

[72] Inventors **Heinz Maassen
Dulken;
Hans Dieter Gaidies, Altenfurt, Nurnberg,
both of Germany**
[21] Appl. No. **868,252**
[22] Filed **May 19, 1969**
[45] Patented **Oct. 5, 1971**
[73] Assignee **Jean Gusken Maschinenfabrik-Eisen-
giesserei
Dulken, Germany**
[32] Priority **Jan. 11, 1967**
[33] **Germany**
[31] **G 48 958 VII/86c**
**Continuation-in-part of application Ser. No.
697,143, Jan. 11, 1968.**

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Primary Examiner—Henry S. Jaudon
Attorney—Edwin E. Greigg

[54] **WEFT-INSERTING ROD DRIVE FOR
SHUTTLELESS LOOMS**
4 Claims, 3 Drawing Figs.
[52] **U.S. Cl.**..... **139/122,
139/123**
[51] **Int. Cl.**..... **D03d 47/12**
[50] **Field of Search**..... **139/122, 1,
127; 74/25**

ABSTRACT: The weft-inserting rods of a shuttleless loom are driven rectilinearly by a crank arrangement including a cycloid gear to produce a variable-speed straight line drive. A drive gear on the loom shaft drives a gear train mounted on the loom frame and includes a shaft having a crank arm affixed thereon. The crank arm, through an adjustable link, drives a crank arm fixed on a stub shaft mounted in the lay of the loom. As the last-named crank arm rotates, a gear fixed on the lay drives a further gear, by means of a toothed belt. The first gear is connected to a crank arm in which the second gear is rotatably mounted. A lever arm fixedly connected to the second gear is pivotally connected to the weft-inserting rod. The mechanism, beginning with the stub shaft mounted in the lay, partakes of motion of the lay.

