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FEEDING MECHANISM FOR SEWING MACHINES

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3 Sheets-Sheet 1

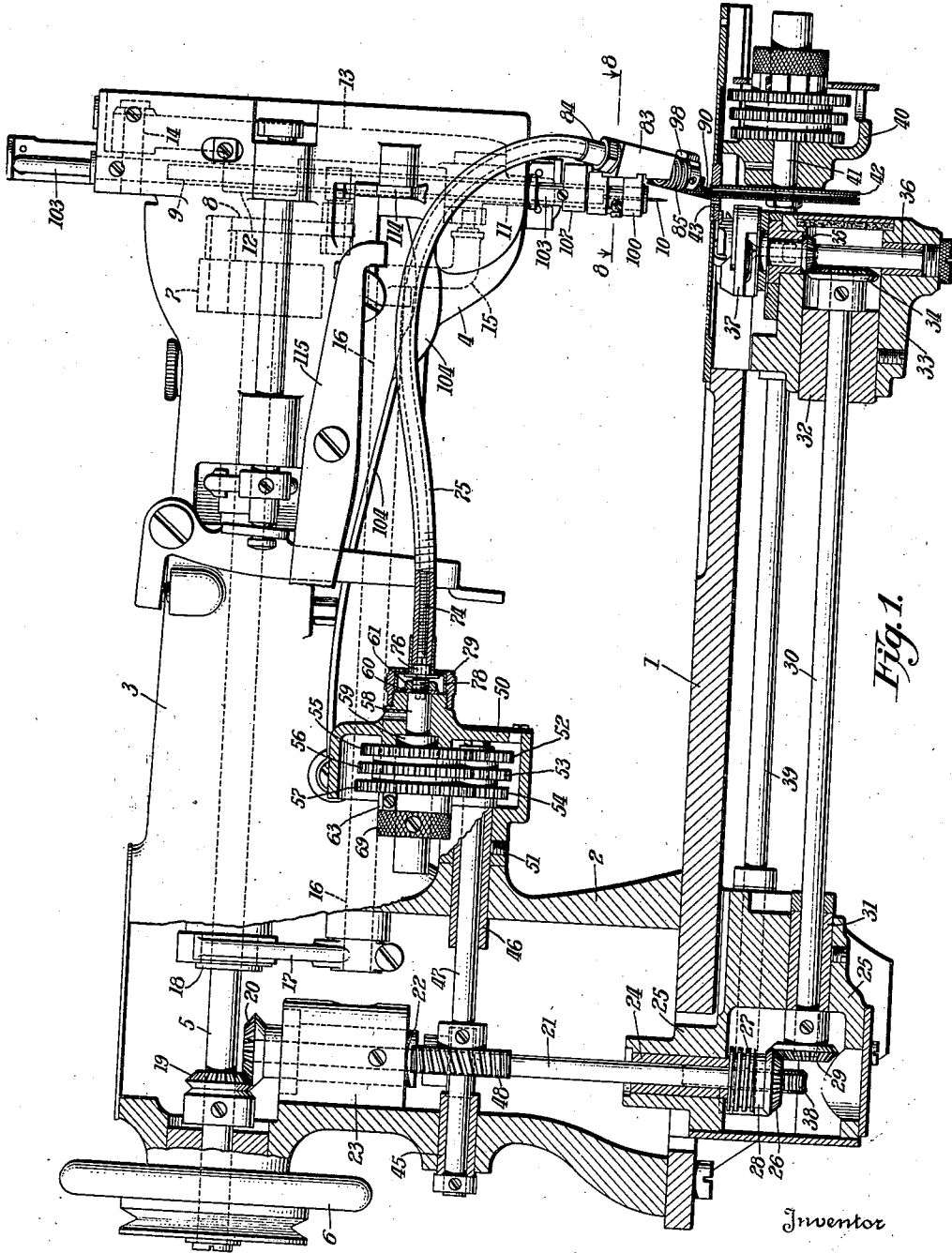


Fig. 1.

