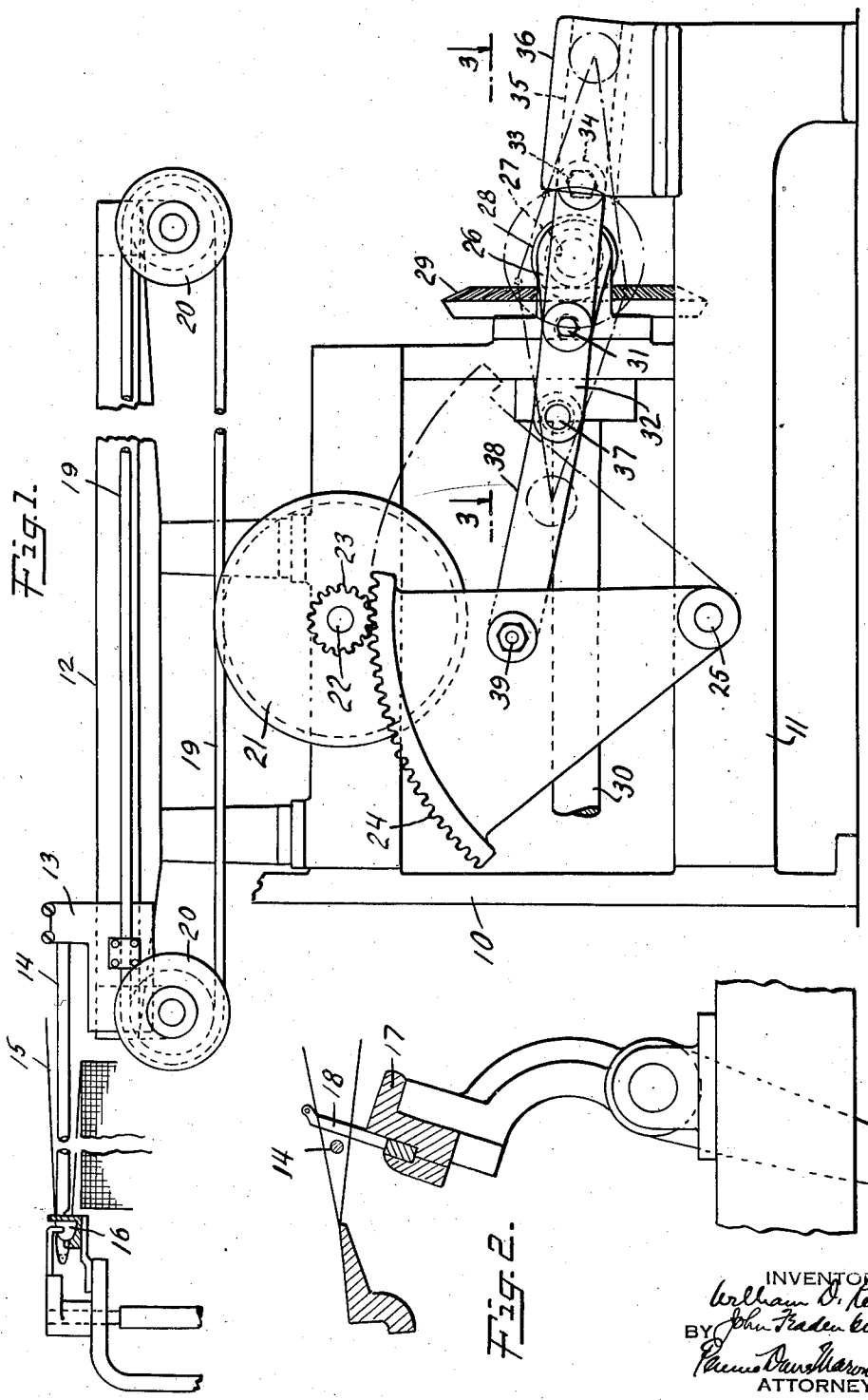
Jan. 5, 1937. W. D. KELLOGG ET AL 2,066,532

LOOM

Filed March 18, 1936 3 Sheets-Sheet 1



INVENTORS
William D. Kellogg
BY John Fladenburgh
Parmelee Dunn Martin & Edmonds
ATTORNEYS

Jan. 5, 1937. W. D. KELLOGG ET AL 2,066,532

LOOM

Filed March 18, 1936 3 Sheets-Sheet 2

Fig. 4.