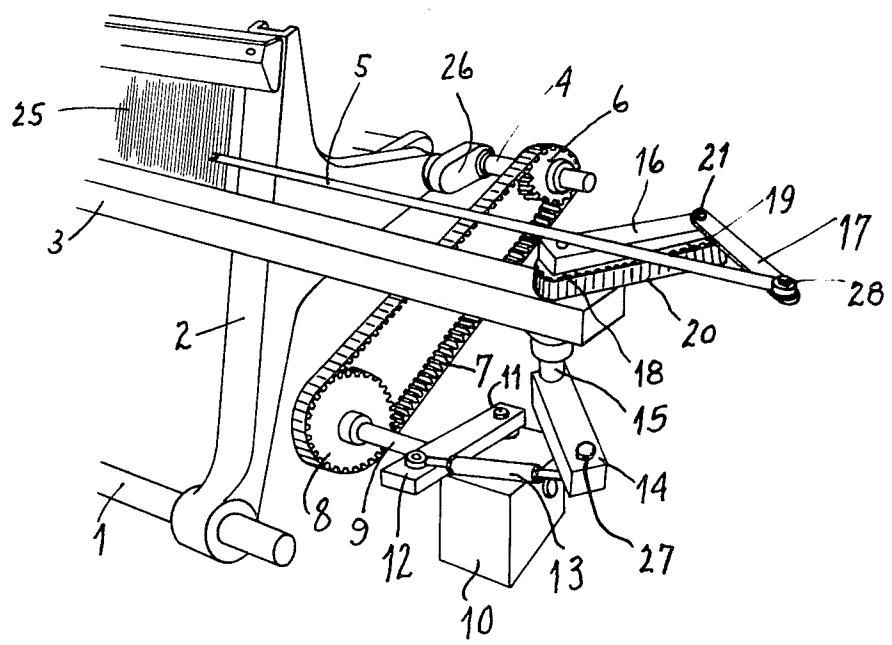
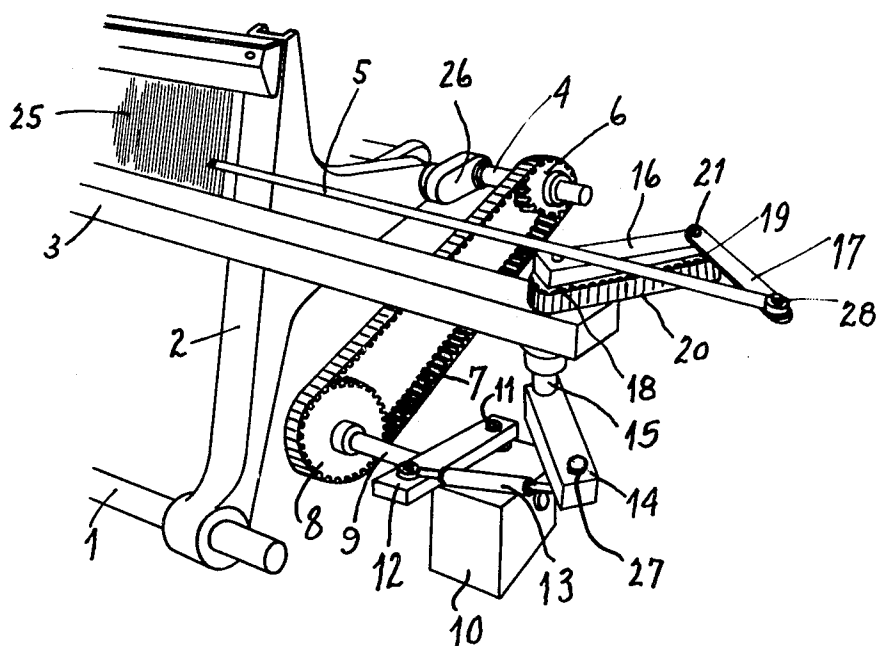
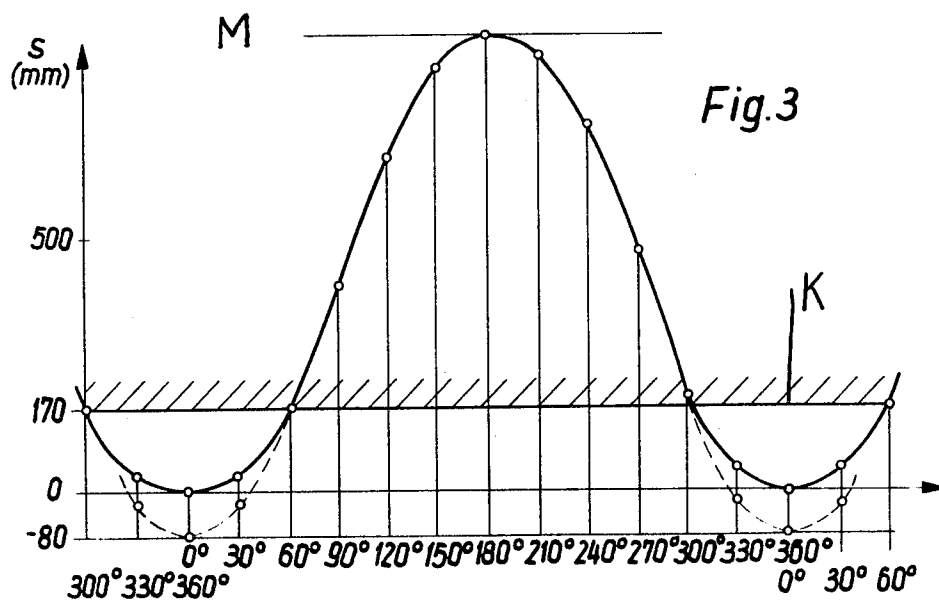
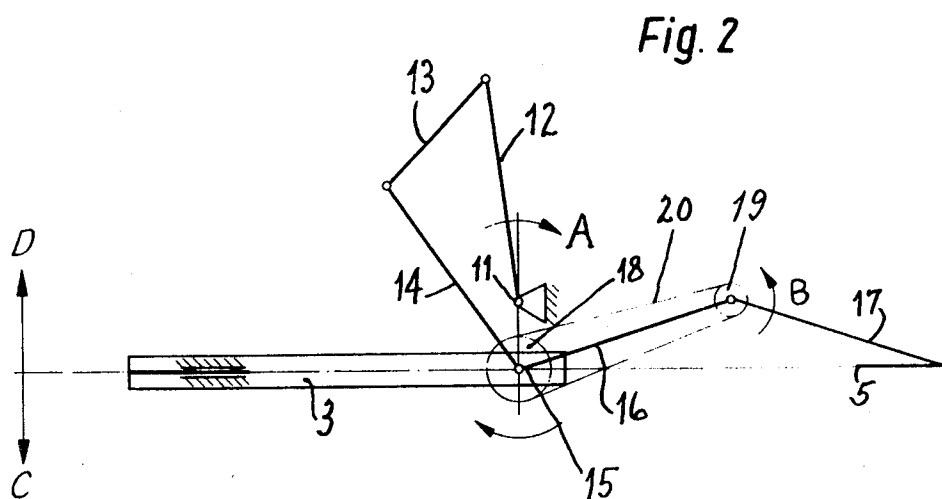