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3 Sheets-Sheet 2

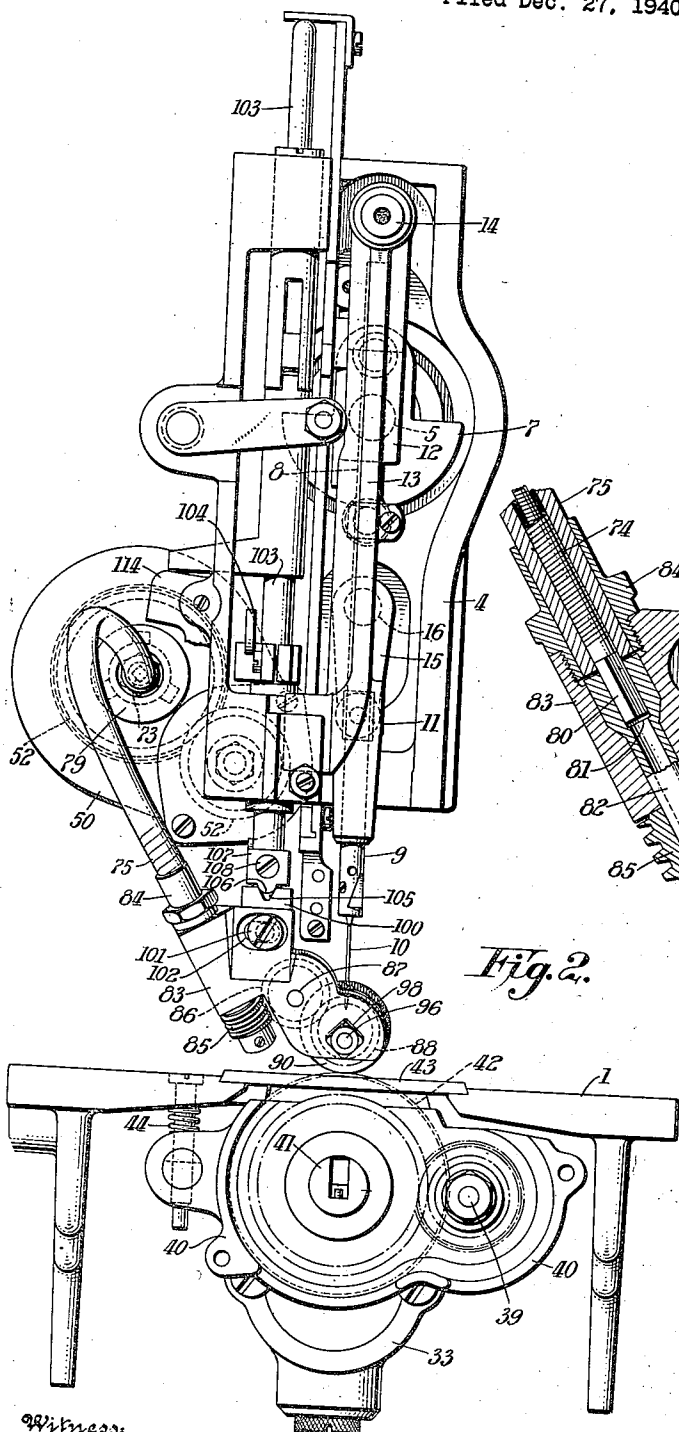


Fig. 2.

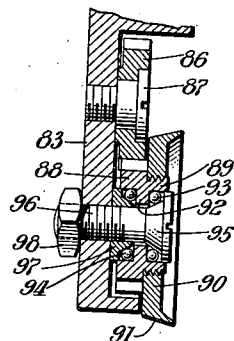


Fig. 4.

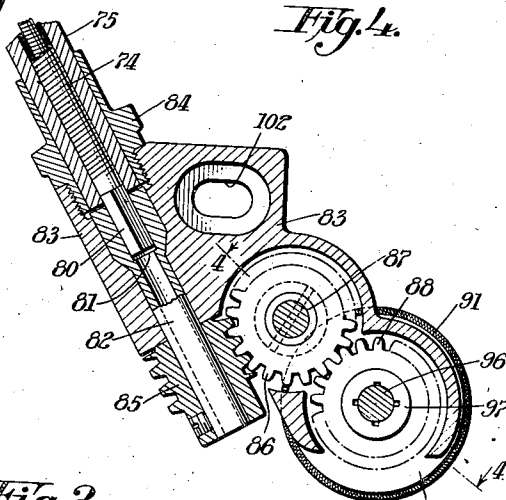


Fig. 3.

