No. 607,080. Patented July 12, 1898.

F. H. RICHARDS.

LOOPER MECHANISM FOR SEWING MACHINES.

(Application filed Sept. 20, 1897.)

(No Model.) 2 Sheets—Sheet 1.

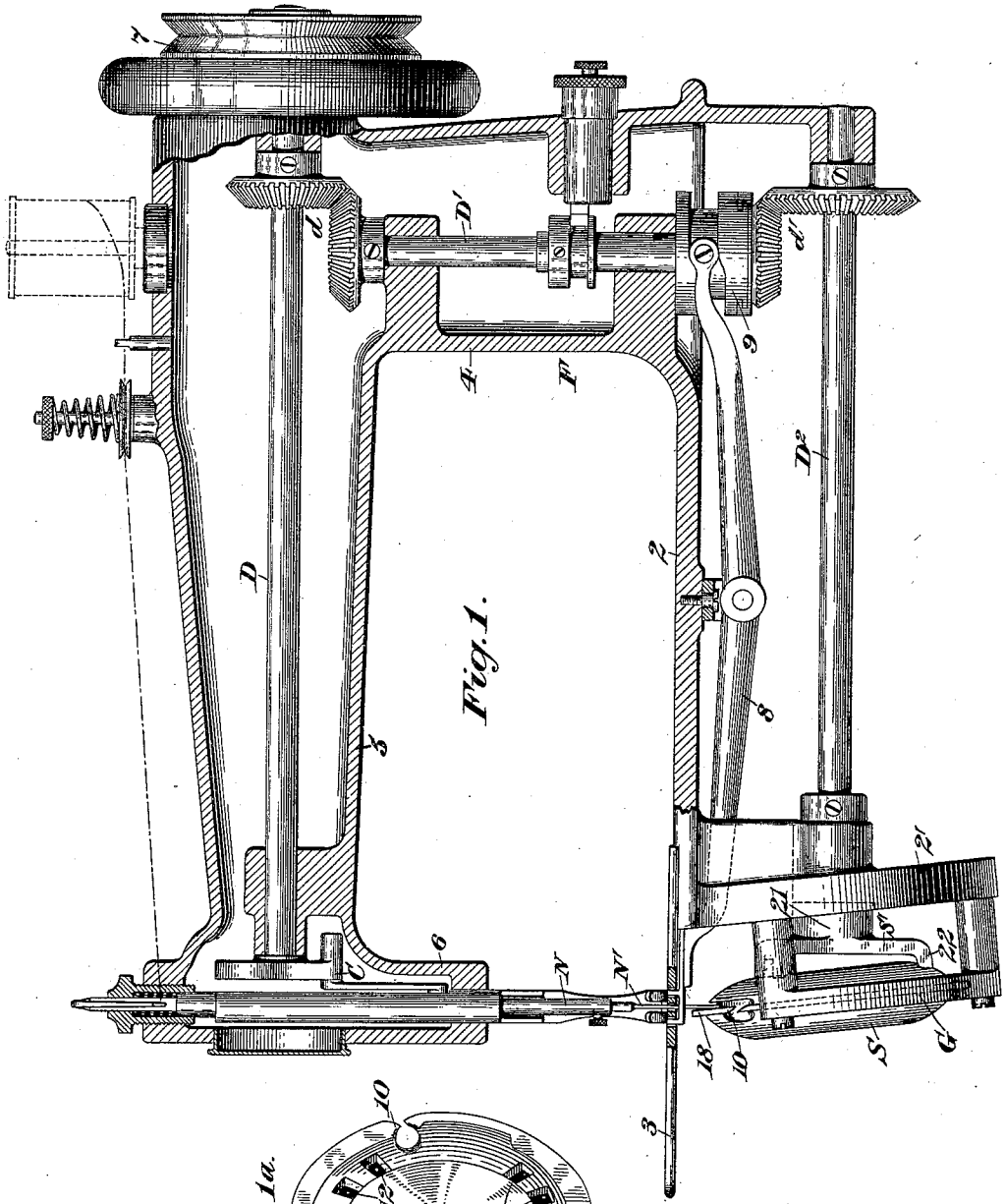

Fig. 1.