Fig. 1



Inventors
 Hans-Dieter Laiden &
 Heim Maassen
 by Edwin E. Greigg



Inventors
 Hans-Dieter Gaidies &
 Hein Maassen
 by Edwin C. Geigg

WEFT-INSERTING ROD DRIVE FOR SHUTTLELESS LOOMS

This is a continuation-in-part application of Ser. No. 697,143, filed Jan. 11, 1968.

The present invention relates to a drive for the weft-inserting rods in shuttleless looms. It was customary heretofore to provide the drive of the weft-inserting rods by means of curve-controlled lever systems with oscillating lever arms. A particular difficulty always arose in connection with the passage or transfer of the gripper rod drive from stationary driving means to the gripper rods which oscillate together with the reed. It is the object of the present invention to provide a gear system which is as simple as possible and wherein the driving movement is transferred as a rotary movement to the driving elements oscillating with the reed.

In accordance with the present invention, this object is obtained by means and with the aid of a cycloid gear for the rectilinear guide of the weft-inserting rods which is mounted on the reed, and by means of a dual-crank gear for driving the cycloid gear, which rotates around a locally stationary center of rotation.

It is an advantage of the weft-inserting rod drive proposed by the present invention that the oscillating movement of the weft-inserting rods does not impair in any way the to-and-fro movement of the drive thereof. In addition thereto, very favorable moving conditions or ratios are obtained by virtue of the fact that only rotating drive elements are employed. Owing to this fact, however, there arises again the difficulty that normally during the deviation of a rectilinear movement, in this instance of the weft-inserting rods, from a uniform rotary movement, the former shows a sinusoidal travel-time-relation. This is undesirable, however, since the weft-inserting rods must be disposed outside the shed for a very specific period of time in order to receive the weft yarn or thread. Yet coordinated to this required period of time, according to the sine function, is a curvature with a great amplitude; in other words, the weft-inserting rods must swing out very far toward the sides. In order that a swinging motion or deflection of such an amount and extend be not required, and in order to save space, it is necessary to operate with a nonuniform rotary movement as drive movement for the weft inserting rods. While crank gears produce a nonuniform secondary drive movement, they unfortunately also have the disadvantage that a technically usable simple crank gear has, on the one hand, a relatively slow secondary driving speed in a specific angular range within which the weft inserters would have to be disposed outside of the shed, but on the other hand, there is an increased speed in another range which, in the present case, would be effective at the moment when the thread is being transferred in the center of the shed where a slow inserter speed is desirable in order to assure a safe transfer, and this requirement exists also with regard to the other extreme position thereof.