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3 Sheets-Sheet 3

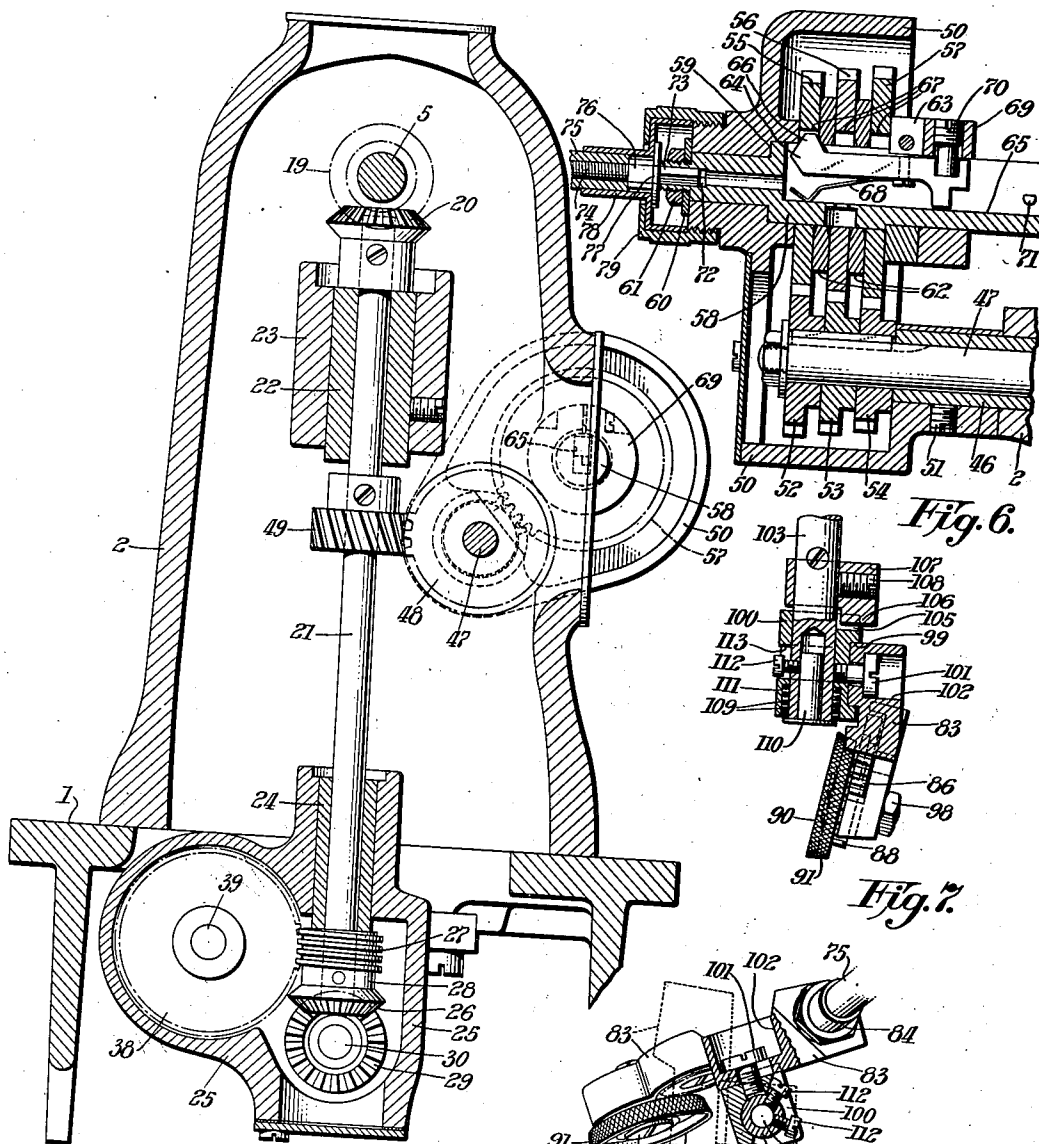


Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

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FEEDING MECHANISM FOR SEWING MACHINES

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16 Claims. (Cl. 112—214)

This invention relates to improvements in feeding mechanisms for sewing machines and has for its primary objective the provision of an improved feeding mechanism designed to advance the superposed plies of material past the stitching mechanism at an equal and uniform rate without any relative movement of the plies of material during the feeding thereof.

Another object of the invention is the provision of a wheel-feed mechanism having upper and lower driven feed-wheels each of which is driven through connections including means, readily accessible to the operator, for changing the speed of rotation of the feed-wheel, whereby the feed-stroke of both the upper and lower feed-wheels may be synchronized or made unequal to effect a differential feeding action.