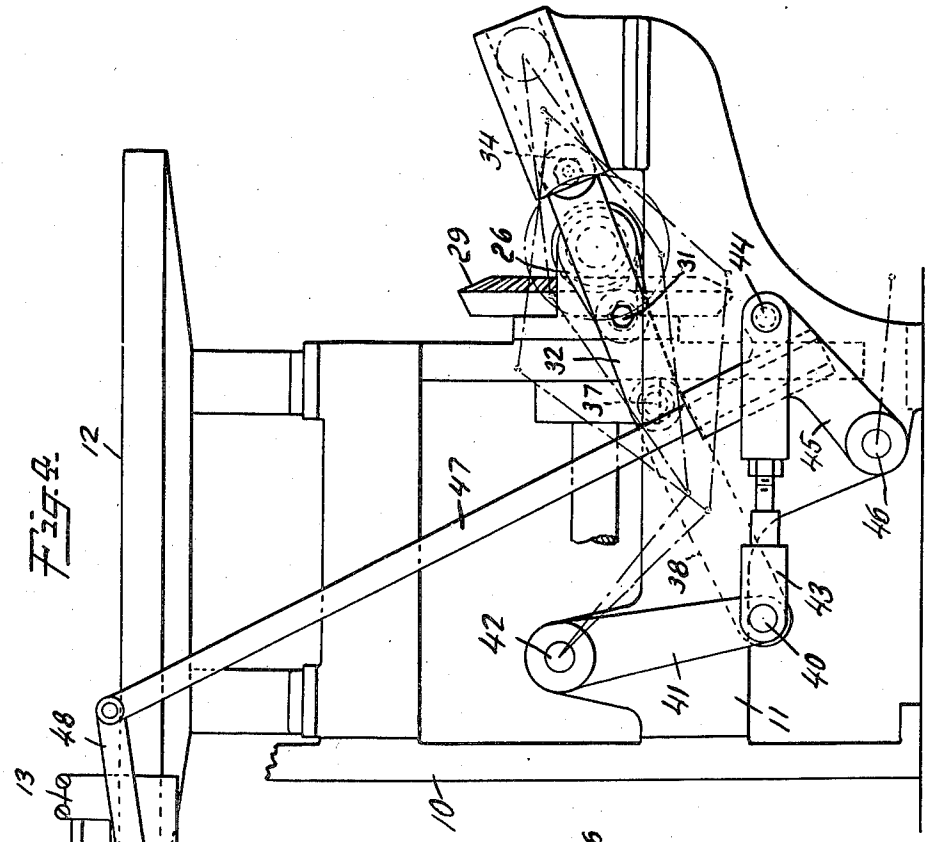
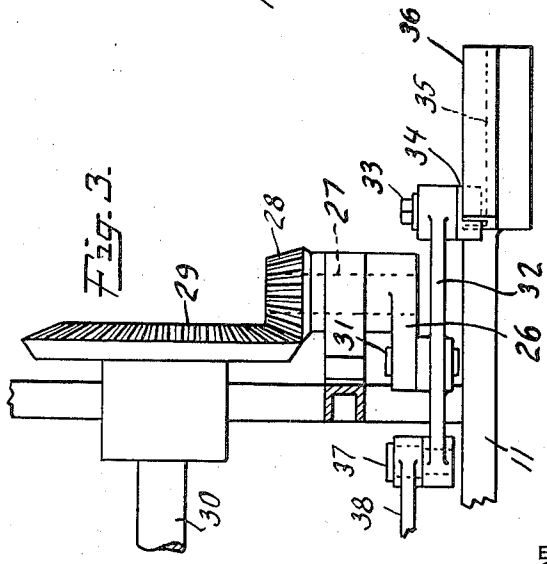


Fig. 3.



INVENTORS
William D. Kellogg
John Fradenburgh
BY Pennie Davis Marvin & Edmonds
ATTORNEYS

Jan. 5, 1937. W. D. KELLOGG ET AL 2,066,532

LOOM

Filed March 18, 1936 3 Sheets-Sheet 3

Fig. 5.

