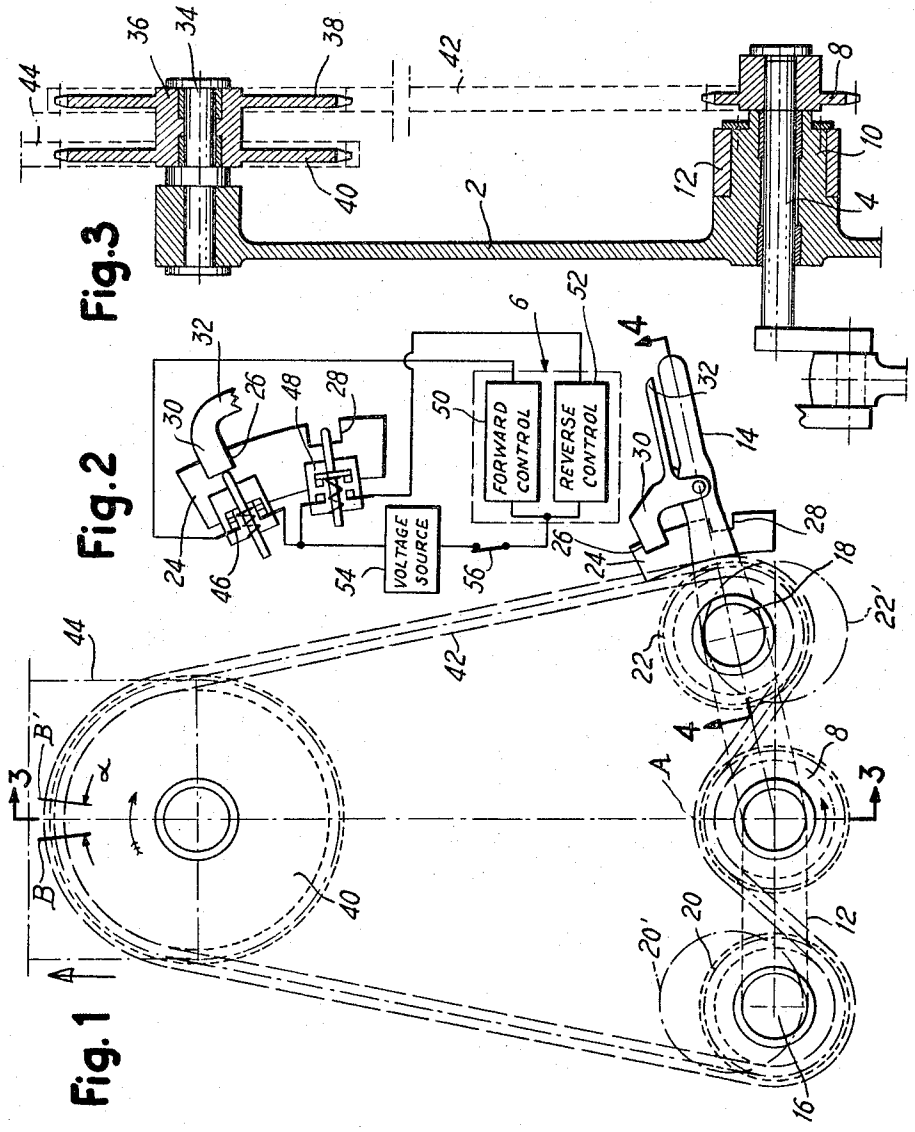
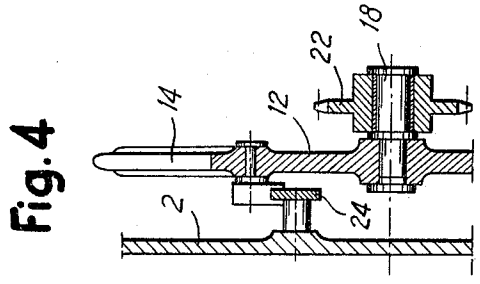
May 9, 1967 G. NOLLET 3,318,341