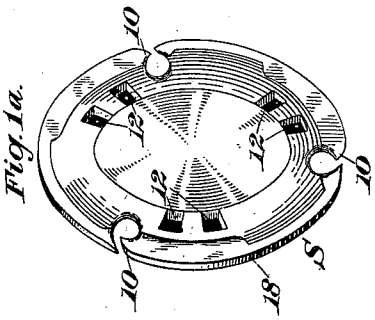

Fig. 1a.

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(No Model.) 2 Sheets—Sheet 2.

Fig. 4.

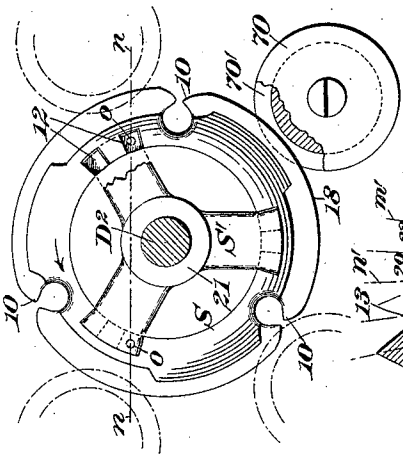


Fig. 9.

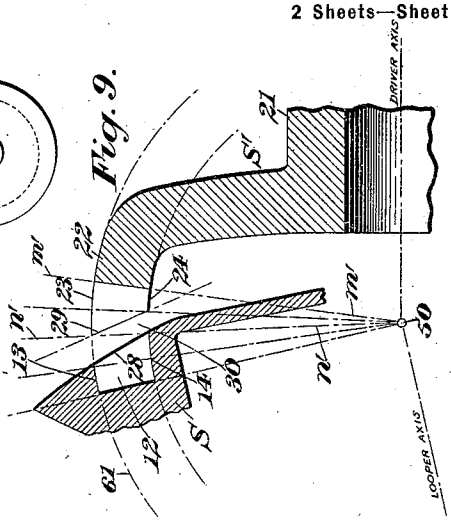


Fig. 3.

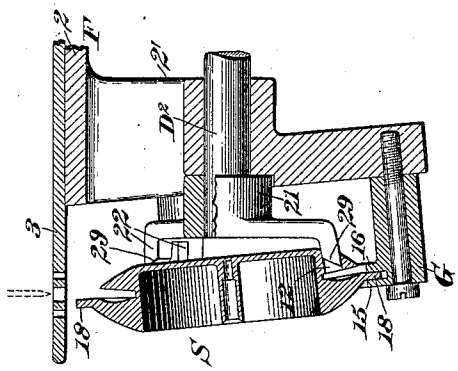


Fig. 8.

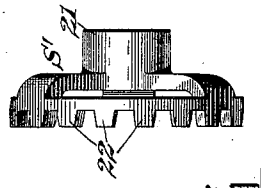


Fig. 10.

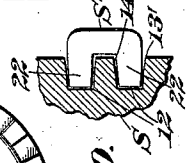


Fig. 7.

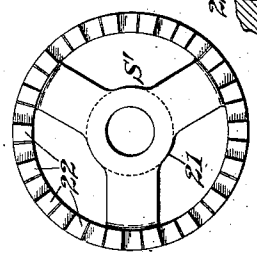


Fig. 2.

