April 5, 1960 R. E. JOHNSON 2,931,329

WORK FEEDING MECHANISMS FOR SEWING MACHINES

Filed April 12, 1957 5 Sheets-Sheet 1

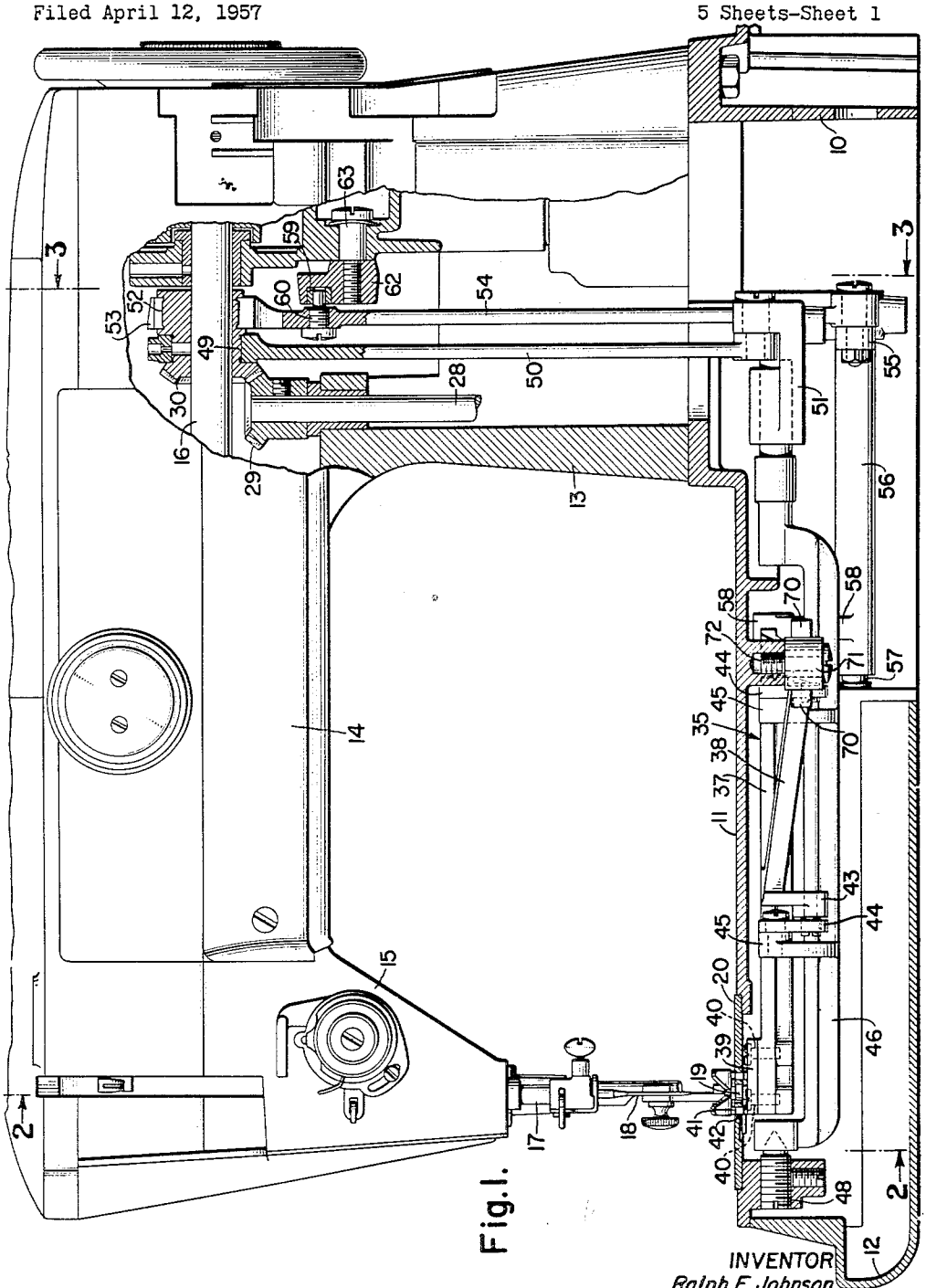

Fig. 1.

INVENTOR
Ralph E. Johnson

BY

Marshall J. Breen
ATTORNEY

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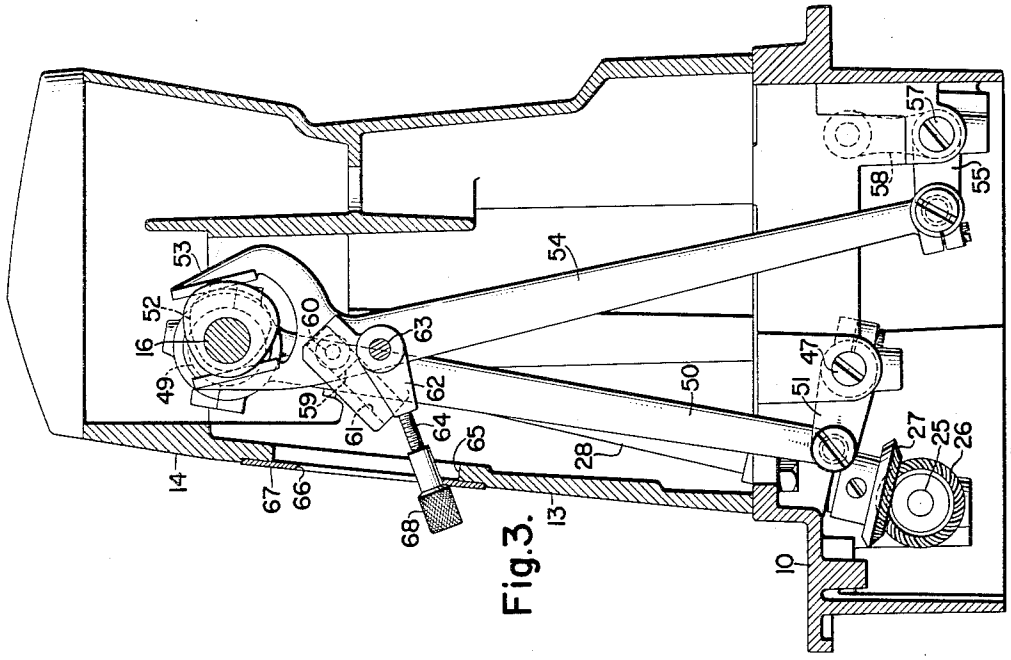

Fig.3.