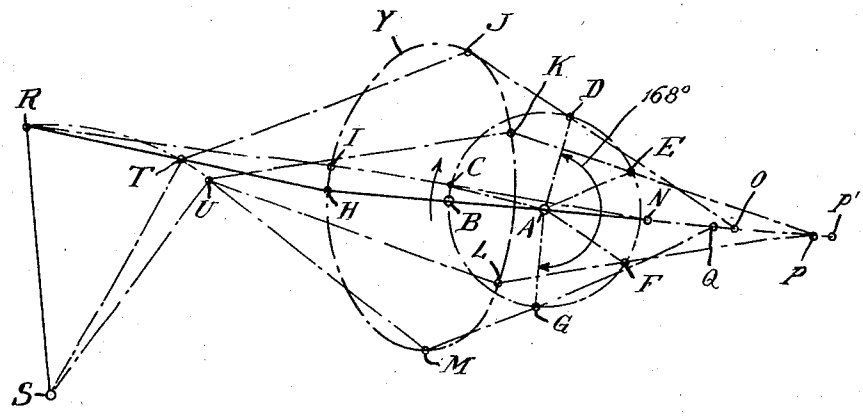
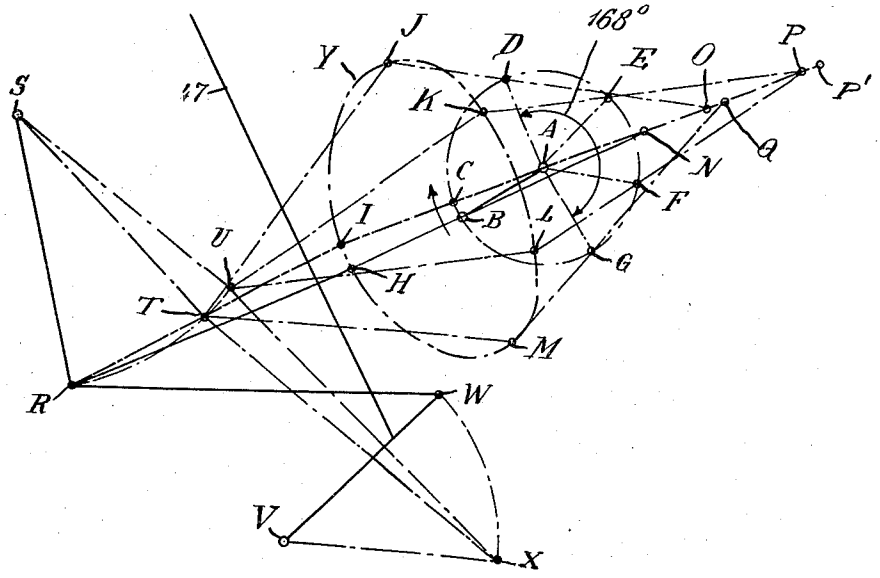


Fig. 6.



INVENTORS
William D. Kellogg
BY John Bradenburgh
Pierce Davis Marron & Edmonds
ATTORNEYS

Patented Jan. 5, 1937 2,066,532

UNITED STATES PATENT OFFICE

2,066,532

LOOM

William D. Kellogg and John Fradenburgh, Amsterdam, N. Y., assignors to Mohawk Carpet Mills, Inc., Amsterdam, N. Y., a corporation of New York

Application March 18, 1936, Serial No. 69,446

11 Claims. (Cl. 139—123)

This invention relates to weft inserting mechanisms or needle motions for use on looms, such as those of the Axminster type, in which the weft threads are carried through the shed by a needle and interlocked with a selvedge cord, after which the inserted shot of weft is beaten up by a lay. More particularly, the invention is concerned with an improved weft inserting mechanism by which the needle is given a reciprocating movement which includes a retardation or dwell when the needle is fully in and fully out of the shed, without the use of a power arm which is intermittently actuated.

In looms of the type described, the lay which beats up the inserted weft shots may be operated by means of a cam on the main loom shaft to have equal or unequal beats, or connecting arms on a crank shaft may be employed to give the lay equal beats. Regardless of the means used to operate the lay, the weft inserting needle must be so inserted and withdrawn from the shed as not to interfere with the lay in its beating-up movements.

A typical loom, employing the first means for operating the lay, is an Axminster loom of the type disclosed in the patent to Smith No. 186,374, Jan. 16, 1877, in which the lay is operated by a cam, and the cycle of operations includes three unequal periods or beats of the lay per revolution of the lay cam. For example, the angular movement of the lay cam, during which the three weft shots are beaten up, may be 28, 56, and 36 degrees, respectively, totaling 120 degrees, or a third of the time required for one revolution of the cam. The remaining two-thirds of the time for one revolution of the cam is used for the insertions and withdrawals of the needle, and with an ordinary three shot construction in which there are three insertions and withdrawals of the needle for each revolution of the cam, the time available for each insertion and withdrawal of the needle is that during which the lay cam rotates through 80 degrees. During those portions of a revolution of the cam in which the lay is beating up a shot, the needle must remain out of the shed, and if the lay beats are unequal, as in the example given, the periods during which the needle remains out of the shed are likewise unequal, and the needle motion must be constructed to impart that type of motion to the needle.

In looms of the Smith type, in which the lay is operated by a cam, it is customary to operate the needle by a driven power arm operatively connected to the needle. In order to obtain a retardation or dwell in the needle movement while the latter is out of the shed, the power arm is given an intermittent rotation in timer relation to the unequal time of the lay. Thus, during each complete revolution of the power arm, the needle is inserted into and withdrawn from the shed, and it remains out of the shed during the time that the lay is beating up the inserted shot. This intermittent motion imparted to the power arm requires that the arm, and its associated parts, be started and stopped suddenly, and as a result, the parts are subjected to repeated shock, and there is a limitation on the speed at which the loom can be run.

