No. 867,866 PATENTED OCT. 8. 1907.

H. A. BALLARD.

MECHANICAL MOTION.

APPLICATION FILED JAN. 24, 1906.

Fig. 1.

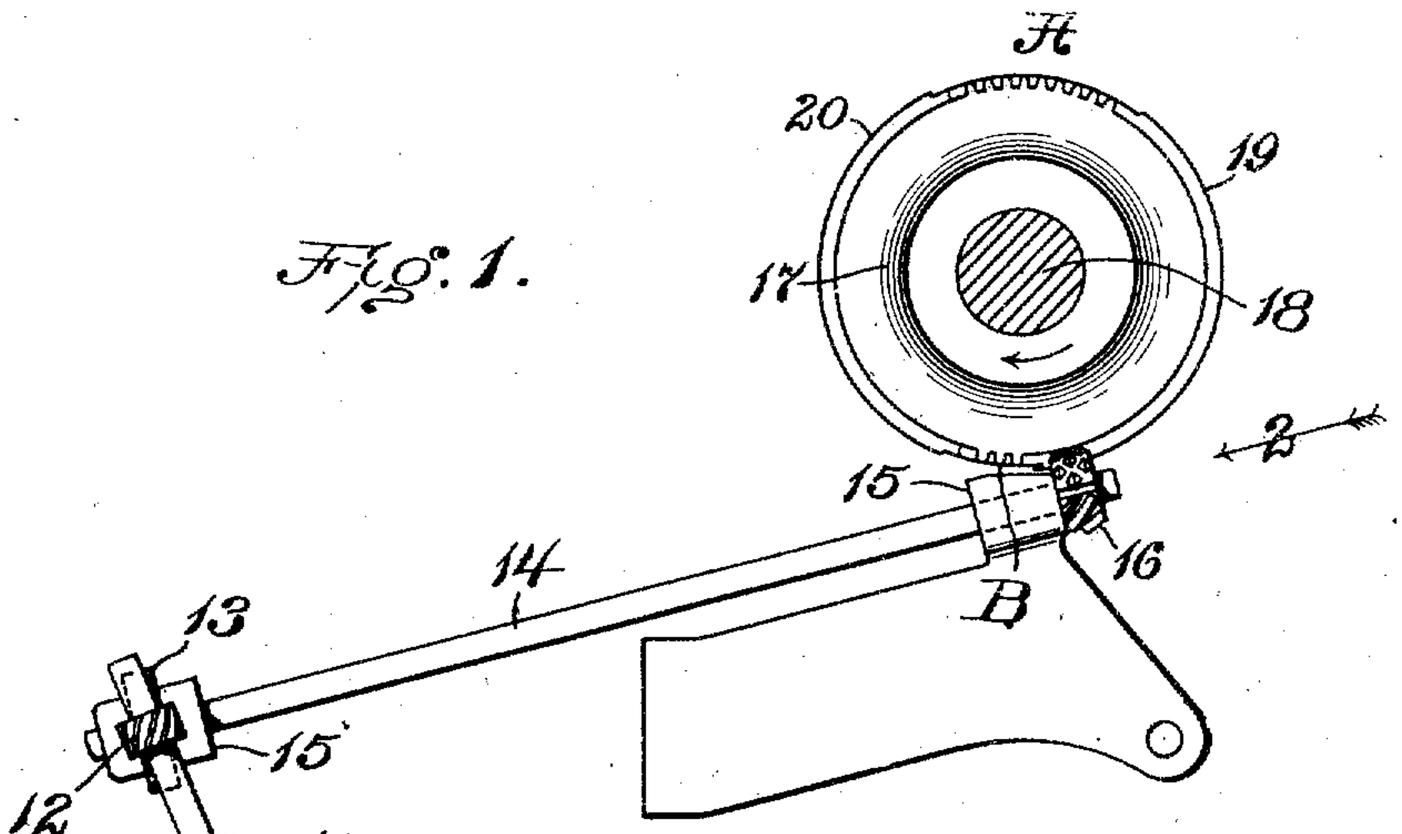


Fig. 2.