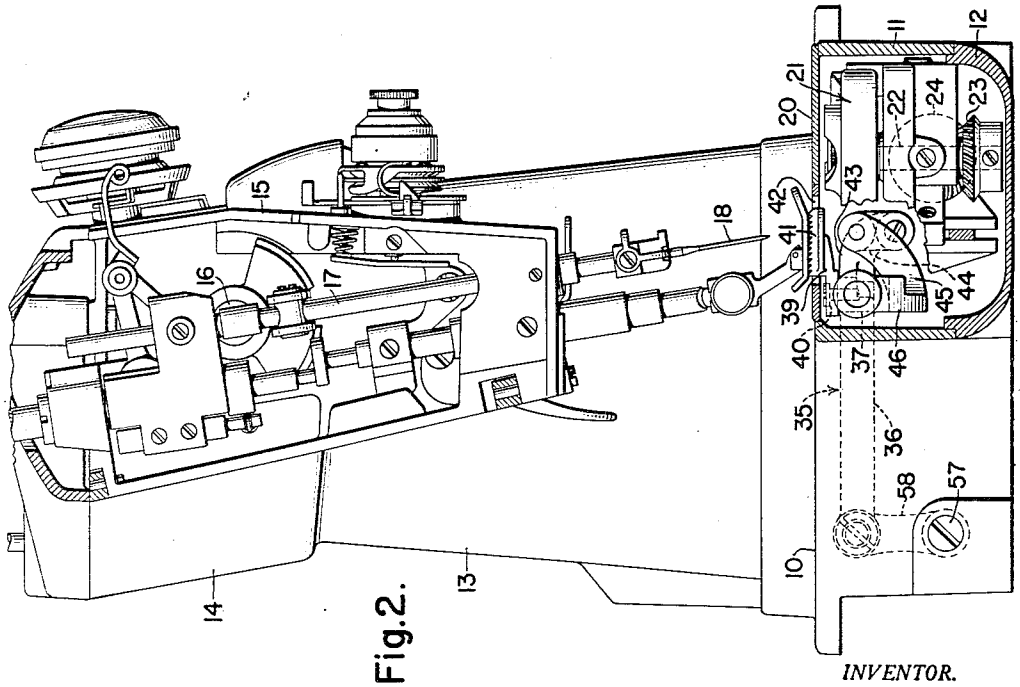

Fig.2.

INVENTOR.
Ralph E. Johnson

BY

Marshall J. Breen
ATTORNEY

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WORK FEEDING MECHANISMS FOR SEWING MACHINES

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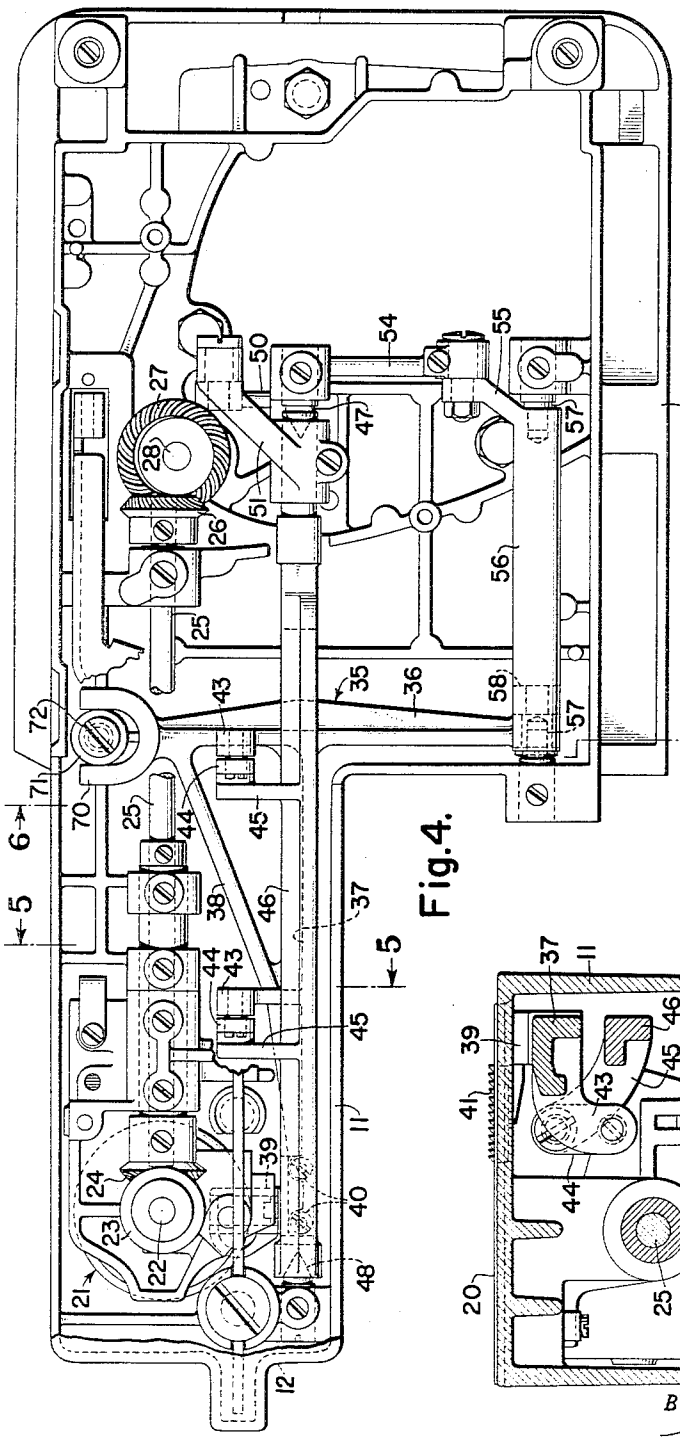

Fig.4.