In order to overcome these difficulties, an attempt has been made to employ a power arm which is driven continuously, and for this purpose, the needle is given a pronounced over travel which will consume sufficient time to permit the lay to beat up the inserted shots in either equal or unequal beats. With this construction, there are no dwells in the travel of the needle, except the momentary dwells which occur at the instants when the needle changes direction, and the shocks resulting from the use of an intermittently operating power arm are, accordingly, eliminated. The use of over travel of the needle is, however, subject to the important disadvantage that, as the needle is withdrawn from the shed and proceeds to the limit of its over travel, the weft thread is unsupported for a substantial distance from the selvedge of the fabric to the eye of the needle, and this condition results in frequent breakage of the thread, so that the running time of the loom is cut down and its efficiency and the rate of production are reduced. Moreover, the over travel of the needle necessitates the use of a needle guide rail of extraordinary length, and each loom thus requires additional floor space.

Attempts have been made heretofore to employ a power arm, which is driven uniformly and continuously, by connecting the arm to the needle through a system of levers and toggles, this system being so arranged that a dwell is produced in the movement of the needle while it is out of the shed, so that the lay may beat up the inserted shed without interference from the needle. The prior apparatus of this type, with which we are familiar, have not been wholly satisfactory because they have not provided dwells in the movement of the needle while it is out of the shed of sufficient duration to permit the lay to function, except by imparting a substantial over travel to the needle.

In those looms in which the lay is operated by a crank shaft through connecting arms, more

time is required for the beating up of the weft shots, and this is particularly true when the crank shaft is connected to the lay through a toggle, so that the lay has a double beat. The increased time consumed by the lay on the beat up in such looms, necessitates a corresponding retardation or dwell of the needle while it is out of the shed, and if a continuously operated power arm were to be employed on such a loom, the over travel of the needle and the length of the needle rail would be so great as to be impractical.

The present invention is, accordingly, directed to the provision of a new mechanism for weft insertion which overcomes the objections to the prior devices above described, and is greatly superior thereto in that the new mechanism includes a continuously operating power arm, and no substantial over travel of the needle is required. At the same time, the new mechanism may be employed in a variety of applications in which the lay is operated, either by a cam or a crank, and with either equal or unequal beats.

The new mechanism includes a power arm which may conveniently take the form of a crank on a shaft rotating continuously and uniformly throughout the operation of the loom, and this power arm drives the needle through connections which include an intermediate member actuated by the power arm and having a point between its ends which describes a circle, and a point at one end which is constrained to reciprocate, as the member is actuated by the power arm. The other end of the intermediate member is then connected to an oscillating element which is operatively connected to the needle, and, as the intermediate member operates, it moves the oscillating member to two extreme portions corresponding to the full inward and full outward points on the path of travel of the needle. Thus, in one position, the oscillating member places the needle so that the selvedge shuttle may pass through the loop of weft thread carried by the needle, and in the other position, the oscillating member places the needle wholly out of the shed so that the lay may function.

In certain looms in which a retardation of the needle for a period equal to 120 degrees of angular movement of the power arm is sufficient to permit the operation of the lay, the intermediate member may be connected to the oscillating member by a link, and the desired retardation may be obtained without over travel of the needle. In looms such as those of the Axminster type in which a greater retardation of the needle is required, such, for instance, as that corresponding to 168 degrees of angular movement of the power arm, to accommodate a lay movement having a duration of 56 degrees of movement of the arm, or in looms in which a retardation equivalent to about 190 degrees of travel of the power arm is required to take care of a double beat movement of the lay, the intermediate member is connected to the oscillating member through a mechanical device which cooperates with the intermediate member in modifying the movement imparted to the needle by the power arm and oscillating member. Such a mechanical device may take the form of a toggle joint, and when that device is employed, the longer retardation of the needle referred to may be obtained without any substantial over travel.

Referring now to the drawings, Figure 1 is a view in elevation of a portion of a needle motion embodying the present invention, in which the intermediate member is connected to the oscillating member by a link;

Figure 2 is a fragmentary view in side elevation illustrating the action of the lay;

Figure 3 is a sectional view on the line 3—3 of Figure 1;

Figure 4 is a view similar to Figure 1, but showing a form of the new mechanism in which a toggle is employed between the intermediate member and the needle;

Figure 5 is a diagrammatic view illustrating the operation of the parts of the mechanism shown in Figure 1; and

Figure 6 is a view similar to Figure 5, showing the positions of the parts of the mechanism as illustrated in Figure 4, during operation.