LOOM REVERSING MEANS

Filed July 28, 1965 3 Sheets-Sheet 1





INVENTOR:
Georges Nollet
BY:
Lawrence E. Laubscher
ATTORNEY

May 9, 1967 G. NOLLET 3,318,341

LOOM REVERSING MEANS

Filed July 28, 1965 3 Sheets-Sheet 2

Fig. 7

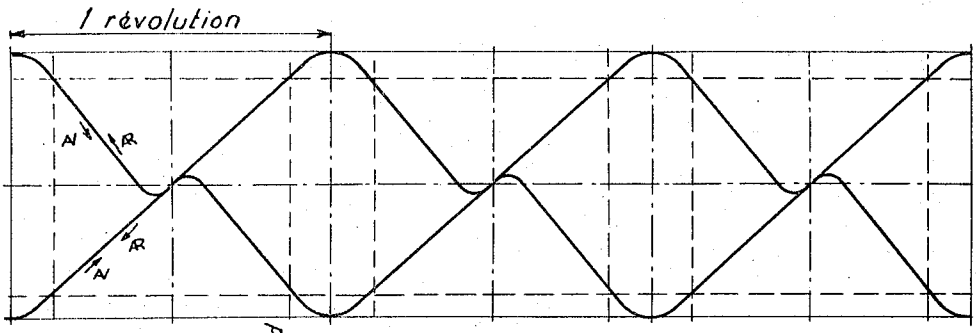


Fig. 6

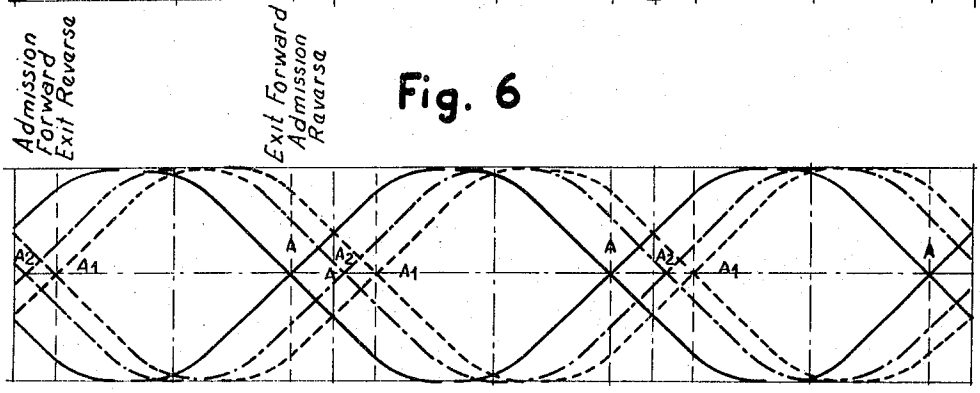
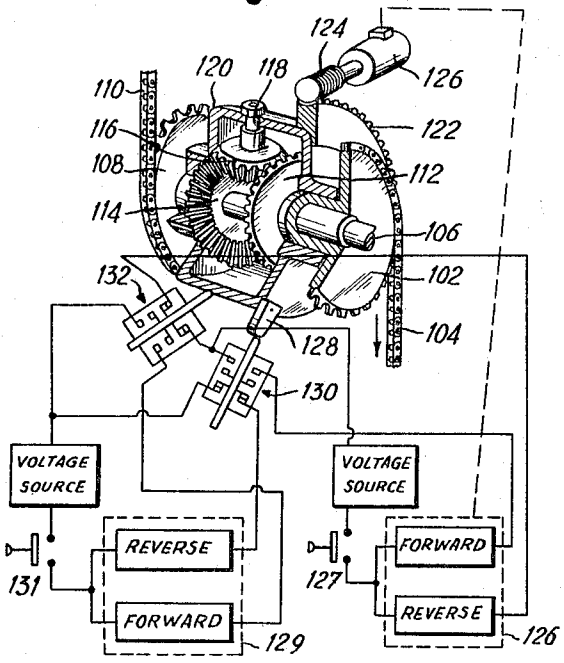


Fig. 5



INVENTOR:

Georges Nollet

BY:

Laurence E. Laubscher

ATTORNEY.