A further object of the present invention is the provision of a top wheel-feed mechanism having an improved driving mechanism which is positive in its action, flexible to permit the feed-wheel to be raised and lowered and also swung into an inoperative or an out-of-the-way position without disconnecting the power transmitting drive, and disposed in proximity to the bracket-arm and head so as not to encroach upon the work-handling space beneath the bracket-arm.

Further advantages and beneficial results in operation will be apparent from the following description of an illustrative embodiment of my invention taken in connection with the accompanying drawings, in which:

Fig. 1 is a front elevation, partly in section, of a sewing machine embodying the present improvement.

Fig. 2 is an end elevation of the machine head and bed.

Fig. 3 is an enlarged sectional view taken through the upper feed-wheel supporting bracket, showing the gear drive connections between the feed-wheel and the flexible cable.

Fig. 4 is a fragmentary sectional view taken substantially along the line 4—4, Fig. 3.

Fig. 5 is a vertical transverse section taken through the machine standard, illustrating the way in which the respective drives for the upper and lower feed-wheels are derived from the vertical shaft connecting the upper and lower main-shafts of the machine.

Fig. 6 is an enlarged sectional view taken through the change-speed gear drive of the upper feed-wheel, showing the means employed for selectively keying the desired one of a plurality of nested gears to be driven by its companion gear.

Fig. 7 is an enlarged vertical sectional view taken through the lower end-portion of the presser-bar and the feed-wheel supporting bracket.

Fig. 8 is a horizontal sectional view taken substantially along the line 8—8, Fig. 1.

The present improvement has been embodied in a sewing machine constructed substantially as disclosed in the U. S. patent to H. Corral et al., No. 1,414,625, issued May 2, 1922.

Referring to the drawings, the machine frame comprises a bed 1 from one end of which rises a hollow standard 2 supporting a tubular bracket-arm 3 which terminates in a head 4 overhanging the bed 1. Journaled for rotation in suitable bearings provided in the bracket-arm 3 is a main actuating shaft 5 which at its outer end carries a belt-pulley 6 and at its inner end carries a crank-disk 7. The crank-disk 7 is connected in the usual manner by a link 8 to a needle-bar 9, thereby to reciprocate the needle-bar upon rotation of the main-shaft 5. At its lower end the needle-bar 9 carries a needle 10.

The needle-bar 9 is journaled for endwise reciprocation in aligned bearings provided in the spaced lugs 11 and 12 of a vibratory frame 13 pivotally supported at its upper end upon a pin 14 fixed in the head 4, whereby the frame 13 is confined to swinging movements in the line of feed. The vibratory frame 13 is swung in the line of feed to assist in advancing the work through the machine by a crank-arm 15, the lower end of which is operatively connected to said vibratory frame and the upper end of which is mounted on one end of a horizontally disposed rock-shaft 16 journaled in the bracket-arm 3 below and in substantial parallelism with the main-shaft 5. Clamped upon the other end of the rock-shaft 16 is an upstanding rock-arm 17, see Fig. 1, forked at its upper end to embrace a common form of adjustable eccentric 18 fast upon the main-shaft 5. The eccentric 18 is preferably made adjustable so that the feeding movement imparted to the needle 10 may be made to correspond in amplitude to the feeding movements of the feed-wheels later to be described.

Adjacent the adjustable eccentric 18, the main-shaft 5 has secured thereon a bevel gear 19 meshing with a bevel gear 20, carried by the upper end of a vertical shaft 21 journaled at its upper end in a bearing bushing 22 provided in the lug 23 integral with the standard 2. At its lower end, the shaft 21 is journaled in a bearing bushing 24 secured in the frame of a housing 25 suitably attached to the under side of the bed 1.

Within the housing 25 the shaft 21 carries a bevel gear 26 having a worm 27 cut into its hub 28. Meshing with the bevel gear 26 is a similar bevel gear 29 secured upon one end of a loop-taker actuating shaft 30 journaled at one end in a bushing 31 in the housing 25 and at its other end in a bushing 32 fixed in a loop-taker saddle 33. Secured on the other end of the loop-taker actuating shaft 30 is a bevel gear 34 in mesh with a bevel-gear 35 which is one-half the size of the bevel gear 34 and which is carried by a relatively short loop-taker shaft 36 journaled for rotation in vertically aligned bearings provided in the loop-taker saddle 33. Fixed to the upper end of the shaft 36 is any suitable or well known vertical-axis loop-taker 37 for cooperation with the needle 10 in the formation of lock-stitches.