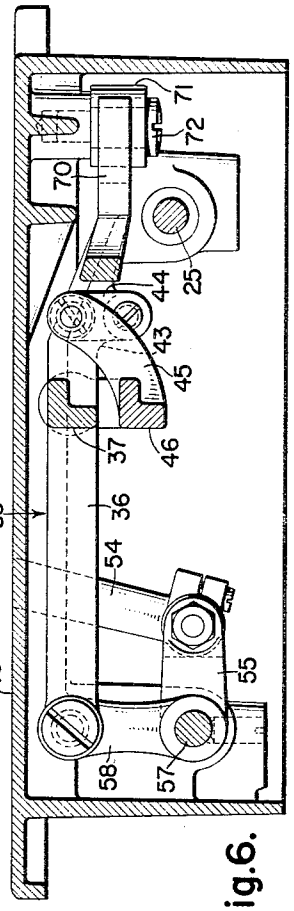

Fig.6.

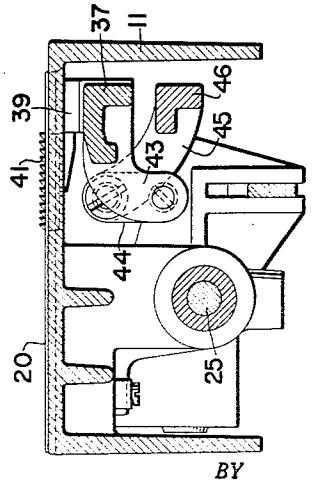

Fig.5.

INVENTOR.
Ralph E. Johnson

BY

Marshall J. Breen

ATTORNEY

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WORK FEEDING MECHANISMS FOR SEWING MACHINES

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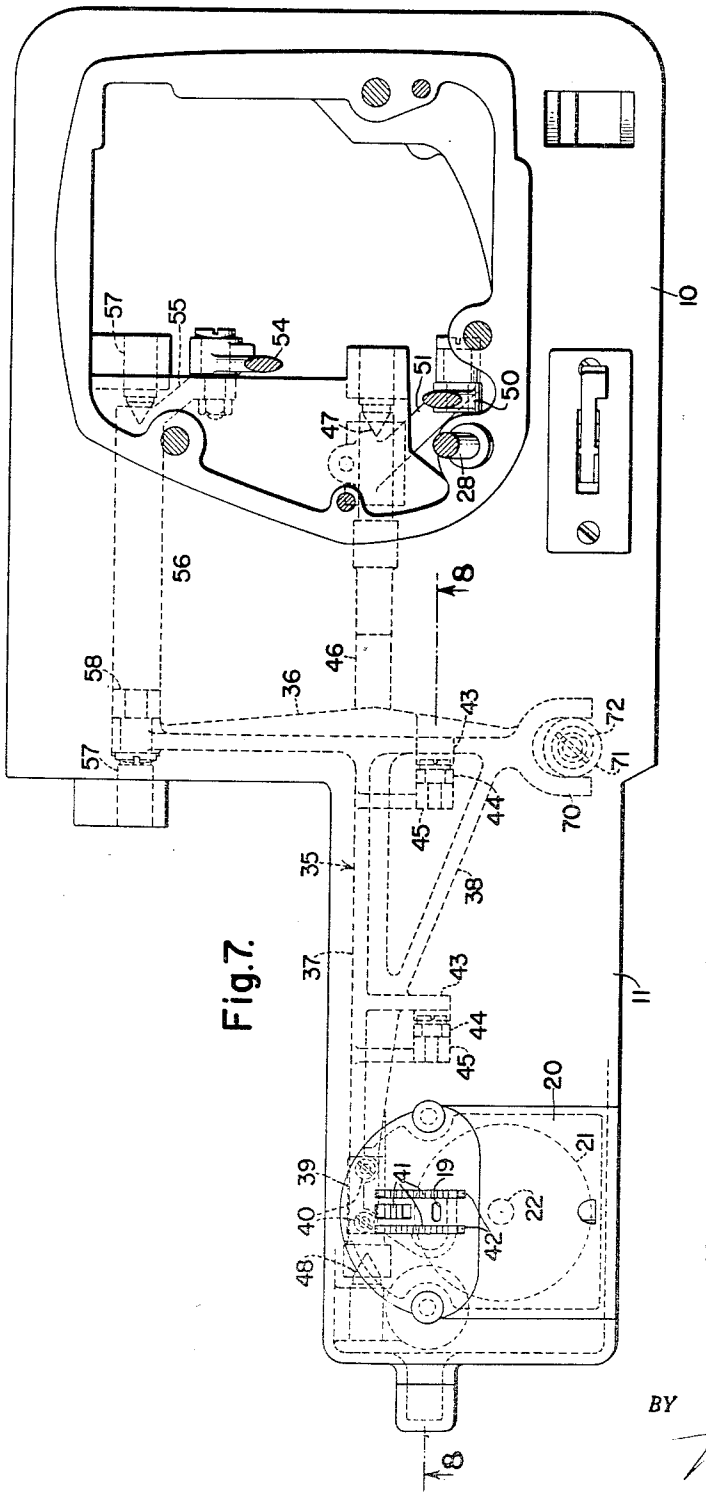

Fig.7.