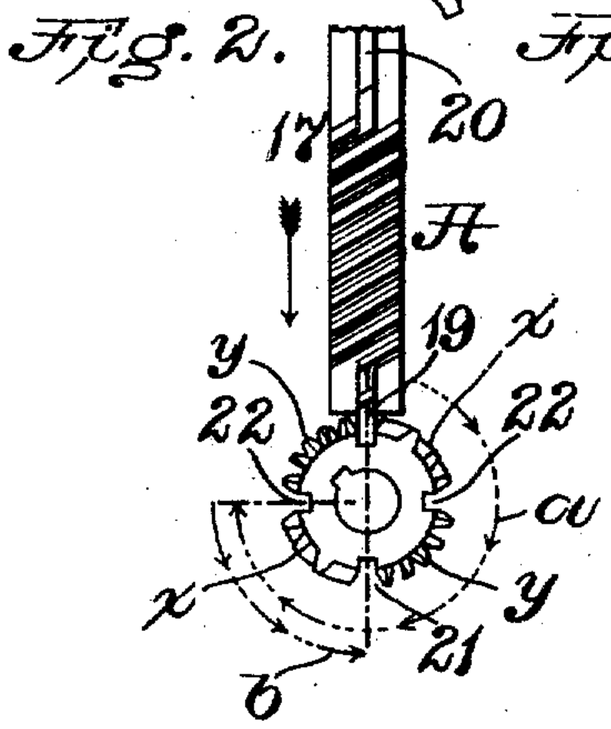


Fig. 3.

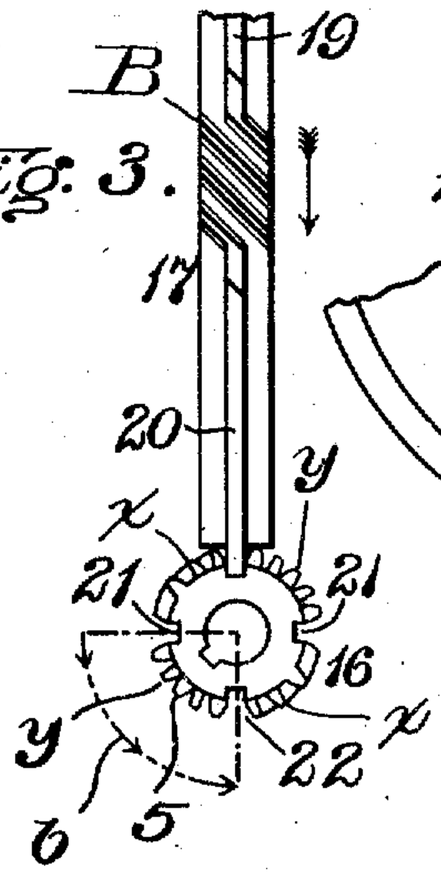


Fig. 4.

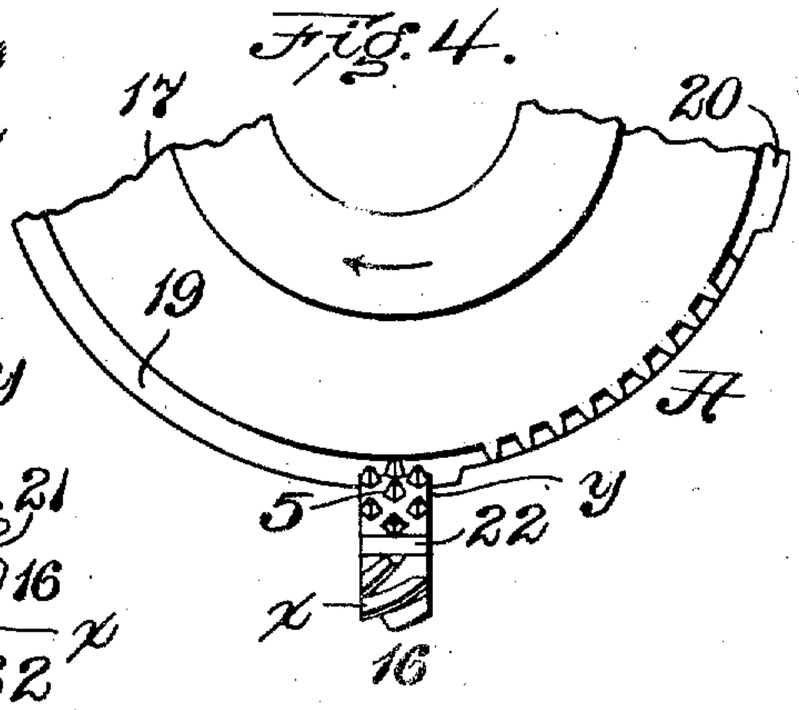


Fig. 5.