Referring now to the means employed beneath the bed 1 for assisting in feeding the work past the stitching mechanism, the worm 27 on the lower end of the vertical shaft 21 drives a worm-wheel 33 secured upon a substantially horizontal feed-wheel actuating shaft 39 journaled at its rearward end in the housing 25 and at its forward end in the loop-taker saddle 33, in a manner similar to that disclosed in the above mentioned Corral et al. patent. Pivotaly mounted to turn about the axis of the feed-wheel actuating shaft 39 at its forward end is a supporting bracket 40 in which is journaled a stub-shaft 41 carrying at one end a feed-wheel 42 which projects through an opening in the usual throat-plate 43, the extent to which the feed-wheel 42 projects through the opening being adjustable by the screw 44 to facilitate the handling of materials of various thicknesses. To provide for different stitch-lengths, the stub-shaft 41 is connected to the feed-wheel actuating shaft 39 through a change-speed gear unit, similar to that shown in Fig. 6 which will later be described in connection with the drive for the upper feed-wheel.

Referring now to the means employed for driving the upper feed-wheel, the standard 2 intermediate its ends is fitted with two bearing bushings 45 and 46 in which is journaled an intermediate shaft 47. This intermediate shaft 47 has fixed thereon a spiral gear 48 which meshes with a similar gear 49 fastened upon the vertical shaft 21, the ratio of the two gears 48 and 49 preferably being $1\frac{1}{2}$ -to-1. As shown in Figs. 1 and 6, the bearing bushing 46 has an extended outer end which provides a support on which is mounted a casing 50 secured in fixed position by a set-screw 51. Projecting into the lower portion of the casing 50 is the outer end of the intermediate shaft 47 (see Fig. 6) on which are keyed three pinions 52, 53 and 54 of different size in constant mesh, respectively, with different size spur-gears 55, 56 and 57 which are adapted to be selectively keyed to a stub-shaft 58 journaled in the upper portion of the casing 50. To prevent endwise movement, the stub-shaft 58 is formed with a shoulder 59 maintained seated in the stepped bearing in the casing 50 by a washer 60 and nut 61 threaded upon the reduced end of the stub-shaft 58.

As will be observed in Fig. 6 the spur-gears 55, 56 and 57 are freely journaled upon the stub-shaft 58 and are spaced from each other by washers 62, the gears and washers being held against movement endwise of the stub-shaft 58 by a split collar 63 suitably clamped upon the stub-shaft. The means employed for keying any one of the spur-gears to the stub-shaft 58 comprises a shift-

able key 64 adapted to track the longitudinal slot 65 in the stub-shaft 58, the key having a nose 63 adapted to enter any one of the notches 67 in the shaft apertures of the spur-gears. The key 64 is acted upon by a spring 63 to urge the key-nose 66 into the notches, the washers 62 serving to disengage the key-nose from one gear notch before entering another gear notch, when the key 64 is shifted lengthwise of the slot 65. For conveniently shifting the key 64, there is provided a knurled shift-ring 69 slidably disposed upon the stub-shaft 58, the shift-ring carrying a stud-screw 70 of which the reduced end enters a suitable slot in the key. To guard against the inadvertent withdrawal of the key 64 from the shaft-slot 65, a pin 71 is disposed near the outer end of the shaft-slot. It will be understood from the above description that while the spur-gears 55, 56 and 57 of the change-speed gear unit are rotated continuously during the operation of the machine, the stub-shaft 58 will be rotated at a speed corresponding to the speed of rotation of the particular spur-gear which has been selectively coupled to the sub-shaft 58 by the key 64, the spur-gear coupled giving the required stitch-length. While no detailed description is given of the change-speed gear unit located beneath the bed 1 and used to connect the actuating shaft 39 with the stub-shaft 41 carrying the lower feed-wheel 42, it is to be understood that its details of construction are the same as those of the unit employed for driving the upper feed-wheel, and that the speed ratios of the gears in each unit are such that the upper and lower feed-wheels may be operated to effect an equal or a differential feeding action relative to each other.