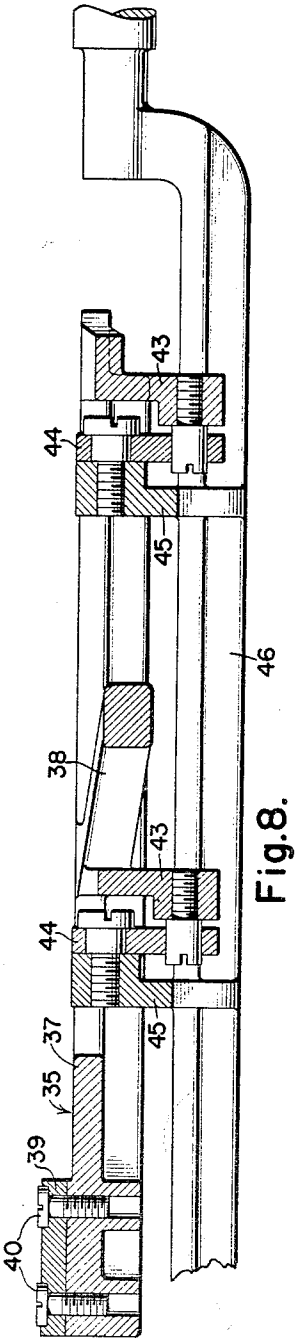

Fig.8.

INVENTOR
Ralph E. Johnson

BY

Marshall J. Breen

ATTORNEY

April 5, 1960 R. E. JOHNSON 2,931,329

WORK FEEDING MECHANISMS FOR SEWING MACHINES

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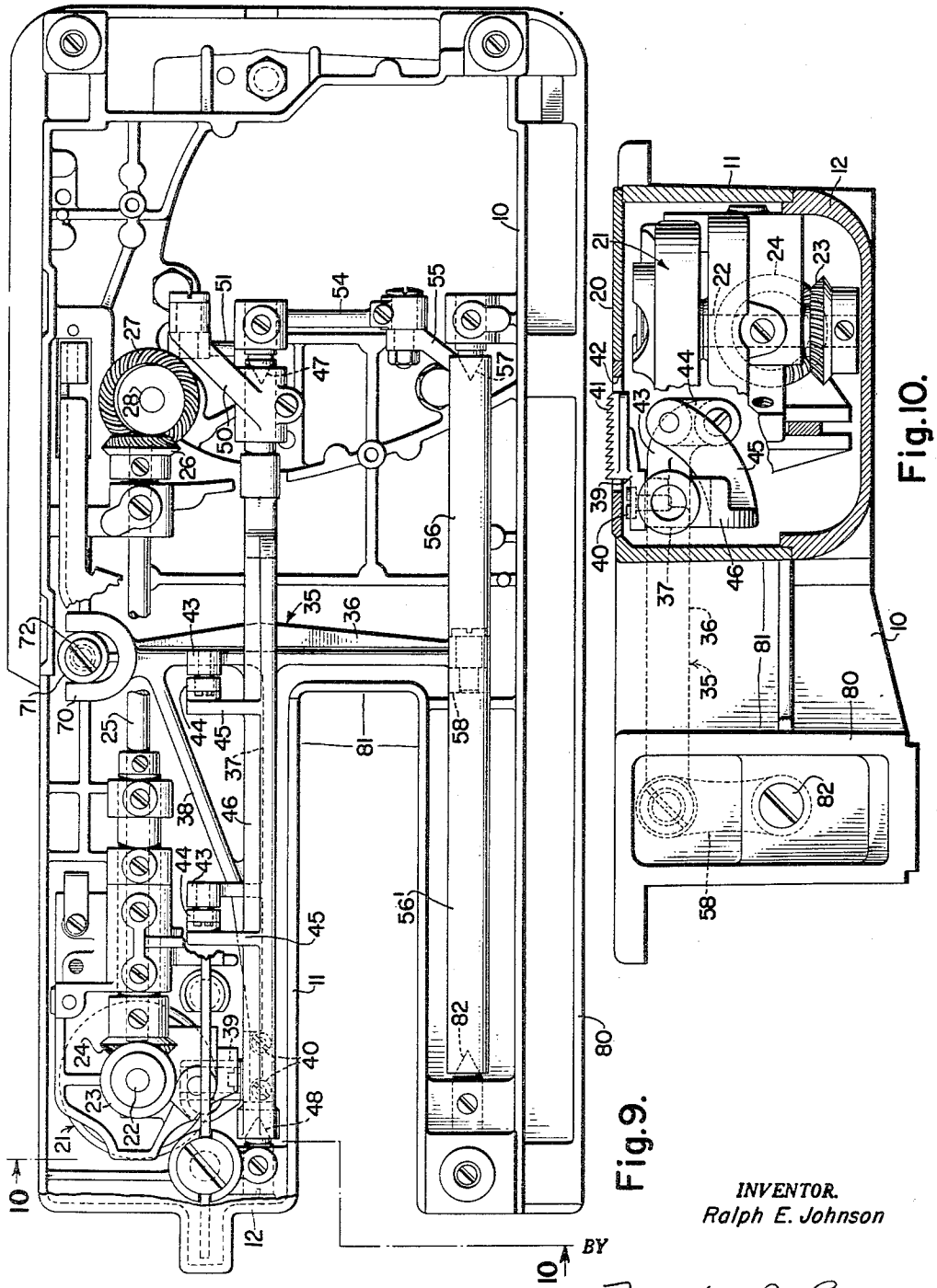

Fig.9.

Fig.10.