May 9, 1967 G. NOLLET 3,318,341

LOOM REVERSING MEANS

Filed July 28, 1965 3 Sheets-Sheet 3

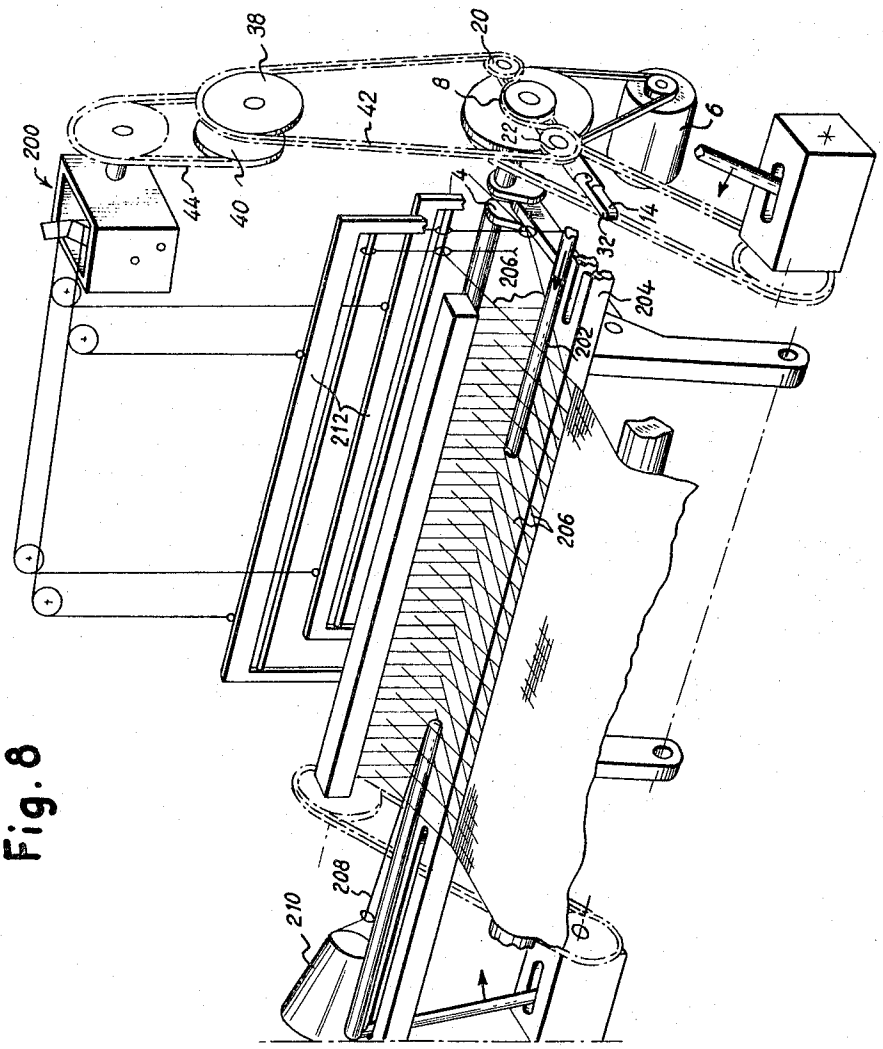


Fig. 8

INVENTOR:
Georges Nollet
BY:
Lawrence C. Laubscher
ATTORNEY.

United States Patent Office

3,318,341
Patented May 9, 1967

3,318,341

LOOM REVERSING MEANS

Georges Nollet, 6 bis Ave. Foch,
Mouveaux, France

Filed July 28, 1965, Ser. No. 475,464
12 Claims. (Cl. 139—1)

This invention relates generally to means for reversing looms of the type including a stationary weft supply located outside the shed, and more particularly to loom reversing means including means for angularly displacing the sprocket gear that drives the heald operating means relative to a sprocket gear that operates in synchronism with the weft insertion means and other ancillary components of the loom.

It is known in the prior art (as evidenced, for example, by the U.S. patent to Alfred Cuiengnet No. 3,095,015 of June 25, 1963) that in looms of the aforementioned type, the shed closes on the weft insertion means at the moment the weft thread is released. Consequently, it is not usually possible to drive the entire loom in the reverse direction since such reverse motion would generally result in the penetration of a closed shed by the weft insertion means.