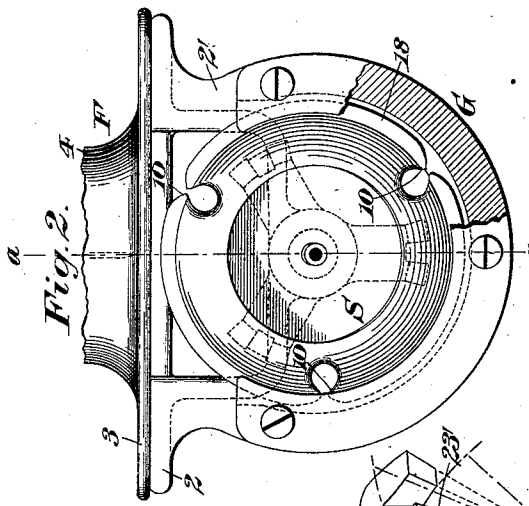


Fig. 6.

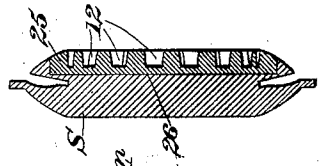


Fig. 5.

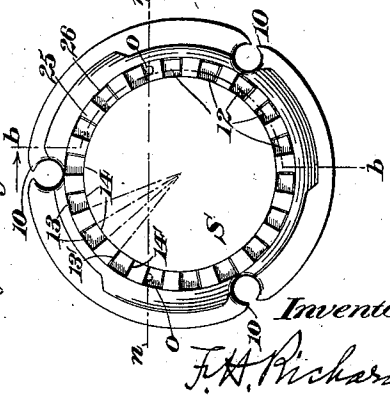
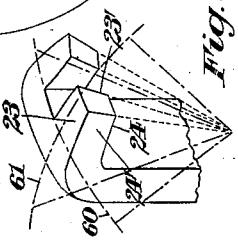


Fig. 11.



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UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT.

LOOPER MECHANISM FOR SEWING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 607,080, dated July 12, 1898.

Application filed September 20, 1897. Serial No. 652,242. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Looper Mechanism for Sewing-Machines, of which the following is a specification.

This invention relates to looper mechanism for a sewing-machine of that class in which a rotary looper or shuttle is employed for engaging the loop of the needle-thread and for carrying the same entirely around said looper to inclose a second or lower thread to thereby form a lock-stitch or in which said looper carries a succeeding loop through a preceding loop to thereby form a chain-stitch.

In a looper mechanism wherein a rotary looper having a series of driver-sockets formed in one face thereof is employed and set to rotate at an angle oblique to the driver and wherein the looper-driver is provided with a series of pins to enter the sockets in and rotate the looper it has been found in practice that owing to the relatively oblique angles of movements of and the resultant rolling action between the looper and driver it was necessary for the purpose of facilitating a free movement of the driver-pins when engaging and disengaging the looper to form the driver-sockets of the looper of considerably greater area than the driver-pins, and for this reason it was impossible to secure such a coöperative engagement between the driver-pins and the walls of the sockets as would enable the driver to support the looper positively and obviate diametrical vibratory movement of said looper relatively to the driver, as is well appreciated by those familiar with this class of looper mechanisms.

One object of my present invention is to provide an improved rotary looper mechanism for sewing-machines in which the driver and looper are so constructed that they will coöperate in a manner somewhat similar to that of two intermeshing gears with a rolling action and in which engaging portions of the looper and driver are so constructed that said driver will positively support the looper in fixed peripheral relation with the axis of and obviate vibratory movement of such looper relatively to said driver and also to provide as an element of the looper mechanism means whereby the looper will be guided in its rotation, be held as against movement transversely of its path of rotation, and be left free, so far as the guiding means is concerned, for diametrical movement.

A further object of the invention is to furnish a looper mechanism for sewing-machines comprehending a looper having one or more peripheral loop-takers and also having in one side face thereof a series of sockets or recesses, the outer and inner end walls of which are spherical and concentric to a common center, and a looper-driver supported with its axis oblique to the axis of movement of the looper and having a series of projections or driver-teeth, the outer and inner end faces of which are of spherical conformation corresponding to and which coöperate with the spherical walls of the looper recesses or sockets for supporting said looper in fixed peripheral relation to the axis of the driver and incidentally for rotating the same, the spherical outer and inner end faces of the teeth of the driver being also concentric to the aforesaid common center.