INVENTOR.
Ralph E. Johnson

BY
Marshall J. Breen
ATTORNEY

United States Patent Office

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WORK FEEDING MECHANISMS FOR SEWING MACHINES

Ralph E. Johnson, Mountainside, N.J., assignor to The Singer Manufacturing Company, Elizabeth, N.J., a corporation of New Jersey

Application April 12, 1957, Serial No. 652,412

11 Claims. (Cl. 112—210)

This invention relates to work feeding mechanisms for sewing machines, and more particularly, to a drop feed or four motion type of work feeding mechanism operable to advance the work fabric across the bed of a cylinder bed type of sewing machine.

It is an object of this invention to provide a new and improved four motion drop feed mechanism providing a work feeding motion having a flat feed advancing motion across the bed of a cylinder bed of a sewing machine.

In order that the fabric can be stitched into tubes of the smallest possible diameter, it is advantageous in sewing machines having a cylinder bed construction to maintain the smallest possible cross section of the bed. From the point of view of the work feeding mechanism, however, an attenuated cylindrical bed of small cross section is conducive to many serious problems to the solution of which the present invention is directed.

The limited space available within a cylinder bed has presented difficulties in obtaining a feed motion of a desired accuracy and precision. The cramped quarters and limited clearances within the cylinder bed have in the past given rise to arrangements in which the feed motions are derived from necessarily small motions of feed actuating mechanisms. In these cases, the effects of normal play in the parts, lost motion, tolerances, etc., are magnified in the feed motion and precision of feed motion suffers.

In some prior art constructions the desirable flat feed motion has been sacrificed in favor of an arcuate motion in order to surmount the difficulties encountered in properly actuating a feed mechanism within a cylinder bed.

It is an object of this invention to provide a novel work feeding mechanism for a sewing machine in which highly accurate and precise flat feed motion above the throat plate is obtained.

It is another object of this invention to provide a work feeding mechanism of the above character which is supported and actuated in a novel fashion so as to be subject, during operation, to a minimum of objectionable deformation.

With the above and other objects and advantages in view as will hereinafter appear, this invention comprises the devices, combinations and arrangements of parts hereinafter described and illustrated in the accompanying drawings of a preferred embodiment in which:

Fig. 1 represents a side elevational view of a sewing machine with portions of the machine frame broken away and shown in vertical cross section, illustrating the feed mechanism of my invention applied thereto,

Fig. 2 is a vertical cross sectional view of the head end of the sewing machine taken substantially along line 2—2 of Fig. 1,

Fig. 3 is a vertical cross sectional view of the standard end of the sewing machine taken substantially along line 3—3 of Fig. 1,

Fig. 4 represents a bottom plan view of the sewing machine of Fig. 1 with the cylinder bed bottom cover removed,

Fig. 5 is a vertical cross sectional view of the work supporting bed taken substantially along line 5—5 of Fig. 4,

Fig. 6 is a vertical cross sectional view of the machine base taken substantially along line 6—6 of Fig. 4,

Fig. 7 represents a top plan view of the sewing machine base with the feed mechanism shown in dotted lines,

Fig. 8 is a vertical cross sectional view taken substantially along line 8—8 of Fig. 7,

Fig. 9 represents a bottom plan view of a modified form of sewing machine base, illustrating the feed mechanism of my invention applied thereto, and

Fig. 10 is an enlarged vertical cross sectional view taken substantially along line 10—10 of Fig. 9.

Referring particularly to Figs. 1 to 4, this invention is illustrated as applied to a sewing machine of the type having a frame base 10 formed with free ended tubular work supporting bed 11 of the so-called "cylinder bed" variety. The bed 11 need not be a true cylinder but only an approximation thereof around which tubular articles may be placed for sewing. At the bottom the bed is closed by a removable bottom cover 12 to prevent interference of work fabrics with the mechanism within the bed. Any known type of support (not shown) may be interposed between the base 10 and a supporting table top or other surface to support the sewing machine with the work supporting bed in spaced relation above the machine supporting surface. Figs. 2, 4 and 7 best illustrate that the bed 11 is offset toward the front of the machine frame base, that is, the bed is arranged to extend from that side of the base nearest the operator. That portion of the machine frame which is above the frame base 11 may be of the type illustrated and described in my copending patent application Serial No. 471,766, filed November 29, 1954, now Patent No. 2,862,468, dated December 2, 1958, to which reference may be had for a more complete disclosure. For purposes of the present invention it is sufficient to understand that the upper portion of the machine frame comprises a hollow vertical standard 13 which supports a bracket arm 14 terminating in a downwardly and forwardly inclined head 15. A main shaft 16, journaled for rotation in the bracket arm, drives an endwise reciprocatory needle bar 17 which is inclined downwardly and forwardly in the head 15. A needle 18 clamped on the needle bar reciprocates through a needle aperture 19 in a throat plate 20 secured on the work supporting bed 12 and cooperates in the formation of lock stitches with a rotary loop taker 21 carried in the bed. Reference may be had to my copending U.S. patent application Serial No. 634,904, filed January 18, 1954, for a complete description of the loop taker. For purposes of the present invention it will be sufficient to understand that the loop taker 21 is rotatable about a vertical axis disposed in front of or toward the position of the machine operator from the stitching point as defined by the needle aperture in the throat plate. The loop taker is fast on a loop taker shaft 22 journaled vertically on the work supporting bed. A bevel gear 23 fast on the loop taker shaft 22 meshes with a bevel gear 24 on a bed shaft 25 which extends into the machine base 11. Meshing bevel gears 26 and 27 operatively connect the bed shaft with a shaft 28 journaled vertically in the standard and meshing bevel gears 29 and 30 operatively connect the vertical shaft 28 with the main shaft 16 in the bracket arm of the machine frame.