The object of the present invention is to provide a weaving loom of the type having a stationary weft supply located outside the shed and including novel means for permitting the complete reversal of motion of the batten, weft-insertion means and other ancillary components of the loom. The invention is characterized by the provision of means for momentarily displacing the movement of the healds between either of two given (e.g., "forward" and "reverse" enabling) positions relative to the loom drive means, whereby reverse motion of the loom is permitted.

As disclosed in the aforementioned Cuiengnet Patent No. 3,095,015, the heald operating means are driven from the loom motor by means including an endless chain and a heald drive sprocket gear. Other means of the loom (for example, the weft insertion means) are driven either directly by the loom motor or from the loom motor via a loom sprocket gear and other endless chain means coupled therewith. In accordance with a more specific object of the present invention, means are provided for adjusting the instantaneous angular relationship between the sprocket gear that drives the heald operating means and the motor-driven sprocket gear associated with the weft insertion means, whereby the timed relationship between the operation of the healds and the weft insertion means may be varied to permit operation of the loom in the reverse direction without penetration of the weft inserters into a closed shed.

According to a first embodiment of the invention, the loom sprocket gear and the sprocket gear that drives the heald operating means are connected by an endless chain that passes over a pair of auxiliary or guide sprocket gears arranged on opposite sides of the loom sprocket gear. The chain is so mounted that the direction of rotation of the loom sprocket gear is opposite that of the other sprocket gears. The guide sprocket gears are mounted on a lever that is pivotally movable about the axis of rotation of the loom sprocket. Latching means are provided for locking the lever in either of two angularly displaced positions. The lever embodiment of the invention is so designed that when the loom motor is de-energized and the loom sprocket gear is stationary, pivotal movement of the lever between the two positions established by the latching means causes a corresponding angular displacement of the drive sprocket gear of the heald operating means relative to the loom sprocket. As a result of this angular displacement of the heald driving sprocket, when the loom is driven in the reverse direction

(for unweaving of the fabric to remove a broken thread, for example) the timed relationship between the heald operating means and the weft insertion means is such as to permit penetration of the shed by the weft inserting means during unweaving rather than having such members inserted into a closed shed.

In accordance with a second embodiment of the invention, differential gearing means are provided for adjusting the instantaneous angular relationship between the drive sprocket of the heald operating means and the loom sprocket associated with the weft insertion means, whereby the loom may be driven in the reverse direction. The differential gearing means includes a pair of bevel sun gears connected with the two sprocket gears, respectively, and planetary bevel gears connecting the sun gears. The planetary bevel gears are carried by a planet carrier that is driven between two predetermined angularly displaced positions by auxiliary motor means. This differential gearing arrangement is such that when the loom motor is de-energized to immobilize the loom sprocket gear and the auxiliary motor is operated to angularly displace the planetary gear carrier, the drive sprocket gear for the heald operating means is angularly displaced relative to the sprocket gear associated with the weft insertion means or other ancillary means of the loom.

According to a more specific object of the invention, switch means are provided for disabling operation of the loom motor in the forward and reverse directions when the loom sprocket gear and the heald driving sprocket gear do not have the appropriate angular relationship, respectively. In the lever embodiment of the invention, a pair of normally open switch means which normally disable the forward and reverse controls of the loom motor are arranged for actuation by the lever latch means to enable the corresponding loom motor operation when the lever is in one of the two latched positions. In the differential gearing embodiment of the invention, normally-open switch means are arranged for operation by stop means carried by the planetary gear carrier to enable the loom motor only when the heald operating sprocket gear and the loom sprocket gear have the appropriate angular relationship.

Other objects and advantages of the present invention will become apparent from a study of the following specification when considered in conjunction with the accompanying drawing, in which:

FIGURE 1 is a somewhat schematic front elevational view, with certain parts removed for clarity, of a first embodiment of the invention for adjusting the instantaneous angular relationship between the heald driving sprocket and the loom sprocket gears;

FIGURE 2 is a detailed view of the means for latching the adjusting lever of FIGURE 1, the electrical safety system being illustrated schematically;

FIGURES 3 and 4 are sectional views taken along lines 3—3 and 4—4 of FIGURE 1, respectively;

FIGURE 5 is a perspective view, with certain parts broken away for clarity, of a differential gearing embodiment for adjusting the instantaneous angular relationship between the heald drive sprocket and the loom sprocket gears;

FIGURES 6 and 7 are timing curves illustrating the relative displacements of the forward-motion and reverse-motion heald means and the forward-motion and reverse-motion weft insertion means, respectively; and

FIG. 8 is a detailed front perspective view, with certain parts removed, of a loom including the control means of FIGS. 1–4.