In the drawings accompanying and forming part of this specification, Figure 1 is a central vertical section, parts being shown in elevation, of one form of sewing-machine embodying my present improvements. Fig. 1^a is a perspective view of the looper, illustrating one form thereof. Fig. 2 is an end view of a portion of the bed of a sewing-machine, on an enlarged scale, showing the preferred form of looper and looper-guide in full lines and the looper-driver in dotted lines. Fig. 3 is a vertical section taken on a line corresponding with the dotted line *a a*, Fig. 2, and showing the same parts as seen from the right in said figure. Fig. 4 is an elevation of the looper-driver and looper, partially in section, as seen from the right in Fig. 3, rollers being shown in full and dotted lines for guiding the looper. Fig. 5 is a side elevation of the looper, showing the same with a complete circuit of driver-sockets, the construction of the looper in said figure being in the nature of a modification of that illustrated in the preceding figures. Fig. 6 is a cross-sectional view of the looper, taken in dotted line *b b*, Fig. 5, looking toward the left in said figure. Fig. 7 is a side

view of the driver for the looper illustrated in Figs. 5 and 6, said driver being shown furnished with a complete circuit of projections or driver-teeth. Fig. 8 is a front view of the driver illustrated in Fig. 7 as seen from the right in said figure. Fig. 9 is a longitudinal section, on a relatively large scale, of a portion of the looper and driver shown in Fig. 3 and illustrating by radial lines the pitch cones or angles of the teeth of said looper and driver. Fig. 10 is a cross-section of a portion of the looper, showing two driver-sockets and two driver-teeth seated therein; and Fig. 11 is a diagrammatic perspective view of a portion of the looper-driver, illustrating the spherical curvature of the ends of the driver-teeth and the angles of the side faces of said teeth.

Similar characters designate like parts in all the figures of the drawings.

The looper mechanism, in which the essence of my present invention resides, is applicable to various kinds of sewing-machines; but for convenience said mechanism is shown in connection with a sewing-machine which in general construction and organization is substantially the same as that described in my Patent No. 574,573, dated January 5, 1897, only so much of said sewing-machine being shown in the drawings as is deemed necessary clearly to illustrate the application and mode of operation of my improved looper mechanism with relation to the other coöperative elements of a sewing-machine.

The framework F of the machine, which may be of any suitable construction, is shown comprising a horizontal bed-plate 2, having the bracket 2′ and a removable throat-plate 3 at one end thereof, the hollow upright 4 at the opposite end of the bed-plate, the hollow horizontal arm 5 above the bed-plate, and the vertical needle-bar-receiving head 6 at the outer end of the arm 5 and above the throat-plate 3. As in the majority of sewing-machines of this class, the stitch-forming mechanism as a whole comprises three principal mechanisms—to wit, the needle mechanism, the looper mechanism, and the feeding mechanism—all of which are connected for cooperative and properly-timed movements.

The needle mechanism shown in the accompanying drawings comprises a needle-bar N, supported for reciprocatory movement in the head 6 of the frame and having a needle N′ at the lower end thereof, a needle-bar-actuating shaft D, journaled in the arm 5 of the machine, and a connecting-actuator C (shown as a crank and arm) between said shaft and needle-bar, the needle-actuating shaft being furnished with a band-wheel 7, whereby the same may be driven.

The feed mechanism is shown comprising a universal feed-lever 8, actuated by a cam 9, fixed to a vertical shaft D′, connected by a train of gears d to the needle-bar-actuating shaft D.

The looper mechanism is shown comprising a looper S, a combined looper support and driver S′, disposed with its axis oblique to the axis of rotation of the looper, and a driver-actuating shaft D^2, connected by a train of gears d' to the intermediate or feed-lever-actuating shaft D′. While the arrangement illustrated is preferable, yet, as is obvious, the looper may be located in a vertical plane and the driver disposed at an angle thereto, if desired.