Referring now to the drawings, the loom is illustrated somewhat diagrammatically in Figures 1 and 3 as comprising the usual side frames 10 from which projects the supporting framework 11 for the needle motion, a needle rail 12 on which the needle carriage 13 is moved being mounted on top of the framework. The needle 14 for inserting the weft thread 15 is attached to the needle carriage in the usual way, and when the needle is at the limit of its inward travel into the shed, the selvedge shuttle 16, operating in the usual raceway in timed relation to the movement of the needle, passes the selvedge cord through the loop of weft thread carried by the needle. The inserted weft shot is then beaten up by a lay 17 provided with the usual reed 18 and oscillated by appropriate means.

In the construction illustrated in Figure 1, the needle carriage is reciprocated lengthwise of the rail 12 by a flexible cable 19 which is guided by suitable sheaves 20 at the ends of the needle rail. The cable is fastened in the usual way to a drum 21 mounted on a shaft 22 supported in suitable bearings on the framework 11, and this shaft is provided with a pinion 23 which meshes with a segment gear 24 which ocillates on a fixed stud 25 on the framework 11. As the gear 24 oscillates, it causes the pinion and drum to rotate first in one direction and then in the other, and the cable attached to the drum moves the needle carriage and needle so that the needle is inserted in the shed and withdrawn therefrom.

During the operation of the needle, its movement must be retarded at each end of its stroke, and one retardation or dwell must be sufficiently long to permit the selvedge shuttle to pass the selvedge cord through the loop of weft thread carried by the needle, and the other dwell must be sufficiently long to permit the lay to beat up the inserted shot of weft. The nature of the needle movement is determined by the motion imparted to the segment gear, and the gear is driven by a constantly and uniformly rotating power arm through suitable connections which modify the movement of the arm so as to produce the desired retardations.

The power arm 26 is mounted fast on a shaft 27, which is supported in suitable bearings on the framework 11 and carries a bevel pinion 28 meshing with a bevel gear 29 on the shaft 30 mounted in suitable bearings on the framework 11, the shaft 30 rotating continuously and uniformly throughout the operation of the loom. The free end of the power arm is provided with a stud 31 on which is mounted an intermediate member 32, the stud connecting the power arm to the intermediate member between the ends of the latter. One end of the intermediate member is provided with a stud 33 carrying a cam ball 34 confined

within a raceway **35** in a stationary cam **36** mounted on the framework **11**, and the other end of the intermediate member **32** is connected by a stud **37** to one end of a link **38**, the other end of the link being connected by a stud **39** to the segment gear **24**.

With the construction described, the rotation of the power arm causes the intermediate member to attempt to follow the circle described by the end of the power arm, and the point on the intermediate member at which it is connected by the stud **31** to the end of the power arm follows the circular path referred to. The end of the intermediate member carrying the cam ball is, however, constrained to move rectilinearly by the stationary cam **36**, and the other end of the intermediate member, accordingly, describes a closed curved path which is non-circular. Since the link **38** has one end connected to the end of the intermediate member describing the non-circular path, the link causes the gear **24** to oscillate about stud **25** as an axis with the gear moving between two extreme positions as the power arm rotates. The gear **24** is shown in Figure 1 in one of these extreme positions, and its other extreme position is indicated in that figure by dotted lines. In the full line position of the gear, the needle is fully in the shed in a position in which the selvedge shuttle may operate, and in the dotted line position of the gear, the needle is fully out of the shed so that the lay may operate without interference.

A detailed analysis of the movements of the several operating members of the mechanism illustrated in Figure 1 is shown in Figure 5, and this analysis is based on the assumption that the beat up of the weft thread by the lay requires a period of time equal to that consumed by the power arm in rotating in a clock-wise direction through an angle of 168 degrees, which is a condition frequently met in actual practice.

In the analysis diagram, the line AB represents the power arm **26** in one position, the point A corresponding to the axis of shaft **27**, the point B to the axis of pin **31**, the point H to the axis of the pin **37**, the point R to the axis of the pin **39**, and the point S to the axis of the stud **25**. The line HN then represents the axis of the intermediate member **32**, the line RH represents the axis of the link **38**, and the line RS represents a radius of the segment gear **24** passing through the axis of stud **39**.

As the power arm AB rotates about the point A as a center, the point B, which is both on the power arm and on the intermediate member, describes a circle. During this movement of the arm, the point N at one end of the intermediate member is constrained to move along the straight line path NP', and the point H, which is at the other end of the intermediate member and at one end of the link **38**, follows the closed curve Y, while the point R at the other end of the link and on the oscillating member, moves through the angle RSU.