Referring first to the lever embodiment of the invention illustrated in FIGURES 1–4 and 8, the weaving loom includes a frame 2 (FIGURES 3 and 4) containing a

bore in which is journalled the main crank shaft **4** that is driven by a reversible electric loom motor **6** (FIGURE 2). Keyed to the shaft **4** is a loom sprocket gear **8** that is normally driven at a constant speed in the forward or reverse directions of rotation by the loom motor. Pivotally mounted intermediate its ends on the tubular extension **10** of the bearing of main shaft **4** is a rigid lever **12** having at one end a handle **14**. Journalled on parallel pins **16** and **18** carried by lever **12** on opposite sides of the pivot extension **10** are a pair of auxiliary or guide sprockets **20** and **22**, respectively. Rigidly secured to the frame **2** adjacent lever handle **14** is a sector plate **24** containing a pair of notches **26**, **28** for alternately receiving the locking finger **30** of a latch **32** that is pivotally connected to the lever handle.

Journalled on a pin **34** carried by the frame **2** is a double sprocket member **36** that includes a pair of integrally connected sprocket gears **38** and **40**. Sprocket gears **8**, **20**, **22** and **38** are coplanar and are interconnected by an endless sprocket chain **42** as shown in FIGURE 1. The chain **42** is so arranged that sprocket gears **20**, **22**, **38** and **40** are rotatably driven in a direction opposite to the direction of rotation of loom sprocket gear **8**. As is generally known in the loom art, sprocket gear **40** drives conventional heald operating means **200** (FIG. 8) via a second endless sprocket chain **44**. The loom-motor-driven main crank shaft **4** drives conventional loom means, such as the weft insertion means **202** (FIG. 8). As is conventional in the art, the weft insertion means **202** travel on the batten or slay **204** inside the shed formed by the warp threads **206**, the weft thread **208** being withdrawn from the stationary supply **210**. Healds **212** are operated by the heald operating means **200** in a conventional manner.

As shown in FIGURE 2, a pair of normally-open switches **46** and **48** are mounted on plate **24** adjacent notches **26** and **28**, respectively, for operation by the finger portion **30** of latch **32**. The switches are connected in series with the forward and reverse control means **50** and **52**, respectively, of the loom drive motor **6**. The motor **6** is energized from a voltage source **54** via start switch **56**.

In operation, assume that lever **12** is in the illustrated latched (i.e., "forward" enabling) position, whereupon switch **46** is closed by latch finger **30**. The loom motor **6** rotates in the forward direction and drives main crank shaft **4** and loom sprocket gear **8** in the counterclockwise direction shown by the arrow in FIGURE 1. Owing to the arrangement of sprocket chain **42**, sprocket gears **20**, **22**, **38** and **40** are driven in the clockwise direction. The heald sprocket gear **40** now drives the heald operating means via endless sprocket chain **44**.