The looper S has a series of peripherally-disposed loop-takers or hooks, (designated by 10,) and also has in the side face thereof a series of recesses or sockets, each of which is designated by 12, and each of which has inner and outer end-wall faces 13 and 14, which are spherical and are concentric to a common center, (designated by 50, Fig. 9.)

In the preferred form thereof (illustrated most clearly in Figs. 1ª, 3, 4, 9, and 10 of the drawings) the sockets 12 of the looper are shown in the nature of recesses adapted to receive driver projections having the form of bevel gear-teeth and are disposed circumferentially with respect to the axis of the looper in three approximately equidistant sets or segments, said sockets having inner and outer end walls whose inner adjacent faces 13 and 14 are curved in two relatively transverse directions and in arcs that are concentric to a common center, and which sockets or recesses are wholly located between the periphery and axis of said looper.

In contradistinction to the usual method of supporting a looper of this class by means of circumferentially-disposed rolls the looper, which in the present instance is disposed to rotate in a path oblique to the line of movement of the needle, is held as against movement transversely of its plane of rotation in a guide-race G. This guide-race G is shown fixed to the head 2′ of the framework of the machine in position to surround the lower portion of the periphery of the looper, and has opposing parallel guide races or faces 15 and 16, engaging parallel guide-faces at opposite sides of the peripheral track 18 of the looper and forming between them a particircular air reservoir or chamber, which during the rotation of the looper maintains a plenum of air for cushioning the looper, thus facilitating the free rotation of said looper in the guide without the application of oil to the race.

The guide-race G is so constructed and is so disposed with relation to the looper that a space is provided between the perimeter of said looper and the inner wall of the channel in said race. This race does not constitute a peripheral support for said looper, but, on the contrary, leaves the same free diametrically and facilitates the slight vibratory movement of the looper, to which it may be subjected from the pulling stress of loops as they pass around the same, and which is provided for by the construction and organization of the looper-driver. It is obvious, however, that the looper may be guided and be permitted to have vibration by rolls 70, having

grooves 70′ to receive the peripheral track 18, as shown in Fig. 4, if desired.

To facilitate a slight diametrical movement of the looper and driver for the purpose of easing the strain on the loop during the passage thereof around the looper, the driver S′ may in practice be fitted to its driving-shaft B^2 in such manner as to permit slight lateral play, but not sufficient to cause the same to wabble during the rotation thereof.

The looper-driver, which also constitutes a looper-support, comprises, in the preferred form thereof, (illustrated in Figs. 1 to 4, inclusive, of the drawings,) a hub 21, which is fixed to the driving-shaft B^2, and a series of radial arms extending from said hub and each having at the outer end a series of driver projections or teeth of a conformation corresponding to and adapted to fit the driver-sockets in the looper, said projections, which are shown in the nature of theoretically-correct bevel-gear teeth, having their outer and inner ends 23 and 24, respectively, spherical and concentric to the common center 50, the angles of the side faces of said gear-teeth being represented by the lines m' m', Fig. 9, and coinciding with the angles of the opposing side faces of the socket-walls of the looper, whose angles are represented by the lines n' n' in said Fig. 9.

The looper, in the form thereof shown in the accompanying drawings, has two opposing guide walls or faces 15 and 16 contiguous to the periphery thereof and located in parallel planes, and the looper-guide G is constructed and disposed, as hereinbefore described, to hold the looper against movement laterally of its path of rotation and free for movement transversely of its axis of rotation.