When the power arm AB and the intermediate member HN occupy those positions, the link RH has caused the oscillating member to take one extreme position RS corresponding to the full inward position of the needle in the shed, and while in this position, the needle must have a dwell for a short period to permit the selvedge shuttle to pass the selvedge cord through the loop in the weft thread carried by the needle. For this purpose, a time interval corresponding to a short angular movement of the power arm, as for example, of 10 degrees, is sufficient, and, as illustrated in the diagram, when the power arm AB turns through the angle BAC of 10 degrees so that the arm assumes the position represented by the line AC, the intermediate member moves to the position represented by the line IN. During this movement of the intermediate member, it swings about the point N as a center, the cam ball **34** at one end of the member remaining stationary while the pin **37** at the other end of the member moves along the curve Y to the position I. During this movement of the member, the link RH swings about the point R as a center to occupy the position represented by the line RI and this movement of the link produces substantially no movement of the segment gear. Accordingly, the needle, when in its full inward position, has a dwell of a duration equal to the time required for a 10 degree movement of the power arm.

The rotation of the power arm continues until it occupies the position AD, and during this movement, the end of the intermediate member connected to the link **38** has progressed along the curve Y to the position J, and the other end of the intermediate member has traveled along the raceway **35** to the position O, so that the intermediate member now occupies a position represented by the line JO. In this movement of the intermediate member, the link **38** has caused the oscillating member to swing through the angle RST, so that the radius through the stud **39** on the segment gear has moved from the position RS to the position TS. In this movement of the oscillating member, the needle has been withdrawn from the shed, and the lay thereupon functions to beat up the weft thread left in the shed upon withdrawal of the needle.

The lay, in beating up the weft thread, requires a period equal to the time consumed by the power arm in passing through the angle DAG, which is equal to about 168 degrees, and during this movement of the power arm, the needle must remain out of the shed. In turning through this angle, the power arm first assumes the position AE in which the intermediate member takes the position represented by the line KP, and the end of the link connected to the intermediate member moves along the curve Y to the position K, during which movement the oscillating member passes through the angle TSU to take up the position US, which is at the extreme end of the path of travel of the oscillating member in one direction. As the power arm continues to move, it assumes the position AF, and during this movement, the cam ball on the end of the intermediate member moves from the point P to the point P', and then moves back to the point P. During this movement of the cam ball, the other end of the intermediate member moves along the path Y from the point K to the point L. The link connected to the oscillating member likewise moves from the position UK to the position UL, and that movement of the link produces a slight rocking of the oscillating member about pin S, which rocking produces only a slight movement of the needle.

The continued rotation of the power arm causes it to move from the position AF to the position AG, during which the cam ball on the end of the intermediate member moves from the point P to the point Q. The pin at the end of the intermediate member connecting it to the link **38** then moves from the point L to the point M on the curve Y, and the corresponding movement of the

link causes the oscillating member to move through the angle UST and assume the position TS. During this movement of the oscillating member, the needle moves from its extreme outer position to a point where it is just entering the shed, the lay having completed its beat up of the weft thread and having moved back out of the path of the needle.

A further rotation of the power arm from the position AG to the position AB causes the intermediate member to move to the position HN, the cam ball thereon moving from the position Q to N. During this movement, the end of the link connected to the intermediate member moves along the path Y from the point M to the point H, and the link causes the oscillating member to move through the angle TSR to its original position RS. As the oscillating member thus moves, the needle is moved into the shed and to the position in which the selvedge shuttle may pass the selvedge cord through the loop of weft thread carried by the needle.

It will be apparent from the analysis that in the movement of the power arm through the angle GAD in a clockwise direction, the arm has caused the oscillating member to move from the position represented by the line TS to that represented by the line RS and back again, and this movement of the oscillating member has in turn caused the needle to be inserted and withdrawn from the shed. At the end of the inward movement of the needle, the needle has remained substantially stationary for a period during which the power arm has moved through an angle of 10 degrees. During the movement of the power arm through the angle DAG of 168 degrees, the oscillating member has moved from the position TS to the position US and then moved back again, and during this movement of the member, the needle has been wholly outside the shed, so that the lay has been free to beat up the inserted weft thread. The length of the arc TR thus corresponds to the length of the travel of the needle in one direction in the shed, and the length of the arc TU represents the length of the travel of the needle while it is out of the shed and during the time that the lay is beating up. In actual practice, the travel of the needle in the shed may be 30½", and the travel out of the shed only 6½", this latter distance representing over travel.

In looms in which the time required for the beating up of a weft thread is equal to a period during which the power arm travels through approximately 120 degrees instead of 168 degrees, the travel of the oscillating member from the position TS to the position US is reduced to a fraction of an inch. As a result, the needle remains substantially at rest while the power arm turns through 120 degrees and there is very little over travel of the needle.