In the event that a weaving condition should now occur for which a reversing operation of the loom is desired, switch **56** is opened to de-energize the loom motor **6**. Latch **32** is operated to withdraw finger **30** from notch **26**, whereupon lever **12** is pivoted in the clockwise direction from the illustrated forward-motion position to the reverse-motion position in which finger **30** is opposite notch **28**. Latch **32** is operated (for example, by spring means, not shown) to effect engagement of finger **30** with notch **28** to lock lever **12** in this pivotally displaced position. During this clockwise pivotal movement of lever **12**, the auxiliary sprocket gears **20** and **22** carried thereby are displaced to the positions **20'** and **22'** illustrated in phantom in FIGURE 1. This displacement of the auxiliary sprockets results in a corresponding slight angular displacement of sprockets **38** and **40** in the clockwise direction (angle "α" in FIGURE 1). More particularly, assuming that point A is stationary on the stationary loom sprocket gear **8**, point B on sprocket gear **38** will be displaced to point B' as a result of the pivotal movement of the lever **12**. The length of the chain **42** is substantially constant, the only variation being the slight change resulting from the sum of the very small free movements afforded between the links of the chain. Owing to the aforementioned angular displacement of sprocket **38** (and heald drive sprocket **40** integral therewith) chain **44** is longitudinally displaced a corresponding slight distance (as indicated by the arrow in FIGURE 1) to rotate through a small angle the heald operating means **200**. Thus it is apparent that as a result of the pivotal movement of the lever **12**, the heald operating means are rotated through a corresponding small angle relative to the various means of the loom (for example, the weft insertion means) driven by main shaft **4**, whereby reverse motion of the loom is permitted. Since switches **46** and **48** are open and closed, respectively, loom motor **6** is prevented from being inadvertently operated in the forward direction and may be operated only in the reverse direction upon closing of switch **56** and actuation of the reverse control means **52**.

Following the operation of the loom in the reverse direction, switch **56** is opened to de-energize the loom motor, lever **12** is unlatched and returned to the illustrated position, switches **46** and **48** are again closed and opened, respectively, and the loom is again enabled for forward operation. During this pivotal movement of lever **12** in the counterclockwise direction, sprockets **38** and **40** are angularly displaced in the counterclockwise direction through the angle α, and the heald operating means are returned to the original angular relationship relative to loom sprocket gear **8**.

FIGURE 5 discloses an alternative embodiment of the invention including a differential gearing arrangement for effecting the aforementioned angular displacement between the loom sprocket gear and the heald-operating sprocket gear. The loom sprocket gear **102**, which is driven simultaneously with the other loom means via drive chain **104**, is journalled on the stationary shaft **106** which is secured to the loom frame. Similarly, the heald driving sprocket **108**, which drives the heald operating means (not shown) via endless chain **110**, is rotatably mounted on stationary shaft **106**. Also journalled on shaft **106** are a pair of bevel gears **112** and **114** that are secured to sprocket gears **102** and **108**, respectively. Interconnecting bevel gears **112** and **114** are a plurality of planetary bevel gears **116** that are journalled on pins **118** carried by planetary gear carrier **120**. This carrier **120** is rotatably supported on the sleeves that interconnect the sprocket gears **102** and **108** with the corresponding bevel gears **112** and **114**, respectively. The carrier is axially rotated by the cooperation between a worm sector **122** secured thereto and a worm drive **124** driven by reversible auxiliary electric motor **126**.

Extending radially from the carrier **120** is a stop **128** which alternately operates switch means **130** and **132** secured to the loom frame. These switch means each include normally closed first switch contacts which normally enable operation of the auxiliary motor **126**, and normally open second switch contacts which normally disable the loom drive motor **129**. The motors **126** and **129** are energized from appropriate voltage sources via switches **127** and **131**, respectively.

In operation, when the elements are in the positions illustrated in FIGURE 5 and the chain **104** is driven by the loom motor in the direction indicated by the arrow, loom sprocket gear **102** and bevel gear **112** connected thereto are rotated in the clockwise direction upon stationary shaft **106**. Assuming that auxiliary motor **126** is de-energized whereby planetary gear carrier **120** is maintained stationary, bevel gears **116** and **114** are driven by sun gear **112** to rotate sprocket gear **108** in the counterclockwise direction and thereby drive chain **110** in the direction indicated by the arrow. In the event that it should be desired to operate the loom in the reverse direction (for an unweaving operation, for example) the loom motor is de-energized and the auxiliary motor **126** is energized to drive carrier **120** in the clockwise direction

from the illustrated "forward" motion position, whereupon the auxiliary motor enabling contacts and the loom motor disabling contacts of switch means **130** are closed and opened, respectively. The carrier **120** is rotated until switch means **132** are actuated by projection **128** to disable the auxiliary motor **126** and to enable the loom motor **129**. During this movement of the carrier **120** relative to the stationary sprocket gear **102**, bevel gears **116** and **114** are driven to slightly displace the heald driving sprocket **108** through an angle relative to sprocket gear **102** that is a function of the extent of angular movement of the carrier **120**. The heald-operating means are now in the "reverse" motion position relative to the weft insertion means. Upon operation of the reverse control means of loom motor **129**, the loom components (such as the weft insertion means) and the heald operating means, are driven in the reverse direction.