The work feeding mechanism of the present invention, as applied to the above described cylinder bed sewing machine, comprises a T shaped feed bar, indicated generally as 35, of which the cross bar portion 36 is disposed within the confines of the frame base 11 and extends substantially transversely thereof. A stem portion

37 of the T shaped feed bar extends lengthwise within substantially the entire length of the work supporting cylinder bed 12. Preferably, the stem portion 37 of the feed bar extends along the rear wall of the cylinder bed and a diagonal brace 38 which extends diagonally from the stem to one limb of the cross bar portion of the feed bar may be included to stabilize the feed bar. Secured to the feed bar at the free extremity of the stem portion 37 at a point rearwardly of the stitching point, that is on the opposite side of the stitching point from the axis of the loop taker shaft 22, is a feed dog 39 made fast on the feed bar by screws 40. The feed dog is formed with a plurality of transversely serrated cloth gripping surfaces 41 certain of which extend across the stitching point and all operating through slots 42 in the throat plate to grip and advance the work.

Extending from the stem portion of the feed bar at points thereon spaced apart lengthwise of the work supporting arm are a pair of arms 43, Fig. 8, each extending downwardly and outwardly toward the front of the machine. Pivotally secured to the free extremity of each of the arms 43 is a short link 44 which extends substantially vertically upwardly from the arms 43. The upper extremity of each link 44 is pivotally secured to the free extremity of one of a pair of rock arms 45 which extend upwardly and outwardly toward the front of the machine from a feed lift rock shaft 46 and terminate substantially vertically above said feed bar arm 43. The feed lift rock shaft is disposed substantially vertically beneath the stem portion of the feed bar and is journaled in a pintle 47 fast beneath the frame base 11 and a pintle 48 fast in the free extremity of the work supporting cylinder bed 12. Referring to Figs. 1 and 3, the feed rock shaft is oscillated by an eccentric 49 fast on the main shaft 16 of the machine by means of a pitman 50 which embraces the eccentric 49 and extends through the hollow standard and into the frame base. A rock arm 51 fast on the feed lift rock shaft 46 is pivotally connected to the pitman 50.

As illustrated in Fig. 1, the feed lift eccentric 49 may be made as an integral part of the driving gear 30 and a feed advance eccentric or cam 52. With this construction the feed lift motion will always occur in predetermined timed relation with the feed advance motion and the timing of both of the feed motions with the rotary hook may be accomplished readily by an angular adjustment of any one of the gears in the train of hook driving gears, as for instance by an angular adjustment of the gear 29 relatively to the shaft 28.

The feed advance cam 52 is embraced by the bifurcated jaws 53 of a feed advance pitman 54 which extends downwardly through the hollow standard and is pivotally connected to the free extremity of a rock arm 55 fast on a feed advance rock shaft 56 journaled between bearing pintles 57 carried in the frame base 11. The feed advance rock shaft is formed with an upstanding rock arm 58 disposed substantially at a right angle to the rock arm 55. At its upper free extremity, the rock arm 58 is pivotally secured to the rearward limb of the cross bar portion 36 of the T shaped feed bar 35.

Regulation of the length of work feeding stroke is attained by means of a slide block 59 pivoted on a stud 60 threaded into the feed advance pitman in the machine standard. The slide block 59 is embraced in a guide slot 61 formed in a feed regulating and reversing lever 62 fulcrumed on a stud 63 carried in the machine standard. The feed regulating lever includes a threaded handle 64 which extends through a slot 65 formed in the front wall of the standard and through a slot 66 with indicia plate 67 carried by the standard. By means of a knurled adusting nut 68, any desired stitch length can be determined or the direction of stitching reversed by shifting the handle 64 to change the angular relation between the guide slot 61 and the feed advance pitman 54.

The forward limb of the cross bar portion of the feed bar beyond its juncture with the diagonal cross brace 38 is bifurcated, as indicated at 70, and embraces a stabilizing guide roller 71 journaled on a shouldered screw 72 threaded substantially vertically beneath the frame base 11.

The T shaped feed bar 35 with the diagonal brace 38 makes for rigid horizontal stability of the feed mechanism. The limbs of the feed bar may preferably be ribbed, as illustrated particularly in the cross sectional views Figs. 5, 6 and 8, to provide for rigid vertical stability of the feed bar. The T shape of the feed bar also provides for operable connections with the feed actuating mechanism in a manner conducive to movement in a highly desirable path which produces a linear feed straight across the cylinder work supporting bed of the machine and an advantageously flat feed advancing motion of the feed dog. Considering the feed advance actuating connection to the feed bar and referring to Figs. 4 and 6, it will be noted that the construction thereof provides for an extremely wide spacing between the point of connection of the feed advance rock arm 58 with the feed bar and the slidable stabilizing connection between the bifurcated portion 70 of the feed bar and the guide roller 71. Also as illustrated in Figs. 4 and 6, the point of connection of the feed advance mechanism 58 with the feed bar occurs on one side of the connections of the feed lift mechanism 44 with the feed bar, and the stabilizing connection of the feed bar with the guide roller 71 occurs at the opposite side of the feed lift connections. Since these connections are spaced apart in the relatively wide frame base 10, rather than being crowded together in the cylinder bed as is conventional in this type of machine, any tendency for the feed bar to rock idly in a horizontal plane is minimized.

Considering the feed lift motion and referring particularly to Figs. 7 and 8, the pair of connections between the feed lift rock shaft and the feed bar being spaced lengthwise of the stem portion 37 of the feed bar resist any tendency for the feed bar to rock idly in a vertical plane. The short links 44 which depend from the feed lift rock arms 45 to the feed bar arms 43 give rise to a lifting motion of the feed bar at the beginning and end of each feed advance stroke to augment the motion imparted by the feed lifting mechanism and thereby to provide an extremely flat feed advance motion which is considered desirable because the work fabrics will then be gripped evenly and continuously by the feed dog during a greater portion of the feed advance stroke than with heretofore conventional arrangements.