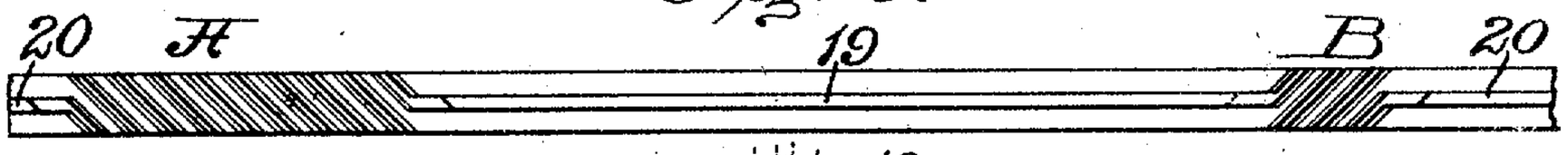
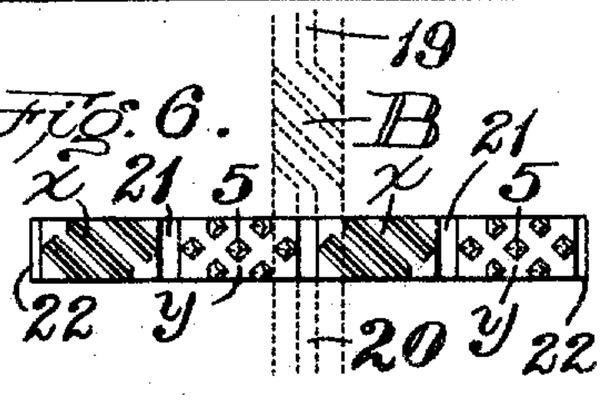


Fig. 6.



Witnesses:
Laurence E. Kennedy.
Walter P. Ubell

Inventor:
H. A. Ballard
by
Wright Brown Quinby
His Attys.

UNITED STATES PATENT OFFICE.

HARRIE A. BALLARD, OF ASHLAND, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE BOYLSTON MANUFACTURING COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF NEW JERSEY.

MECHANICAL MOTION.

No. 867,866. Specification of Letters Patent. Patented Oct. 8, 1907.

Application filed January 24, 1905. Serial No. 242,490.

To all whom it may concern:

Be it known that I, HARRIE A. BALLARD, of Ashland, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Mechanical Motions, of which the following is a specification.

This invention is a novel form of mechanical motion, and although especially adapted for the looper mechanism of a shoe-sewing machine, as illustrated in my co-pending application, Serial No. 242,489 filed January 24, 1905, it may be modified in many ways to be adaptable to various other machines.

The prime object of the invention is to convert continuous rotary motion into intermittent rotary motion having a counter motion.

In the form illustrated upon the accompanying drawings, a counter-shaft is interposed between the driving-member and the member for which the motion is intended, and inasmuch as the operated member is geared to rotate twice for each revolution of the counter-shaft, the ratio of the driving member and counter-shaft is made correspondingly inverse. The purpose for which this embodiment of the invention is especially adapted is to impart to the operated member continuous rotary motion to the extent of one revolution and 180 degrees of another, followed by a dwell, and then 180 degrees' rotation in the opposite direction, followed by a dwell, during each complete cycle of the driving-member.

The relation of the counter-shaft to the driving-member, and to the operated member, may be varied in many ways, according to the available space and distribution of parts without departing from the spirit and scope of the invention.

On the accompanying drawings, forming part of this specification,—Figure 1 shows in side elevation an intermittent driving mechanism in connection with a looper. Fig. 2 is an enlarged view of the operative portion of the coacting gear members, from the point indicated by the arrow 2. Fig. 3 is a similar view of the reversing portions of the coacting gear members. Fig. 4 is a side elevation of the portions included in Fig. 2. Fig. 5 is a development of the face of the driving-member. Fig. 6 is a development of the face of the coacting driven member.