In the construction and organization of the looper and driver illustrated in the accompanying drawings it will be seen that portions of the looper during the rotation thereof move successively toward and away from the teeth of the driver and that the successive sets of projections or driver-teeth are alternately brought into and out from engagement with the sockets of the looper, certain of said driver-teeth being in and certain out of operative engagement with the looper simultaneously. Furthermore, it will be seen that the looper and driver coöperate in a manner similar to two intermeshing bevel-gears, and therefore to secure such proper working engagement between the driver and looper that the driver-teeth will freely enter the sockets of said looper and at the same time have a close bearing engagement with the walls thereof I have found it desirable, owing to the peculiar angles of movement of the looper and driver, to furnish the projections of the former and the socket-walls of the latter with coöperative faces of peculiar construction. The novel structure of the driver-teeth and the walls of the looper-sockets resides in the spherical structure or the peculiar curvilinear formation of the inner and outer end faces of said driver-teeth and the similar formation of the inner and outer end walls of said driver-sockets. Each inner and outer end wall of each socket of the looper and the inner and outer end face of each tooth of the driver is curved, as hereinbefore stated, in two relatively transverse arcs or lines, one arc, as 60, (see Fig. 11,) being in the plane of rotation of the looper and the other, as 61, (see Fig. 9,) being transverse to said plane, and both arcs being preferably concentric to the theoretical cone-center of the driver and looper, and the outer and inner end faces of the looper-driver teeth are of spherical formation, corresponding to and are adapted for coöperating with the spherical walls of the looper-sockets, whereby to support said looper during rotation thereof, as will be readily understood by reference to the figures referred to.

In Fig. 4 of the drawings the looper is shown in dotted and full lines somewhat in the nature of a mutilated or intermittent wheel having three sets of tooth-like sockets or mortises, two mortises in each set, and the mortises are shown having outer and inner end walls, the adjacent faces of which are curved in a direction transversely to the path of rotation of the wheel in arcs concentric to a common center and are also curved in the direction of rotation of said wheel in arcs concentric to a common center, and the looper-driver is somewhat in the nature of a mutilated or intermittent bevel-gear having three sets of approximately equidistantly-disposed driving projections or teeth having inner and outer end faces curved in two relatively transverse directions in arcs concentric to the aforesaid common centers and coinciding to and coöperating with the end walls of the looper mortises or recesses for supporting said looper during rotation thereof.

In Figs. 5 to 8, inclusive, the looper is shown having a complete circuit of driver-sockets or mortises, each of which is of a structure coinciding with the structure shown in Figs. 3 and 4, and the looper-driver is shown having a complete circuit of driver projections, each of which corresponds in structure to that illustrated in Figs. 3, 4, and 11.

In Figs. 5 and 6 an annular recess 26 of requisite depth is shown formed in the side face of said looper, and an annulus 25, having a circuit of radial grooves or recesses, is shown fixed in the annular recess of said looper, the adjacent faces of the annular recessed portion of the looper being curved in two directions and forming end walls for the grooves or recesses of the annulus when the parts are assembled.

From the foregoing it will be understood that both the looper and driver have corresponding driving-faces and corresponding looper-carrying bearing-faces. The driving-faces of the looper are shown in the drawings as the side faces of the sockets or recesses thereof and the looper-carrying or bearing faces are illustrated as the spherical end

walls of said recesses, whereas the corresponding driving-faces and looper-carrying faces of the driver are shown, respectively, as the side faces and end faces of the teeth or projections of said driver. In the drawings these faces are disposed in a circle; but it will be obvious that the disposition of these faces with relation to the axis of the looper or driver is an arbitrary matter and that, if desired, some of the driving and carrying faces may be disposed more remote from the axis of rotation than others. Hence I do not wish to limit this invention to the particular location or disposition of the successive driving-faces and bearing-faces with relation to the axis of the looper or driver. In the drawings the spherical opposing bearing-faces of the looper are designated, respectively, by 13 and 14, and the opposing driving-faces of said looper are designated, respectively, by 13′ and 14′, whereas the spherical end bearing-faces of each of the driver projections are designated by 23 and 24, and the opposing driving-faces of each driving projection are designated by 23′ and 24′.

For the purpose of facilitating an unobstructed passage of the loop while being carried around the looper, whereby to permit the same to be drawn out in the usual manner, the front faces 28 of the socketed portions of the looper and the front faces 29 of the projections or teeth of the looper-driver are beveled or inclined in substantial parallel lines, a clearance-space 30 being provided between the ends of the driver-teeth and the adjacent upper end of the looper.