The present invention provides a compact work feeding mechanism which may not only be confined within the limited space available in a cylinder bed of a sewing machine but which is adapted to be arranged at one side of, and in the preferred form to the rear of, the vertical axis rotary loop taker within a cylinder bed. This feature is highly advantageous inasmuch as it makes possible a feed dog arrangement which is cantilevered over the stitching point from only one side leaving the other side open for ready access to the loop taker as, for instance, for removing and replacing a bobbin therein.

Referring to Figs. 9 and 10, the feed mechanism of this invention is illustrated as applied to a modified form of sewing machine frame which differs from that previously described in that the frame base 10 is formed with an outwardly projecting leg portion 80. As indicated in the drawings, the leg portion extends substantially parallel to the cylinder bed 11 and rearwardly thereof with respect to the normal position of the machine operator. A space 81 is provided between the leg 80 and the cylinder bed 11 for passage of work fabrics around the cylinder bed. The leg portion 80 thus provides a steadier support for the sewing machine to minimize tipping of the machine. In the embodiment illustrated in Figs. 9 and 10, the work feeding mechanism remains unchanged except for the feed advance rock shaft 56 which has been

extended as at 56' within the leg portion 80 of the frame substantially the entire length thereof. A pintle 82 carried in the extremity of the leg portion is embraced by the extended portion 56' of the feed advance rock shaft. This extended feed advance rock shaft provides not only for more convenient access to the outboard pintle 82 thereof, but being elongate provides for an extremely stable feed advance actuating connection to the feed bar, that is, one in which lost motion, etc. between the pintles 82 and 57 and the feed bar will reflect in a minimum of objectionable rocking movement being transmitted to the feed bar.

Having thus set forth the nature of the invention, what I claim herein is:

1. A four motion work feeding mechanism for a sewing machine having a frame base and a free ended work supporting bed extending from said frame base, comprising a feed bar formed with mutually perpendicular limbs, a first of said limbs extending lengthwise within the work supporting bed, a second of said limbs extending within said frame base, feed lift actuating mechanism including a feed lift rock shaft extending lengthwise within the work supporting bed, a plurality of operative connections between said feed lift rock shaft and said feed bar, said connections arranged at points on the first of said limbs spaced lengthwise of said work supporting bed, and feed advance actuating mechanism including a feed advance rock shaft disposed within said frame base, an operative connection between said feed advance rock shaft and said second limb of said feed bar, and means for actuating said feed advance and said feed lift rock shafts.

2. A four motion work feeding mechanism for a sewing machine having a frame including a base and a free ended work supporting bed extending from said frame base, comprising a feed bar formed with mutually perpendicular limbs, a first of said limbs extending lengthwise within the work supporting bed, a second of said limbs extending within said frame base, feed lift actuating mechanism including a feed lift rock shaft extending lengthwise within the work supporting bed, means for actuating said feed lift rock shaft, a plurality of operative connections between said feed lift rock shaft and said feed bar, said connections arranged at points on the first of said limbs spaced lengthwise of said work supporting bed, feed advance actuating mechanism including a feed advance rock shaft disposed within said frame base, means for actuating said feed advance rock shaft, an operative connection between said feed advance rock shaft and said second limb of said feed bar, and a slidable stabilizing connection between said feed bar and said sewing machine frame.

3. A work feeding mechanism for a sewing machine having a frame formed with a free ended work supporting bed, comprising a feed bar extending lengthwise within the confines of said work supporting bed, complemental bearing means on said feed bar and on said frame including a cylindrical guide member carried by one of said parts and bifurcated jaws carried by the other of said parts in slidable engagement with said guide member, means for shifting said feed bar in a direction lengthwise of said guide member, said means including an oscillatory member extending lengthwise within the confines of said work supporting bed, means actuated by said sewing machine for oscillating said member, a plurality of operative connections between said oscillatory member and said feed bar, said connections arranged at points on said feed bar spaced lengthwise of said work supporting bed, and mechanism carried in said frame and driven by said sewing machine for vibrating said feed bar in a direction transversely of said guide member.

4. A four motion work feeding mechanism for a sewing machine having a frame formed with a free ended work supporting arm, comprising an elongate feed bar extending within substantially the entire length of said work supporting arm, a feed dog secured to said feed bar at the free extremity of said work supporting arm, first feed actuating mechanism driven by said sewing machine and extending within said work supporting arm for imparting motion in one direction to said feed bar, a plurality of operative connections between said mechanism and said feed bar, said connections spaced lengthwise along said work supporting arm, second feed actuating mechanism driven by said sewing machine for imparting motion to said feed bar in a direction substantially perpendicular to that imparted by said first feed actuating mechanism, an operative connection between said second feed actuating mechanism and said feed bar arranged at one side of said plurality of connections of said feed bar with said first feed actuating mechanism, and a slidable stabilizing connection between said feed bar and said sewing machine frame at the opposite side of said plurality of connections.

5. A four motion work feeding mechanism for a sewing machine having a frame including a machine supporting base and a free ended work supporting bed extending from said base, said work feeding mechanism comprising a feed bar disposed in said machine supporting base and extending lengthwise into said work supporting bed, a feed dog secured to said feed bar within said work supporting bed, a slidable stabilizing connection between said sewing machine and a point on said feed bar within said machine supporting base, first feed actuating mechanism carried by said frame and driven by said sewing machine, a plurality of spaced operative connections of said first feed actuating mechanism with said feed bar within said free ended work supporting bed for imparting substantially translatory vibration to said feed bar, second feed actuating mechanism carried by said frame and driven by said sewing machine, and operative connections between said second feed actuating mechanism and said feed bar to impart vibratory motion to said feed bar in a direction substantially perpendicular to the motion of said feed bar in response to said first feed actuating means.