The stub-shaft 58 is formed in one end with an axial socket 72 (see Fig. 6) adapted to receive the squared end-portion 73 of a common form of flexible driving cable 74 rotatably mounted within a flexible protective sheath 75. The squared end-portion 73 of the flexible cable is maintained seated in the axial socket 72 preferably by means of a collar 76 secured to the flexible cable 74 and having a flange 77 adapted to be engaged by an enlarged head 78 soldered or otherwise secured to the sheath 75, the enlarged head 78 being seated against the face of an extended lug on the gear unit casing 53 by a sleeve nut 79 threaded upon said extended lug. At its other end the flexible cable 74 is provided with a squared end-portion 80 (see Fig. 3) adapted to project into a socket 81 formed in the upper end of a hollow spindle 82 journaled for rotation in a feed-wheel supporting bracket 83. Threaded into the feed-wheel supporting bracket 83 above the upper end of the spindle 82 is a sleeve-nut 84 soldered or otherwise attached to the protective sheath 75 of the flexible cable 74, whereby the sheath 75 is fastened against rotation at its lower end to the supporting bracket 83.

Secured upon the lower end-portion of the spindle 82 is a worm 85 in mesh with an intermediate idler gear 86 journaled upon a shouldered screw 87 threaded into the supporting bracket 83. In order to render negligible the inherent twisting characteristic of the flexible cable 74, which twisting might affect the synchronization between the upper and lower feed-wheels, the gear ratio between the worm 85 and the idler gear 86 is preferably large and in the order of 20-to-1. It will be appreciated that any lost motion between the stub-shaft 58 and the worm 85, resulting from the twisting of the flexible cable 74, will be considerably reduced in mag-

nitide through the 20-to-1 speed reduction between the worm 85 and the idler gear 86. The idler gear 86 (see Fig. 4) drives a gear 88 which is formed with a lateral hub 89 threaded on its outer surface to receive the upper feed-wheel 90 having a knurled peripheral surface 91. The gear 88 has an internal rib 92 to provide spaced annular recesses for two sets of bearing-balls, as 93 and 94. The bearing-balls 93 have a rolling contact with a bearing-cone 95 afforded by the head of a feed-wheel supporting screw 96. Threaded upon the screw 96 is a bearing-cone 97 for the balls 94, the screw 96 being itself threaded into the feed-wheel supporting bracket 83 and secured in the adjusted position of the bearing-cones by means of a nut 98.

The feed-wheel supporting bracket 83 is secured in a recessed seat 99 in one side of a swing-out collar 100, the bracket-securing means comprising a screw 101 passing through an elongated aperture 102 in the supporting bracket 83 to provide for adjustment of the feed-wheel 90 in the direction of seam-formation. As will be observed in Figs. 1 and 2, the swing-out collar 100 is carried by the lower end of the usual presser-bar 103 which is endwise slidable in bearings in the machine-head 4, a spring 104 being provided for biasing the presser-bar 103 downwardly, whereby the upper feed-wheel 90 is yieldingly pressed into contact with the work in opposition to the lower feed-wheel 42. Through the medium of the swing-out collar 100, the feed-wheel 90 is supported so that it may be swung from its operative position, shown in Figs. 1, 2 and in dotted lines in Fig. 8, to an inoperative position as shown in full lines in Fig. 8, in which position the needle 10 may be conveniently threaded. To lock the feed-wheel 90 in its operative position the swing-out collar 100 at its upper end is formed with a groove 105 adapted to receive a locating tooth 106 formed on a collar 107 fixed on the presser-bar 103 by a set-screw 108. The swing-out collar 100 is normally biased upwardly toward the collar 107 by a coil-spring 109 surrounding the lower end of the presser-bar 103 and acting between the head of a stud 110 in the presser-bar and the upper end of a spring-receiving recess 111 formed in the collar 100. The spring 109 functions to maintain the groove 105 and locating tooth 106 in engagement with one another. To limit the swinging movement of the collar 100 the presser-bar has threaded into it two stop-screws 112 which cooperate with the opposite ends of a slot 113 in the collar 100 and also secure the stud 110 in the lower end of the presser-bar.

When it is desired to swing the feed-wheel 90 from its operative position to an inoperative position, the presser-bar 103 is first elevated by the usual hand-lifting lever 114 or the treadle-controlled lifting lever 115, thus permitting the supporting bracket 83 carrying the feed-wheel 90 to be turned away from the needle 10 about the axis of the presser-bar 103 to a position determined by one of the stop-screws 112. It will be understood that the cable 74 is preferably of such length and flexibility that the feed-wheel supporting bracket can be swung into an inoperative position without having to disconnect either of the ends of the cable. This is desirable in that the feed-wheel 90 can be maintained in constant driving relation with its actuating connections regardless of whether it is in operative or inoperative position.