Upon completion of the loom unweaving operation, the loom motor is de-energized, and the auxiliary motor **126** is operated in the reverse direction, whereupon the loom motor reverse control means are disabled and the auxiliary forward control means are enabled. The auxiliary motor **126** rotates planetary carrier **120** in the counterclockwise direction until switch means **130** are actuated by projection **128** to de-energize the auxiliary motor and to enable the forward control means of the loom motor as shown. During this return movement of the planetary carrier relative to the stationary loom sprocket gear **102** and bevel gear **112**, sprocket gear **108** is driven by bevel gears **114** and **116** to its original angular relationship relative to loom sprocket gear **102**. The loom motor may then be energized to resume driving of the loom in the forward direction.

The effect of the angular displacement of the heald drive sprocket relative to the loom sprocket gear in each of the two embodiments described above is apparent from an examination of the timing curves of FIGURES 6 and 7. In FIGURE 6, the movement of the healds in the forward direction is illustrated in by the solid line. It will be noted that the point of intersection A of the healds occurs as the weft inserters (FIGURE 7) leave the shed. To permit operation in the reverse direction, it is necessary merely to displace the point of intersection to the point A_1 shown by the broken line in FIGURE 6. The weft inserters then enter a shed on a line at right angles to A and pass out of the shed at the new point of intersection A_1. Actually, since no weaving takes place, this point of intersection is not absolutely necessary, and consequently the point A_2 is preferably selected such that the opening of the shed is sufficient for the introduction of the weft inserters, that the uncrossing is appropriate, and that the closing of the shed takes place slightly after the weft inserters have left in order to spare the warp threads.

The displacement of the weft inserters is shown in FIGURE 7 wherein the co-ordinates which correspond to the displacements and to the times are chosen so as to show the correlation between the weft insertion means and the heald movements.

While in accordance with the provisions of the patent statutes, the preferred forms and embodiments of the invention have been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made in the apparatus described without deviating from the invention set forth in the following claims.

What is claimed is:

1. In a loom apparatus of the type including a shed, a stationary weft supply located outside the shed, a loom motor, first loom means driven by said motor, and heald operating means adapted to be driven by said motor in a given timed relationship relative to said first loom means; the invention which comprises

a loom sprocket gear connected with said first loom means for simultaneous driven movement therewith;

means including a second sprocket gear for driving said heald operating means;

adjustable means affording a continuous and positive mechanical connection between said second sprocket gear and said loom sprocket gear to thereby effect driving of said heald operating means, said adjustable means being operable to vary the instantaneous angular relationship of said second sprocket gear relative to said loom sprocket gear; and

operating means for operating said adjusting means to establish one of two predetermined angular relationships between said loom sprocket gear and said second sprocket gear.

2. In a loom apparatus, the invention which comprises

a reversible loom drive motor;

a loom sprocket gear driven by said loom motor;

heald drive means including a second sprocket gear;

adjustable means connecting said second sprocket gear with said loom sprocket gear to effect driving of said heald operating means, said adjustable means being operable to vary the instantaneous angular relationship of said second sprocket gear relative to said loom sprocket gear;

and operating means for operating said adjusting means to establish one of two predetermined angular relationships between said loom sprocket gear and said second sprocket gear;

said adjustable means comprising

a lever arranged for pivotal movement intermediate its ends about a pivot axis colinear with the axis of rotation of said loom sprocket gear, a pair of auxiliary sprocket gears journalled on said lever on opposite sides of, and coplanar with, said loom sprocket gear, respectively, and an endless sprocket chain so mounted on all of said sprocket gears to cause each of said auxiliary and heald sprocket gears to be driven in a direction opposite to the direction of rotation of said loom sprocket gear, whereby when said loom sprocket gear is maintained stationary and said lever is pivoted, the angular relationship between said loom sprocket gear and said second sprocket gear is varied.