6. A four motion work feeding mechanism for a sewing machine having a frame including a frame base and a narrow free ended work supporting bed extending from said frame base and a driving shaft journaled in said frame, comprising a "T" shaped feed bar, a stem portion of said feed bar extending lengthwise within the work supporting bed, a cross bar portion of said feed bar extending transversely within said frame base, feed lift actuating mechanism including a feed lift rock shaft actuated from said driving shaft and extending lengthwise within said work supporting bed, feed advance actuating mechanism including a feed advance rock shaft actuated from said driving shaft and disposed within said frame base, an operative connection between said feed advance rock shaft and one extremity of said cross bar portion of the feed bar, the opposite extremity of said cross bar portion being bifurcated, and a cylindrical guide member carried by said frame base and disposed between the bifurcation of said cross bar portion of the feed bar.

7. A four motion work feeding mechanism for a sewing machine having a frame base and a narrow free ended work supporting bed extending from said frame base comprising, a T shaped feed bar, a stem portion of said feed bar extending lengthwise within the work supporting bed, a cross bar portion of said feed bar extending transversely within said frame base, a guide roller journaled on a substantially vertical axis beneath said frame base, one extremity of the cross bar portion of said feed bar being bifurcated and arranged to embrace said guide roller, a feed advance rock shaft carried in said frame base and actuated by said sewing machine, means operatively connecting said feed advance rock shaft to the opposite extremity of the cross bar portion of said T shaped feed bar to impart vibratory motion to said feed bar perpendicular to the axis of said guide roller, a feed lift rock shaft actuated by said sewing machine and ex-

tending lengthwise within the work supporting bed, a plurality of operative connections between said feed lift rock shaft and said feed bar spaced lengthwise along said stem portion of said feed bar for imparting substantially translatory vibration to said feed bar in a direction axially of said guide roller.

8. A four motion work feeding mechanism for a sewing machine having a frame formed with a free ended work supporting bed comprising a feed bar extending lengthwise within the confines of said work supporting bed, means for advancing and returning said feed bar transversely across said work supporting bed, and means for lifting and lowering said feed bar vertically in said work supporting bed, said last named means including a rock shaft extending lengthwise within the confines of said work supporting bed, means actuated by said sewing machine for oscillating said rock shaft, a pair of rock arms extending from said rock shaft in spaced relation thereon lengthwise of said work supporting bed, a pair of links pivotally secured one to the extremity of each of said rock arms, a pair of feed bar arms extending from said feed bar in spaced relation thereon lengthwise of said work supporting bed, and means pivotally securing each of said pair of links to a respective one of said feed bar arms substantially vertically beneath the pivotal connection of the link with said rock arm.

9. A four motion work feeding mechanism for a sewing machine having a frame base and a narrow free ended work supporting bed extending from said frame base, comprising a T shaped feed bar, a stem portion of said feed bar extending lengthwise within the work supporting bed, a cross bar portion of said feed bar extending transversely within said frame base, feed lift actuating mechanism including a feed lift rock shaft actuated by said sewing machine and extending lengthwise within said work supporting bed substantially vertically beneath said feed bar stem portion, a pair of upwardly and outwardly extending rock arms extending from said feed lift rock shaft in spaced relation thereon lengthwise of said work supporting bed, a pair of feed bar arms extending from said stem portion of said feed bar downwardly and outwardly in spaced relation thereon lengthwise of said work supporting bed, said feed bar arms terminating each in substantially vertical alignment beneath a respective one of said pair of feed lift rock arms, and a pair of substantially vertically arranged links pivotally interconnected between each of said vertically aligned feed lift rock arms and feed bar arms, feed advance actuating mechanism including a feed advance rock shaft actuated by said sewing machine and disposed within said frame base, an operative connection between said feed advance rock shaft and one extremity of said cross bar portion of the feed bar, and a slidable stabilizing connection between the opposite extremity of said cross bar portion and said frame base.

10. In a sewing machine having a frame including a supporting base defining a plane of support for the sewing machine, a free ended work supporting arm extending from the supporting base above said plane of support and adapted to accommodate tubular articles lengthwise thereon, and a bracket arm extending over said work supporting arm, stitch forming instrumentalities including a needle carried in said bracket arm for endwise reciprocating movement in a path intersecting said work supporting arm at a stitching point thereon, a loop taker supported for circular movement within the confines of said work supporting arm about a substantially vertical axis disposed in front of the stitching point, a feed bar extending lengthwise within the confines of said work supporting arm and having a portion extending behind said stitching point, mechanism carried within said frame and operatively connected to said feed bar for imparting movement to said feed bar transversely of the longitudinal axis of said work supporting arm, a feed dog extending transversely of the longitudinal axis of said work supporting arm beneath said stitching point and being attached to said portion of said feed bar behind said stitching point.

11. A four motion work feeding mechanism for a sewing machine having a frame including a supporting base defining a plane of support for the sewing machine, and a free ended work supporting bed extending from the supporting base above said plane of support, means defining a substantially planar work supporting area about a stitching point on said work supporting bed, said work feeding mechanism comprising, a feed bar extending within said work supporting bed, a feed dog secured to said feed bar within said work supporting bed, a guide roller journaled in said sewing machine frame on an axis substantially perpendicular to the plane of said work supporting area about said stitching point, said feed bar being provided with bifurcated jaws embracing said guide roller, a feed lift rock shaft carried by said frame and actuated by said sewing machine, a plurality of spaced operative connections of said feed lift rock shaft with said feed bar for imparting substantially translatory vibration to said feed bar in a direction axially of said guide roller, a feed advance rock shaft carried by said frame and actuated by said sewing machine, and means operatively connecting said feed advance rock shaft to said feed bar to impart vibratory motion to said feed bar perpendicular to the axis of said guide roller.

References Cited in the file of this patent

UNITED STATES PATENTS

402,259	Leilich	Apr. 30, 1898
2,386,660	Clayton	Oct. 9, 1945
2,453,072	Johnson	Nov. 2, 1948
2,808,793	Ayres	Oct. 8, 1957