaging force of these surfaces is derived solely from the spring **110** which normally acts to engage the clutch.

Disengagement of the clutch is effected by a spring **113** (FIGS. 2 and 6) connected at one end with a stud **114** carried by the frame of the machine and connected at its other end with a lever arm **115** mounted for swinging movement around a shaft **120** (FIG. 3) mounted in a boss **119** on the machine frame. Arm **115**, as best shown in FIGS. 4 and 6, has an inwardly bent portion intermediate its ends which extends through an opening **115***a* in the wall of the machine frame so that the left end of the arm (FIG. 4) is on the outside of the frame, while the right end is within the chamber **142** of the frame. Integral with the arm **115**, or otherwise rigidly connected therewith, is an upwardly extending forked arm **121** (FIGS. 3 and 4) which carries at its upper end a pair of

inwardly extending pins **122**. These are disposed in the horizontal plane containing the axis of the shaft **17** and are arranged to cooperate with a radially extending flange **123** of a housing **124** surrounding and mounted on the ball bearing unit **112**. The outer raceway of this unit is retained against an inwardly extending flange of the housing **124** by means of a threaded annular element **125** having screw threaded engagement with the inner surface of the housing **124**. It will be seen that the arrangement is such that when the spring **113** lifts the lever **115**, or rocks it in a counterclockwise direction (FIG. 6), the pins **122** carried by the forked arm **121** will engage the flange **123** and urge the latter, together with the assembled parts including the clutch element **109**, toward the right (FIG. 3). Spring **113** is stronger than spring **110** and is adapted to overcome the force of the latter when the lever **115** is free to rise in the manner explained. A chain **116** connected with the outer end of the lever **115** may have its other end connected with a treadle or a kneepress to permit a downward pull to be applied to the lever arm **115** whenever desired by the operator. When lever **115** is thus operated, the pins **122** will be shifted toward the left (FIGS. 3 and 4) away from the flange **123** and thus permit the spring **110** to shift the clutch element **109** and its assembled parts toward the left to engage the clutch and bring about rotation of the element **109** and shaft **17** by the continuously rotating pulley **106**. In order to stop the machine it is simply necessary for the operator to release the downward pull on the chain **116** so that the spring **113** will again become effective to overcome the force of the spring **110** and thus bring about disengagement of the clutch. When the clutch element **109** is shifted toward the right (FIG. 3), by the spring **113**, it is brought into engagement with a braking surface preferably of frusto-conical form carried by a portion **118** of the frame. In this way the clutch element and the main shaft **17** of the machine will be quickly arrested. It should be noted in this connection that the mass of the revolving parts is comparatively small so that the deceleration and stopping of the machine takes place more quickly than in constructions in which the moving parts to be stopped include not only a pulley on the main shaft of the machine, but also a relatively heavy driven clutch member of the electric transmitter and the interconnecting belt.

In accordance with the invention a fan wheel or blower **126** (FIGS. 3 and 4) is secured, by screws or the like, to the pulley member **106** for continuous rotation thereby so long as the electric motor is operating, and regardless of whether or not the machine is in operation. The fan **126** may be arranged either to blow or to draw cooling air through an air channel **127** (FIGS. 7 and 8) provided in a hollow portion of the rear wall of the enclosed housing of the machine frame. The air so blown or drawn is discharged or drawn in through an opening **129** (FIG. 9), through the rear wall of the enclosed housing, which communicates with the inner end of the channel **127**. The inner member of the hollow wall forming the air channel **127** is provided with a plurality of ribs or fins **128** which extend into the enclosed, lubricant-tight housing of the frame, these fins preferably being disposed in stepped relation as shown in FIG. 8. There is thus provided a plurality of large cooling fins over which the lubricant, that is dispersed within the machine as a mist by the operation of the gearing **29**, **30**, may descend and be effectively cooled in returning to the reservoir at the bottom of the enclosed housing. The cooling action thus brought about takes place continuously so long as the electric motor is in operation and regardless of whether the machine itself is in operation or idle.