The same reference characters indicate the same parts, wherever they occur.

In describing the present embodiment of the invention, it may be stated that the object is to provide, instead of the usual levers, cams and springs, which usually constitute the looper-mechanism of a chain-stitch shoe-sewing machine mechanism which shall accomplish the desired result, and which shall be cheaper, simpler, lighter, and of less bulk than those heretofore employed. In carrying out this embodiment of the invention, a bodily immovable rotary looper has been developed. It is well known, by those familiar with the shoe-sewing machines that in forming each stitch the looper necessarily describes one turn around the barb of the needle. Various distributions of this motion are employed in various styles of machines, and the motion designed for the looper herein shown has already been described.

In Fig. 1 the looper, indicated at 11, is affixed to the lower end of a stem 10, which is preferably hollow, so that the thread may pass through it to the looper. The stem 10 is adapted to be supported by and to rotate in a fixed bearing provided by a suitable bracket, not shown. A spiral gear 12 affixed to the stem, intermeshes with a spiral gear 13 affixed to a countershaft 14. Said countershaft is mounted in suitable fixed bearings 15 15 and extends from front to rear of the machine. It may be here stated that the gear 13 has twice as many teeth as the gear 12, although this ratio may be varied for various purposes. Attached to the shaft 14 is a gear 16, which may be termed a "cross-cut mutilated spiral gear." Said gear intermeshes with and is driven by a gear 17 affixed to a power shaft 18 on a different plane and transversely of the shaft 14.

The gear 17 comprises a segment A of spiral teeth of right-hand pitch and a segment B of spiral teeth of left-hand pitch connected by a peripheral flange or fin 19 on one side of the axis and a fin 20 on the opposite side thereof. The fin 19 is adapted to enter either of two diametrically opposite grooves 21 in the face of the gear 16 and parallel to the axis thereof, and the fin 20 is likewise adapted to enter either of two diametrically opposite grooves 22 midway between the grooves 21. The gear 16 thus becomes interlocked with the gear 17 without preventing the rotation of the latter. The periphery of the gear 16 is divided by the grooves 21 21, 22 22, into four equal divisions x x and y y. As previously stated, the number and length of the coacting portions of the gears 16 and 17 may be varied in many ways, and so it must be remembered that, although the present description deals with only one form, the distribution of coacting portions of the two gears is arbitrary.

In Fig. 6 the relative locations of the portions x x, y y, and the grooves 21 21, 22 22, is best shown. It will be seen that the portions x x comprise simple spiral teeth of right-hand pitch, adapted to intermesh with only the segment A of right-hand pitch. The portions y y comprise equidistant pegs 5, the remaining stock of spiral teeth after having been cut at right angles to their original pitch, thus being adapted to intermesh with coacting portions of either right or left-hand

pitch. In the present case, the portions *y y* are successively engaged by both the segments A and B, as hereinafter explained. When, however, the segment A operates upon the peg-teeth 5, the teeth of said segment engage two opposite sides only of the peg-teeth, and when the segment B operates upon the peg-teeth, the teeth of that segment engage the other two opposite sides of the peg-teeth. The periphery of the gear 16 is spaced for twelve teeth and subdivided by the diametrically opposite grooves into segments of three teeth each. The segment A of the gear 17 comprises nine teeth, or enough to engage three-fourths of the teeth on the gear 16. Hence, by the passage of the segment A, the gear 16 is rotated 270 degrees, as indicated by the broken line *a* in Fig. 2. It should be stated before further explanation that the fins 19 and 20 are so formed as to emerge from the grooves 21 and 22 in due time to permit the gear 16 to be rotated by the coöperation therewith of the segments A and B. As the last tooth of the segment A leaves the gear 16, the nose of the fin 20 enters one of the grooves 22, thereby locking the gear against rotation in either direction. This leaves the gear 16 in the position shown by Fig. 3. Continued rotation of the gear 17 causes the fin 20 to leave the groove 22, upon which the half-tooth at the end of said fin engages the last tooth of the preceding segment *x*, while at the same time, the nose of the next tooth in the segment B engages the first tooth or peg 5 in the segment *y*. The shock in starting the gear 16 is thus distributed between a whole tooth of the segment *x* and a peg-tooth of the segment *y*. The left-hand pitch of the segment B, which comprises three teeth, or, more correctly, two whole teeth and two half teeth, produces reverse rotation of the gear 16. By reason of the number of teeth in the segment B, the reverse rotation of the gear 16 embraces 90 degrees of one revolution, (see broken line *b*, Figs. 2 and 3). As the last tooth of the segment B leaves the segment *y*, the nose of the fin 19 enters the groove 21. The fin 19 continues through the groove, as explained in connection with the fin 20. The advance rotation of the gear 16, after deducting the reverse rotation, resolves itself into one half of one revolution for each cycle of the gear 17. In summarizing the operative relation of the two gears, it is evident that the segment A, each time it operates, engages segments *x y x* in the order named, although first upon one series of segments and then upon the other series.