In order to eliminate the difficulties mentioned above, a preferred embodiment of the present invention includes a dual-crank gear coupled to a cycloid gear in a rotary angle position such that the slowest rotary speed of the latter is produced in the extended position of the weft-inserting rods, and during the oscillating movement with the reed, the driven shaft of the dual crank gear extends toward both sides through the vertical plane extending through the center of rotation and is parallel to the reed. In this type of weft inserting rod drive, a deceleration of the weft inserter rod movement is obtained in the extended position and an increased speed of the weft inserters is prevented during the transfer of the thread by reason of the fact that the center of rotation of the dual-crank gear and the driven shaft thereof change their mutual positions in such a manner that the sign of the eccentricity measured between them will be reversed during the oscillation of the reed into the casting-on position. One embodiment of the present invention will now be further described hereinbelow on the basis of the accompanying drawing, wherein:

FIG. 1 is a perspective view of the weft-inserting rod drive according to the present invention for the right-hand side weft-inserting rod of a shuttleless loom;

FIG. 2 is a schematic illustration of the moving conditions of the driving elements according to FIG. 1; and

FIG. 3 is a diagram of the weft-inserting rod path as a function of time, and of the position of the operating crank.

In FIG. 1, the numeral 1 indicates the lay or beat-up shaft on which is mounted the arm 2 carrying the lay 3 and the reed 25. The arm 2 is oscillated by the crank 26 on the continuously rotating loom shaft 4. A gear 6 fixed on the shaft 4 drives a toothed belt 7 which connects a gear 8 fixed on the shaft 9, for driving the same. The shaft 9 extends into a gear box 10 fixedly mounted on the loom frame. The output shaft 11 of the gear box 10 is substantially normal to the shaft 9, vertical as shown, and has an arm 12 fixed at one end thereon. The drive ratio is such that the arm 12 rotates about the axis of the shaft 11 at a speed corresponding to the angular velocity of the shaft 4.

An adjustable link 13 pivotally connects the other end of the arm 12 to a pivot 27 adjacent one end of an oscillating arm 14. Adjacent the other end of the arm 14 there is fixedly mounted a stub shaft 15. The stub shaft 15 passes through a suitable opening on the lay 3, and has one end of an arm 16 fixed thereon. The arm 16 and a gear 18, which is fixedly secured to lay 3 and through which the stub shaft 15 passes, are components of the cycloid gear which partakes of the motion of the lay 3. The cycloid gear further includes an arm 17 fixed at one end on the pivot 21 at the other end of the arm 16. The other end of the arm 17 is pivotally connected at 28 to the weft-inserting rod 5. On the pivot 21 there is also fixedly mounted a gear 19 which is connected by a suitable toothed belt 20 to the gear 18.

To recapitulate, arms 14 and 16 are fixed on shaft 15 which is rotatably mounted in the lay 3, to which, in turn, gear 18 is fixedly attached. Arm 17 is fixedly mounted on pivot 21 which is rotatably mounted in arm 16 and has gear 19 fixed thereto. Arm 17 is also pivotally connected to the weft-inserting rod 5.

FIG. 2 shows diagrammatically the elements of the structure shown in FIG. 1, and the lines representing the elements have the same numerals as the corresponding elements. The crank arm 12 rotates about the axis of the shaft 11 as indicated by the arrow A. Crank arms 12, 13 and 14 and cycloid gears 16, 17, 18 and 19 are shown in the position wherein the right-hand weft-inserting rod is in approximately its outermost position as shown in FIG. 1. The rotation of the crank arm 12 imparts a rotatable movement to the crank arm 14. This crank arm 14 rotates the crank arm 16 and, as a result, the gear 18, stationary with respect to lay 3, drives by means of the belt 20, the gear 19, the pivot 21 and the crank arm 17, whereby the gear 19 rotates in a direction opposite that of the gear 18. Thus, the movement of the weft-inserting rod 5 is slowest at the points in FIGS. 1 and 2 when the weft-inserting rod is withdrawn from the shed, or is about to be inserted in the shed. The motion speeds up and then slows as the weft inserter approaches the middle of the shed for transfer of the weft to other weft inserters.