The lubrication of the machine is brought about in a completely automatic manner, largely through the dispersing of lubricant within the enclosed housing of the frame by the operation of the gears **29**, **30**. An oil mist is thus created which is delivered to the various relatively sliding surfaces within the enclosed housing. The bearing surfaces of the sleeves **32**, **33** and **34** in which the feed lift shaft **31** is journaled are lubricated by wicks **130**, **131** and **134** which serve to lift oil by capillary action from a reservoir **138** to these bearings. The bearings **18** and **19** for the main drive shaft **17** are similarly lubricated by wicks **135** and **136** (FIG. 3). From the wicks **130**, **131** and **135** the oil is pumped by means of spiral grooves cut in the shafts **31** and **17**, respectively, and delivered to the points requiring lubrication. For example, the lubricant delivered by the wicks **130** and **131** may be forced by the spiral grooves in the shaft **31** through the channels indicated in FIG. 3 to the outer surfaces of the eccentrics **132** and **133**, respectively, which cooperate with the feed dog carrying arms **36** and **37**. Similarly, the spiral groove at the left end of shaft **17** (FIG. 3) may serve to force oil into the bearing surface between the spherical eccentric of head **41** and the cooperating surface of the pitman **47**. Also some of the oil so pumped may be delivered through the channel extending longitudinally of the pitman **47** to hte ball pin carried by arm **48**. Oil dripping from the various parts outside of the enclosed housing of the frame, and to the left of the partition wall **105**, is returned to the oil sump **138** through a combined screen and filter **137** (FIG. 2) arranged in the bottom of the frame.

A machine in accordance with the invention, instead of being provided with a single needle as shown, may be provided with two curved needles without altering the principles of the invention. Machines embodying the invention are suitable for the production of any type of overedge stitch and are adapted to operate upon light, medium heavy, and even quite heavy material. Due to this universal utility of the machine, in addition to its superiority with respect to maximum speed or capacity and simplicity of construction, it is superior to all previously known curved needle overedge machines.

While a preferred embodiment of the invention has been described in considerable detail and certain modifications have been suggested, it will be understood that other changes may be made in the construction without departing from the principles and scope of the invention as defined by the appended claims.

What is claimed is:

1. In an overedge sewing machine having a rotary drive shaft and a work supporting surface, a plurality of stitch forming devices comprising a curved needle, an under looper and an overedge looper, a plurality of rock arms, pivot means located at the right of the line of stitch formation providing a fixed axis for each of said arms, each arm being mounted for swinging movement only about the fixed axis of its pivot means, each of said arms fixedly carrying one of said stitch forming devices and serving to reciprocate the same along a predetermined arc having the fixed axis of the pivot means for said arm as its center of curvature, the axis of said arm which carries the overedge looper being above said work supporting surface, and means comprising connections from said shaft for swinging said arms in coordinated relation to form overedge stitches.

2. An overedge sewing machine in accordance with claim 1 in which the pivot means for each of said arms is a rock shaft having its axis disposed in a vertical plane parallel with the line of stitch formation.

3. An overedge sewing machine in accordance with claim 1 in which each of said stitch forming devices is mounted for reciprocation along a path transverse to the line of stitch formation.

4. An overedge sewing machine in accordance with claim 1 in which said loopers are mounted for movement along arcs at substantially 90° in relation to each other.

5. In an overedge sewing mechine having a rotary drive shaft a plurality of stitch forming devices comprising a needle, an under looper and a overedge looper, work feeding devices comprising a main and a differential feed

dog, a separate arm fixedly carrying each of said stitch forming devices and feed dogs, a plurality of shafts each having a fixed axis, each of said arms being mounted for oscillation around the axis of one of said plurality of shafts, a plurality of eccentrically disposed driving means on said drive shaft, and a link directly connecting one of said eccentric means with each of said arms for rocking the same and thereby driving said stitch forming devices and said feed dogs.