Referring once more to the looper, it will be remembered that it is geared to rotate twice the extent of the shaft 15. Therefore, when the gear 16 is advanced 270 degrees, the looper is caused to describe one revolution and 180 degrees of another, as previously stated. During the passage of the fins 19 and 20, the looper is, of course, held stationarily. Upon the 90 degrees' reverse rotation of the gear 16, the looper is correspondingly caused to describe 180 degrees' reverse rotation, which leaves the looper at zero, after having made a net advancement of one revolution.

One instance of many ways in which the present arrangement of operative parts may be varied is as follows:—A gear 17 having two diametrically opposite segments A and two diametrically opposite segments B between the segments A. The timing of the gear 16 may be made irregular by disposing of the segments on the gear 17 at unequal intervals upon the periphery.

Having thus explained the nature of the invention, and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made, or all of the modes of its use, I declare that what I claim is:—

1. A motion-converting device comprising two rotatable gears, one of said gears having two or more teeth of opposite pitch, and the other of said gears having teeth adapted to mesh with all the teeth of the first gear, certain of the teeth of the second gear being constructed to mesh only with part of the teeth of the first gear.

2. A motion-converting device comprising two rotatable gears, one of said gears having two or more peripheral spiral teeth of opposite inclinations, and the other of said gears having teeth adapted to mesh with all the teeth of the first gear, certain of the teeth of the second gear being constructed to mesh only with those teeth of the first gear having a particular inclination.

3. A motion-converting device comprising spiral gears coacting peripherally, one gear having teeth of such pitch as to drive the other second gear in one direction, and other teeth of a different pitch to drive the second gear in the opposite direction through part of the distance previously traversed in the first direction.

4. A motion-converting device comprising spiral gears coacting peripherally, one gear having teeth of such pitch as to drive the other second gear in one direction, and other teeth separated from the first-named teeth of a different pitch to drive the second gear in the opposite direction through part of the distance previously traversed in the first direction; said gears having interlocking portions to hold the second gear from rotation at predetermined times.

5. A motion-converting device comprising two rotatable mutilated gears on axes transverse to each other, one of said gears having spiral teeth of which a part are of right or left hand pitch, and of which a part are of crossed pitch, and the other of said gears having spiral teeth of which a part are of right or left hand pitch and adapted to intermesh with all the teeth of said first-described gear, and of which a part are of left or right hand pitch and adapted to intermesh with said cross-pitched teeth only.

6. A motion converting device comprising a continuously rotating driving gear having on its periphery a plurality of spiral-gear segments of right and left hand pitch, respectively and segmental flanges connecting said gear segments; and a driven gear on an axis transverse to that of said driving gear, and having on its periphery a plurality of spiral gear segments of which one or more are adapted to intermesh with the right or left hand segments only of said driving gear, and all of which driven gear segments are adapted to intermesh with the left or right hand segments of said driving gear; and said driven gear having notches between its segments in which said segmental flanges are adapted to slide.

7. A motion-converting device comprising a rotatable driving-member having one or more right hand spiral gear-segments and one or more left-hand spiral gear-segments, a driven member having one or more spiral gear-segments adapted to intermesh with those of a similar inclination on said driving member, and having one or more spiral gear-segments adapted to intermesh with all of the segments of said driving member.

In testimony whereof I have affixed my signature, in presence of two witnesses.

HARRIE A. BALLARD.

Witnesses:
WALTER P. ABELL,
C. C. STECHER.