In the diagram in FIG. 3, the center of the fabric is indicated by the symbol M, and the selvage is indicated by the symbol K. The positions of the weft rod tip or eye are also shown in FIG. 3 with respect to the angle of rotation of the crankshaft 4, and of the shaft 11 and crank arm 12. The full line portion of the curve represents the motion of the weft-inserting rods as actually obtained by use of the drive described herein. A sine curve is shown in dashed lines which corresponds to an angular rotation of 120° during which the weft rods are outside the shed.

If a uniform drive were used for the rods, an additional space of 80 mm. on each side would be required to accommodate the weft inserters. A variation of the speed of the crank gear 18 and therewith a variation in the shape of the curve in FIG. 3 may be obtained by adjusting the length of the link 11.

If, as in FIG. 2, the lay 3 were to remain stationary, the angular velocity of the crank arm 14 and of the arm 16 within the range of the laterally extended position of the rods 5, would be less than the angular velocity of the crank arm 12 with respect

to the center of rotation of the shaft 11. Otherwise, the crank arm 14 would cause the angular velocity of the arm 16 at the time of transfer of the weft to be greater than that of the crank arm 12. This would be a less favorable condition for the transfer of the weft than in the case of the uniform drive of the cycloid gear 18 at the constant speed of the crank arm 12. From the position shown in FIG. 2, the lay 3 moves slightly forward in the direction of the arrow C before the weft is cast on or picked up by the inserter rods 5. Thereafter, the lay 3 will swing toward the center of the shed in the direction of the arrow D, during movement of the weft rods 5. At this time, the stub shaft 15 swings out with the lay 3 over the shaft 11, resulting in reversing the translation velocity of the crank gear 12, 13, 14, which is determined by the mutual relation of the shafts 11 and 15 relative to one another. When the shaft 15 is positioned above the shaft 11, referring to FIG. 2, the angular velocity of the crank arm 14 will again be lower than that of the crank arm 12, although both have continued to rotate approximately 180° and due to the fixed position of the shafts 11 and 15, a maximum velocity of the crank arm 14 is now obtained. The deceleration of the weft rods 5 within the range of the extreme position thereof is illustrated in FIG. 3, wherein the space-time curve has a greater radius of curvature than a corresponding sine curve downwardly as well as upwardly. Further variations of the curve shape also within the area where the yarn is being transferred—with the weft rods 5 in retracted position—are possible by varying the length of the link 13.

That which is claimed is:

1. A rectilinear driving means for weft-inserting rods in shuttleless looms including a reciprocating lay, a continuously rotating stub shaft rotatably mounted in the lay, a first gear fixed on said lay and traversed by said stub shaft, a crank arm fixed on one end of said stub shaft, a second gear rotatably mounted on said crank arm, a lever arm connected to said second gear, said lever arm being pivotally connected to a weft-inserting rod, a driving connection between said first and second gears having a ratio of 2:1, a loom shaft, a continuously rotating shaft driven from the loom shaft and rotating about a stationary axis which is in a plane substantially parallel with the axis of said stub shaft, said lay moving the axis of said stub shaft relative to said stationary axis, a second crank arm on said stub shaft, a crank arm on said driven shaft and a link connecting said last-mentioned crank arm with said second crank arm.

2. The structure according to claim 1, wherein the lever arm and the crank arm connected thereto are of the same length and wherein the belt and gear drive connected thereto cause the end of the lever arm connected to the weft-inserting inserting rod to move in a rectilinear path.

3. The structure according to claim 1, wherein during the reciprocating movement of said lay, said stub shaft is arranged to pass through both sides of a plane containing the axis of said rotating shaft and extending parallel to said lay.

4. The structure according to claim 1, in which said connecting link is of adjustable length.

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