3. Apparatus as defined in claim **2** wherein said loom includes a frame, and further wherein said operating means comprises a pair of cooperating latching means mounted on said frame and said lever, respectively, for releasably latching said lever in either of two angularly displaced positions relative to the frame.

4. In a loom apparatus, the invention which comprises

a reversible electric loom drive motor;

a loom sprocket gear driven by said loom motor;

heald operating means including a second sprocket gear;

adjustable means connecting said second sprocket gear with said loom sprocket gear to effect driving of said heald operating means, said adjustable means being operable to vary the instantaneous angular relationship of said second sprocket gear relative to said loom sprocket gear;

operating means for operating said adjusting means to establish one of two predetermined angular relationships between said loom sprocket gear and said second sprocket gear; and

means permitting energization of said loom motor only when said second sprocket gear has one of said two predetermined angular relationships relative to said loom sprocket gear.

5. Apparatus as defined in claim **4** wherein said loom includes a frame; wherein said adjustable means comprises a differential gearing arrangement including a pair of sun gears connected with said loom sprocket gear and said second sprocket gear, respectively, a plurality of planetary gears interconnecting said sun gears, and a planet gear carrier carrying said planetary gears, said carrier being rotatably carried by said frame; and further wherein said operating means comprises means for

rotating said planet gear carrier between a pair of angularly displaced fixed positions relative to the frame.

6. Apparatus as defined in claim **5** wherein said differential gearing arrangement is mounted coaxially relative to said second sprocket gear.

7. Apparatus as defined in claim **5** wherein said differential gearing arrangement is mounted coaxially relative to said loom sprocket gear.

8. Apparatus as defined in claim **5** wherein said loom further includes at least one auxiliary guide sprocket gear, and chain means connecting said guide sprocket gears with said loom sprocket gear and said second sprocket gear; and further wherein said differential gearing arrangement is mounted coaxially relative to said auxiliary guide sprocket gear.

9. Apparatus as defined in claim **5** wherein said planet gear carrier rotating means comprises an auxiliary motor mounted on said frame, means for energizing said auxiliary motor to drive the same in a direction causing the carrier to be displaced from one of said fixed positions toward the other, and end-stop switch means for de-energizing said auxiliary motor when the carrier reaches the other of said fixed positions.

10. Apparatus as defined in claim **9**, wherein said loom motor energizing means includes safety switch means enabling energization of the loom motor only when said planetary gear carrier is in either of said fixed positions.

11. Apparatus as defined in claim **3**, and further including switch means associated with said latching means for energizing said loom motor only when said lever is in either of the two angularly displaced positions relative to the frame.

12. In a loom of the type including a frame supporting a shed, a stationary weft reserve located outside the shed, heald operating means, and weft insertion means, the invention which comprises in combination

reversible electric motor means for driving said weft insertion means;

a loom sprocket gear driven by said motor in synchronism with said weft insertion means;

second sprocket gear means for driving said heald operating means;

adjustable means connecting said second sprocket gear with said loom sprocket gear to thereby effect driving of said heald operating means by said motor, said adjustable means being operable to vary the instantaneous angular relationship of said second sprocket gear relative to said loom sprocket gear;

operating means for operating said adjusting means to establish one of two predetermined angular relationships between said loom sprocket gear and said second sprocket gear;

a pair of normally disabled means for operating said loom motor alternately in the forward and reverse directions, respectively;

and a pair of enabling means associated with said pair of loom motor operating means, respectively, each of said enabling means being controlled by said adjustable means and being operable to enable the associated loom operating means when the second sprocket gear is in a given one of said angular relationships relative to said loom sprocket gear, respectively.

References Cited by the Examiner

UNITED STATES PATENTS

1,104,795	7/1914	Hahnlen	74—395
2,536,102	1/1951	Smith	74—395
2,594,209	4/1952	Porter.	
2,759,494	8/1956	Honegger	139—1.4
3,166,947	1/1965	Hendershot	74—395 XR

FOREIGN PATENTS

733,960	7/1955	Great Britain.

MERVIN STEIN, *Primary Examiner.*

H. S. JAUDON, *Assistant Examiner.*