By furnishing the looper with sockets and the driver with teeth of the construction hereinbefore described said parts will mesh with precision and the outer and inner ends of the driver-teeth will have a close bearing engagement with the outer and inner end walls of the looper-sockets and will support said looper against vibratory movement relatively to the axis of rotation of said driver.

During the rotation of the looper it will be readily apparent that the channel of the guide-race G, into which the periphery of the looper extends, will be supplied with air, which will cushion said looper and cause the same to rotate freely without the necessity of lubrication.

I do not desire to limit this invention to the employment of the particular guide-race G illustrated in the accompanying drawings, as other forms of guides may be employed in lieu thereof without departure from my present invention.

From the foregoing description and by reference to the accompanying drawings it will be seen that the looper S is supported for rotation in a path oblique to the path of rotation of the driver and that by providing the looper with driving projections or teeth having spherically-formed outer and inner faces to engage in said sockets I am enabled to secure a perfect working engagement between the looper and driver and obviate detrimental frictional resistance inherent to looper mechanisms of this class as heretofore constructed.

In connection with the foregoing description it is desired to state that while it is preferable to form the recesses of the looper with their side walls radial to a common center I do not desire to limit myself to the particular form of recess, so far as the side walls are concerned, illustrated in the drawings, as it will be understood that the side walls of the recesses may be of any desired contour.

In Figs. 4 and 5 the horizontal dotted line *n n* indicates the plane at which the supporting projections of the looper-driver engage the looper during the rotation thereof, the circles *o o* in said figures illustrating, respectively, the points of engagement and disengagement between the projections of the driver and looper. Thus it will be seen that the supporting projections of the driver have a positive engagement with the looper throughout more than one-half of its arc of rotation and that the spherical supporting-faces of the looper exert a stress in a radial direction relatively to the axis of rotation of said looper and positively hold said looper against vibratory movement transversely of the axis of rotation of the driver.

It will be of course understood that what is herein termed the "driver" might be provided, in addition to the projections having spherically-formed outer and inner faces for coöperating with the spherical supporting-walls of the looper and supporting said looper, with independent driving instrumentalities for said looper.

Having described my invention, I claim—

1. A looper having in the side face thereof a series of recesses the adjacent faces of the end walls of which are spherical and concentric to a common center, combined with a driver having a series of projections the outer and inner end faces of which correspond in structure to the wall-faces of the looper-recesses and coöperate with said faces to support the looper.

2. A rotary looper having a series of recesses formed in one side face between the axis and periphery thereof and the inner and outer walls of which have spherical inner faces, in combination with a looper-supporting driver having projections adapted to enter said recesses, and which projections have inner and outer faces corresponding to, and coöperative with, the spherical faces of the recess-walls of said looper for holding said looper in fixed relation to the axis of rotation of said driver.

3. A discoidal looper having in the side face, remote from the periphery thereof, a series of tooth-like recesses bridged at their inner and outer ends by webs or walls having spherical inner faces concentric to a common center, combined with a looper-driver having driving teeth or projections corresponding to,

and constructed to fit, the looper-recesses whereby the outer and inner end faces of the driver-teeth will coöperate with the adjacent faces of the end webs which bridge the looper-recesses and support the looper.

4. The combination of a driving and a driven member supported in coöperative relation, and one of said members having a series of driver-sockets formed in one face thereof whose inner and outer end walls are spherical, and the other of said members having a series of driver-teeth whose outer and inner faces are spherical and are adapted to coöperate with the spherical walls of the other member to support said member, and means for rotating the driving member.

5. The combination of a driving and a driven member supported in coöperative relation with their axes oblique to each other, and one of said members having a series of driver-sockets formed in one face thereof, remote from the periphery, whose inner and outer end walls are curved in two relatively transverse directions and in arcs concentric to a common center, and the other of said members having a series of driver-teeth whose outer and inner end faces are curved in two relatively transverse directions in arcs concentric to a common center and are adapted to coöperate with the curved walls of the other member to support said member during rotation; means for rotating the driving member; and means for guiding, and for preventing lateral movement of, the driven member.