In looms in which the time required for the beat up of the weft thread is approximately that required for a travel of the power arm through an angle from about 168 degrees to 200 degrees, and it is desired to eliminate even the small over travel of the needle which takes place with the mechanism illustrated in Figure 1, the apparatus employed may take the form shown in Figure 4. In this construction, the power arm, the intermediate member, and the means for constraining one end of the intermediate member to cause that end to move along a rectilinear path are the same as those employed in the Figure 1 construction, but the link **38** is not connected directly to an oscillating member similar to the segment gear **24**, but is connected to the center of a toggle joint having one end fixed and the other end connected to an oscillating member which is in turn connected to the needle carriage.

As shown in Figure 4, one end of the link **38** is connected by pin **37** to one end of the intermediate member **32**, and the other end of the link is connected by a pin **40** to one end of an arm **41** pivotally mounted on the framework **11** by means of a stud **42**. The pin **40** also serves as a support for one end of a link **43**, the other of which is attached by a pin **44** to an oscillating member **45** pivotally mounted on the framework on a stud **46**. A needle driving arm **47** is rigidly mounted at one end on the oscillating member **45**, and at its other end, the arm **47** is connected by a link **48** to the needle carriage. As the arm **47** is swung through an arc by the rocking of the member **45**, the needle carriage **13** is moved along the guide rail **12** and the needle is inserted and withdrawn from the shed.

The oscillating member **45** in the Figure 4 construction may be considered to correspond to the oscillating segment gear **24** of the Figure 1 construction, and it will be noted that the link **38** is connected to the oscillating member **45** through a toggle joint, the elements **41** and **43** of which also have an oscillating movement.

For an analysis of the movements of the parts shown in Figure 4, reference may be had to Figure 6. In this figure, the letter A represents the axis of rotation of the power arm, B the axis of the pin **31** connecting the end of the power arm to the intermediate member **32**, H the pin **37** connecting the end of the intermediate member to the link **38**, and R the axis of pin **40** connecting the link to the toggle arm **41**. The line RS represents the longitudinal axis of the arm **41**, the line RW represents the axis of the link **43**, and the line VW represents the axis of the oscillating member **45**, the member in that position having moved the needle to its full inward position in which the selvedge shuttle is free to act. When the member **45** is in the position VX, the needle is at its extreme outward position, and while it remains there, the lay functions.

When the needle is in its full inward position, it must remain substantially at rest for a short period to permit the selvedge shuttle to function, and when the power arm is moving from the position AB to the position AC and the pin **37** on the intermediate member is moving from the point H to the point I on the curved path Y, the link **38**, represented by the line HR, swings about the point R as an axis to take up the new position IR. Since the point R is substantially at rest during this movement of link **38**, there are no changes in the positions of the arm **41** and of the oscillating member **45**. Accordingly, the needle remains substantially at rest when fully in the shed through a period during which the power arm passes through an angle of 10 degrees.

As the power arm continues to rotate clockwise, it produces a movement of the arm **41** from the position RS to the position TS, and this results in a movement of the needle, the latter being withdrawn when the arm **41** moves from the position RS to the position TS and being inserted when arm moves back from TS to RS. During the movement of the arm from the position RS to the position TS, the oscillating member **45** moves from the position VW to the position VX, and it returns to its original position with the return of the arm.

When the power arm reaches the position AD,

the arm 41 is in the position TS, the oscillating member 45 is in the position VX, and the needle is fully withdrawn from the shed. The needle must now remain substantially at rest for a period in which the lay operates, and, in the analysis illustrated, this dwell of the needle continues for a period during which the power arm moves through the angle DAG, which is substantially 168 degrees. During the movement of the power arm through this angle, the arm 41 moves from the position TS to the position US, and then back to the position TS, but these movements of the arm produce substantially no movement of the second member 45 since the points T and U lie on a circle about the point X as a center. The oscillating member thus remains at rest and the needle has no movement. Accordingly, by the use of the toggle connection between the link 38 and oscillating member 45, the new mechanism makes it possible to obtain a dwell in the movement of the needle when it is out of the shed for a period corresponding to an angular movement of the power arm through 168 degrees.