From the foregoing detailed description taken in connection with the accompanying drawings, 75

it will be understood that the present invention contemplates an improved feeding mechanism having upper and lower driven feeding wheels of which each is operated through connections including means whereby the stitch-length of each feed-wheel may be independently adjusted so that the feed-wheels operate to effect an equal or a differential feeding action. With this desirable provision superposed plies of material may be advanced past the stitching mechanism of a sewing machine at an equal and uniform rate without any relative movement of the plies of material during the feeding thereof, or one ply may be gathered or stretched relative to another ply by adjusting one of the feed-wheels to operate at a faster or slower speed, respectively, than its opposing feed-wheel.

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

1. In a sewing machine, in combination, a lower work-advancing feed-wheel, means for rotating said lower feed-wheel including a change-speed gear unit comprising nested gears constantly intermeshing and means for selectively establishing driving relationship between said gears, an upper work-advancing feed-wheel, and means for rotating said upper feed-wheel including devices operable for regulating the speed of rotation of said upper feed-wheel relative to the selected speed of said lower feed-wheel to effect an equal or a differential feeding action of the two cooperating feed-wheels.

2. In a sewing machine, in combination, an upper work-advancing feed-wheel, means for rotating said upper feed-wheel including a change-speed gear unit comprising nested gears constantly intermeshing and means for selectively establishing driving relationship between said gears, a lower work-advancing feed-wheel opposed to said upper feed-wheel, and means for rotating said lower feed-wheel including devices operable for regulating the speed of rotation of said lower feed-wheel relative to the selected speed of said upper feed-wheel to effect an equal or a differential feeding action of the two cooperating feed-wheels.

3. In a sewing machine, in combination, a frame including a bracket-arm and a bed having a work-supporting surface, a lower work-advancing feed-wheel having a portion thereof projecting above said work-supporting surface, means for rotating said lower feed-wheel and including devices operable for regulating the speed of rotation of said lower feed-wheel, an upper work-advancing feed-wheel yieldingly opposed to said lower feed-wheel, and means for rotating said upper feed-wheel, said means including a flexible cable adapted to be disposed in proximity to the bracket-arm so as not to encroach upon the work-handling space beneath the bracket-arm.

4. In a sewing machine, in combination, a frame comprising a bed and a bracket-arm terminating in a head, an actuating shaft journaled in said bed, a lower work-advancing feed-wheel, a shaft carrying said lower feed-wheel and operatively connected to said actuating shaft through a change-speed gear unit to permit regulation of the speed of rotation of said lower feed-wheel, an upper work-advancing feed-wheel, means sustained by said head for carrying said upper feed-wheel with capacity for angular movement, and means for rotating said upper feed-wheel, said last-named means including a flexible cable adapted to be disposed in proximity to the bracket-arm and head so as not to encroach

upon the work-handling space beneath the bracket-arm and of sufficient length to permit angular movement of said upper feed-wheel.

5. In a sewing machine, in combination, a frame, a main-shaft journaled in said frame, a work-advancing feed-wheel, means including a flexible cable for operatively connecting said feed-wheel to be driven by said main-shaft, and gearing having a large speed reduction ratio for connecting one end of said flexible cable to said feed-wheel to render negligible any lost motion caused by the normal inherent twisting characteristic of the flexible cable.

6. In a sewing machine, in combination, a frame, a main-shaft journaled in said frame, a work-advancing feed-wheel having a gear connected thereto, means including a flexible cable for operatively connecting said feed-wheel to be driven by said main-shaft, and gearing connecting one end of said flexible cable to the gear attached to said feed-wheel, said gearing including a worm operatively attached to said flexible cable and providing a large speed reduction ratio to render negligible any lost motion resulting from the normal inherent twisting characteristic of the flexible cable.

7. In a sewing machine, in combination, a frame, a main-shaft journaled in said frame, a work-advancing feed-wheel, and means operatively connecting said feed-wheel to be driven by said main-shaft, said means including a change-speed gear unit for regulating the work-advancing movements of the feed-wheel, a flexible cable attached at one end to said change-speed gear unit, and gearing connecting the other end of said flexible cable to said feed-wheel and having a large speed reduction ratio to render negligible any lost motion resulting from the normal inherent twisting characteristic of said flexible cable.

8. A sewing machine having, in combination, a frame, a shaft rotatably journaled therein and supporting a plurality of pinion gears, a sub-shaft, a plurality of spur gears mounted on said stub-shaft and constantly intermeshing with said pinion gears, means for selectively establishing driving relationship between said pinion and spur gears, a work-advancing feed-wheel, a flexible cable attached at one end to said stub-shaft, and means including gearing having a large speed-reduction ratio for operatively connecting the other end of said flexible cable to said feed-wheel.