6. In an overedge sewing machine having a rotary drive shaft a plurality of stitch forming devices comprising a needle, an under looper and an overedge looper, work feeding devices comprising a main and a differential feed dog, a separate arm fixedly carrying each of said stitch forming devices and feed dogs, a plurality of shafts each having a fixed axis, each of said arms being mounted for oscillation around the axis of one of said plurality of shafts, a plurality of eccentrically disposed driving means on said drive shaft, a link directly connecting one of said eccentric means with each of said arms for rocking the same and thereby driving said stitch forming devices and said feed dogs and means driven by said shaft for shifting said feed dog carrying arms longitudinally.

7. Work feeding mechanism for a sewing machine having a rotary drive shaft which comprises a plurality of feed dogs, a plurality of arms each carrying one of said feed dogs, a shaft beneath said feed dogs, each of said arms being carried entirely by and rockable about and extending substantially vertically upwardly from said shaft beneath said feed dogs, eccentric means on said drive shaft, and a link directly connecting said eccentric means with each of said arms.

8. Work feeding mechnism in accordance with claim 7 in which the connection between one of said links and its related arm may be varied to vary the extent of rocking movement of said arm.

9. Work feeding mechanism in accordance with claim 8 in which means are provided for changing the point of connection of said one of said links with its related arm during the operation of the machine.

10. Work feeding mechanism in accordance with claim 7 in which connections are provided between said main drive shaft and said shaft beneath said feed dogs for driving the latter in synchronism with said drive shaft, and eccentric means on said shaft beneath said feed dogs for shifting said arms longitudinally in the course of their rocking movements.

11. Work feeding mechanism for a sewing machine in accordance with claim 7 having a presser foot cooperating with said feed dogs in advancing the work, spring means for urging said presser foot toward the work to retain the latter in engagement with said feed dogs, means operable by the operator for lifting said presser foot away from the work, and adjustable stop means for limiting the extent to which said presser foot may be lifted whereby the feeding action of said feed dogs may be varied.

12. Work feeding mechanism for a sewing machine having a rotary drive shaft and a work supporting surface which comprises a feed dog, means for shifting said feed dog in the direction of feed, means for shifting said feed dog into and out of engagement with the work carried by said surface, connections from said drive shaft for operating both of said feed dog shifting means, a presser foot arranged to engage the work and urge the same into cooperation with said feed dog as the latter is shifted toward the work, means operable by the operator for lifting said presser foot away from the work, and thus lessening its cooperation with said feed dog, and adjustable stop means for limiting the extent to which said presser foot may be lifted, thereby varying the effective stroke of said feed dog.

13. In an overedge sewing machine having a rotary drive shaft, a plurality of stitch forming devices comprising a curved needle, an under looper and an overedge looper, work feeding devices comprising an oscillatable feed dog, work trimming mechanism comprising a stationary cutter blade and a movable cutter blade, an arm fixedly carrying each of said stitch forming devices, said feed dog and said movable cutter blade, a plurality of shafts each having a fixed axis, each of said arms being mounted for oscillation around the axis of one of said plurality of shafts, cranks on said drive shaft and connections therefrom for rocking said arms carrying said stitch forming devices, a head secured to the end of said drive shaft, and eccentric means on said head and connections therefrom for rocking the arms carrying said feed dog and said movable cutter.

14. In an overedge sewing machine having a rotary drive shaft and a work supporting surface, a plurality of stitch forming devices comprising a curved needle, an underlooper and an overedge looper, a plurality of arms each mounted for swinging movement only about a fixed axis, a rock shaft for carrying each of said arms and providing the fixed axis about which each arm is swung, each of said rock shafts having its axis disposed in a vertical plane parallel with the line of stitch formation, said rock shaft which carries the needle carrying arm being disposed at an angle to the horizontal, each of said arms fixedly carrying one of said stitch forming devices and serving to reciprocate the same along a predetermined arc, the axis of said arm which carries the overedge looper being above said work supporting surface, and means comprising connections from said drive shaft for swinging said arms in coordinated relation to form overedge stitches.

15. An overedge sewing machine in accordance with claim 14 in which said drive shaft is provided with a plurality of cranks of equal throw, and in which said connections comprise a pitman extending from each of said cranks to one of said arms for swinging the same.

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