6. The combination of a driving and a driven member supported in coöperative relation with their axes oblique to each other, and one of said members having a series of driver-sockets formed in one face thereof whose inner and outer end walls are spherical and concentric to a common center, and the other of said members having a series of driver-teeth whose outer and inner faces are spherical and concentric to said common center and are adapted to coöperate with the spherical walls of the other member to support said member against diametrical movement, and means for guiding, and for preventing lateral movement of, the driven member.

7. The combination, in a looper mechanism, of a rotary looper having a series of peripheral hooks or loop-takers and having in one face thereof a series of recesses the adjacent faces of the inner and outer walls of which are spherical and concentric to a point coincident with the axis of rotation of said looper; a looper-driver supported with its axis oblique to the axis of, and having a series of bevel-gear teeth disposed to enter the recesses in, said looper, and which teeth have their outer and inner end faces spherical and concentric to the point of intersection of the axes of the looper and driver; and guiding means for said looper.

8. A looper mechanism for sewing-machines, comprehending a rotary looper having a series of circumferentially-disposed driver-sockets formed in one face thereof, and each socket having the inner end wall thereof curved in intersecting lines concentric to a common center; a rotary looper-supporting driver in coöperative relation with the looper and having a series of circumferentially-disposed driving projections each of which has its outer and inner ends curved in intersecting lines in coinciding arcs concentric to the aforesaid common center; actuating means for the driver; and a guiding-face peripherally disposed with relation to, and holding, the looper against movement transversely of its plane of rotation.

9. A rotary looper having a series of recesses in one face between and remote from the periphery and axis thereof, and the adjacent faces of the inner and outer end walls of which recesses are spherical and concentric to the cone center of said recesses, combined with driving means for said looper.

10. A wheel having intaglio bevel gear-teeth formed in the side face wholly between the periphery and axis thereof, and the adjacent faces of the inner and outer end walls of the tooth-spaces of which are spherical and concentric to the cone center of the teeth, combined with a supporting device having corresponding bevel-gear teeth whose outer and inner end walls are spherical and concentric to the cone center of the intaglio teeth of said wheel and which coöperate with the spherical faces of the intaglio-teeth spaces for supporting said wheel.

11. In a looper mechanism, the combination, with a rotary looper, of a channeled guide-race extending around the lower portion of the periphery of said looper and holding the same against movement transversely of its plane of rotation, the construction and disposition of said race being such as to provide an air-space between the inner wall of the channel and the perimeter of said looper, and means independent of the guide-race for supporting and rotating said looper.

12. In a looper mechanism, the combination of a rotary looper having a series of recesses in one face thereof whose outer and inner end walls are spherical and concentric to a common center; a rotary driver having a series of bevel-gear teeth conforming to the recesses of the looper and adapted for supporting and rotating said looper; and a guide-race supported below, and surrounding a portion of, the perimeter of said looper and having a channel for retaining a plenum of air to cushion said looper.

13. The combination, with a rotatable looper having opposing guide-faces in parallel planes, of a guide constructed to engage the looper guide-faces and hold the looper free for movement transversely of its axis of rotation, and a combined looper carrier and driver set with its axis of rotation inclined to the axis of the looper and fitted to engage and carry the looper free of diametrical support by the looper-guide.

14. In a sewing-machine looper mechanism, the combination of a rotatable looper and a rotary looper-carrying driver located with its axis of rotation inclined to the axis of rotation of the looper, said looper and the driver each having a series of corresponding bearing-faces disposed in a circuit and engaging the faces of the looper with the corresponding faces of the driver to support the looper, and each having driving-faces for rotating the looper with and by the driver, and non-looper-supporting means holding the looper against lateral movement and free for movement transversely of its axis of rotation.

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