9. A sewing machine having, in combination, a frame, a main-shaft journaled in said frame, an intermediate shaft operatively connected to said main-shaft and having a plurality of pinion gears fixed thereon, a stub-shaft disposed substantially parallel to said intermediate shaft and having mounted thereon a plurality of spur gears constantly intermeshing with said pinion gears, means for selectively establishing driving relationship between said pinion and spur gears, a work-advancing feed-wheel, means for supporting said feed-wheel in yielding contact with the work, and means operatively connecting said stub-shaft with said feed-wheel.

10. A sewing machine having, in combination, a frame including a bracket-arm terminating in a head, a main-shaft journaled in said frame, an intermediate shaft journaled in said bracket-arm and having a plurality of pinion gears fastened thereon, means connecting said intermediate shaft with said main-shaft, a stub-shaft disposed substantially parallel to said interme-

mediate shaft and having mounted thereon a plurality of spur gears adapted to constantly intermesh with said pinion gears, a work-advancing feed-wheel, a spring-biased bar slidable in said head and carrying said feed-wheel at its lower end, and a flexible cable connected at one end to said stub-shaft and at its other end to said feed-wheel for actuating the latter.

11. A sewing machine having, in combination, a frame including a bracket-arm terminating in a head, a bearing bushing penetrating one wall of said bracket-arm, a shaft rotatably journaled in said bushing and having a plurality of pinion gears fastened thereon, a casing supported by said bushing, a stub-shaft journaled in said casing and having mounted thereon a plurality of spur gears adapted to constantly intermesh with said pinion gears, means for selectively establishing driving relationship between said gears, a work-advancing feed-wheel supported by said head for yielding engagement with the work, and means for operatively connecting said stub-shaft to said feed-wheel for imparting work-advancing movements thereto.

12. A sewing machine having, in combination, a frame comprising a bed and a bracket-arm terminating in a head, a main-shaft journaled in said bracket-arm, an actuating shaft journaled in said bed, a lower work-advancing feed-wheel supported within said bed, means operatively connecting said actuating shaft with said feed-wheel including a change-speed gear unit, a vertical shaft rotatably mounted within said bracket-arm for connecting said main shaft with said actuating shaft, an intermediate shaft mounted in said bracket-arm and geared to said vertical shaft, a stub-shaft operatively connected to said intermediate shaft through a change-speed gear unit, an upper work-advancing feed-wheel opposed to said lower feed-wheel, and means including a flexible cable connecting said stub-shaft with said upper feed-wheel for imparting work-advancing movements thereto.

13. A sewing machine having, in combination, a frame, an actuating shaft journaled therein, a work-contacting rotary member, a supporting bracket yieldingly sustained by said frame and carrying said rotary member, a spindle journaled in said supporting bracket, means including a flexible cable for operatively connecting said spindle to said actuating shaft, and means connecting said spindle to said rotary member and operable to render negligible any lost motion caused by the inherent twisting characteristic of the flexible cable.

14. A sewing machine having, in combination, a frame, an actuating shaft journaled therein, a work-contacting rotary member, a supporting bracket yieldingly sustained by said frame and carrying said rotary member, a spindle journaled in said supporting bracket, means including a flexible cable for operatively connecting said spindle to said actuating shaft, and gearing including a worm and worm-wheel for connecting said spindle to said rotary member, said worm being mounted on said spindle.

15. A sewing machine having, in combination, a frame, a main-shaft journaled therein, a work-advancing feed-wheel, a supporting bracket carrying said feed-wheel and sustained by said frame with capacity for vertically yielding and angular movement, a spindle journaled in said supporting bracket, means including a flexible cable for operatively connecting said spindle to said main-shaft, and gearing connecting said

spindle to said feed-wheel and having a large speed reduction ratio to render negligible any lost motion resulting from the normal inherent twisting characteristic of said flexible cable.

16. A feeding mechanism for a sewing machine having a frame and an actuating shaft journaled therein, comprising, a work-advancing feed-wheel having a gear secured thereto, a supporting bracket sustained by said frame and car-

rying said feed-wheel, a spindle journaled in said supporting bracket, means including a flexible cable for operatively connecting said spindle to said actuating shaft, a worm secured to said spindle, and a worm-wheel journaled on said supporting bracket and meshing with said worm and with the gear secured to said feed-wheel.

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