In both forms of apparatus as described, the retardation or dwell of the needle when it is fully within the shed, for the purpose of permitting the selvedge shuttle to operate, is provided by so constructing the mechanism that during the period of operation of the shuttle, the link swings about its point of connection either to the segment gear or to the toggle joint as a center, the movement of the link consequently producing substantially no movement of the gear or the joint. As the time required for the operation of the shuttle is small, this retardation or dwell is not absolutely essential, and instead of a dwell, the needle might be given a slight over travel. The use of over travel is somewhat undesirable from the standpoint of operation, because if the needle had such over travel inward, it would pass beyond the shuttle. This would require the use of a special type of needle and it might be difficult in the operation of the loom to position the needle during the operation of the shuttle in such manner that the shuttle would be certain to pass through the loop of weft thread carried by the needle. Because of these considerations, we prefer to provide a dwell at each end of the path of travel of the needle.

From the foregoing, it will be evident that with both forms of the new apparatus described, the needle is moved into and out of the shed by means of a continuously and uniformly rotating power arm, and at each end of the needle movement, it has a retardation or dwell. These dwells are of different durations, the one occurring when the needle is in the shed and during which the selvedge shuttle operates, being relatively short, and the other occurring when the needle is out of the shed and during which the lay beats up the inserted weft thread, being relatively long. In the first apparatus shown in Figure 1, the needle has a slight over travel when the apparatus provides a dwell of a duration equivalent to between 120 degrees and 168 degrees of angular movement of the power arm, but this over travel is so small that it does not add substantially to the floor space occupied by the loom and presents no problem relative to the construction of the needle rail. In the second form of the apparatus shown in Figure 4, the desired result is accomplished without any over travel of the needle whatever. In both forms, the dwells at the ends of the stroke of the needle are of appropriate duration for the purpose for which they are provided, and their duration may be varied by suitable changes in the connections. The new mechanism, accordingly, makes it possible to operate the loom efficiently and the needle motion imposes no limitations on the speed of operation. Also, it functions without shock to the parts, such as occur when an intermittently operating power arm is employed.

We claim:

1. In a loom, the combination of a needle movable into and out of the shed, means for imparting to the needle a reciprocating movement with a retardation at at least one end of its path of travel, said means including a constantly and uniformly rotating power arm, a member connected between its ends to the arm and having one end constrained to move along a rectilinear path, and a connection between the other end of the member and the needle.

2. In a loom, the combination of a needle movable into and out of the shed, means for imparting to the needle a reciprocating movement with a retardation at at least one end of its path of travel, said means including a constantly and uniformly rotating power arm, a member connected between its ends to the arm with said point of connection describing a circle as the arm rotates, a connection between the needle and a point on the member which describes a non-circular closed path as the arm rotates, and means for limiting to a rectilinear movement a point on the member remote from the point of connection to the needle and on the opposite side of the member from the point of connection to the arm.

3. In a loom, the combination of a needle movable into and out of the shed, and means for imparting to the needle an endwise reciprocating movement with a dwell at at least one end of its path of travel, said means including a constantly and uniformly rotating power arm, an intermediate member connected between its ends to the power arm, said member having one end constrained to reciprocate as the arm rotates, an oscillating member operatively connected to the needle, and means including a link for connecting the oscillating member and the other end of the intermediate member.

4. In a loom, the combination of a needle movable into and out of the shed, a power arm rotating with a constant and uniform motion, a cable drum, a cable attached to said drum and to said needle, an oscillating member for rotating said drum in opposite directions, and means actuated by said power arm for oscillating said member, said means including an intermediate member connected between its ends to the power arm and having one end constrained to move rectilinearly as the intermediate member is actuated by the arm, and a connection between the intermediate member and the oscillating member.

5. In a loom, the combination of a needle movable into and out of the shed, a power arm rotating with a continuous and uniform motion, an oscillating member operatively connected to the needle, means driven by the power arm for actuating said oscillating member, said means including an intermediate member connected to the power arm and having a portion constrained to move along the rectilinear path, and a toggle joint connected to the intermediate member and to the oscillating member and actuated by the

intermediate member to oscillate the oscillating member.

6. In a loom, the combination of a needle movable into and out of the shed, a power arm rotating with a continuous and uniform motion, an oscillating member operatively connected to the needle, and means driven by the power arm for actuating said oscillating member, said means including an intermediate member actuated by the power arm and having a portion constrained to move rectilinearly, and a pair of toggle members connected to each other and to the intermediate member at the same point, one of said members swinging about a fixed pivot and the other member being connected to the oscillating member, the movements of said other toggle member produced by the intermediate member causing the oscillations of the oscillating member.

7. In a loom, the combination of a needle movable into and out of the shed, a cable connected to the needle, a cable drum to which the cable is attached, an oscillating member operable to rotate the drum alternately in opposite directions, means for operating the oscillating member, said means including a power arm rotating with a continuous and uniform motion, an intermediate member connected between its ends to the power arm, said member having one end connected to the oscillating member, and means for constraining the other end of the intermediate member to move along a rectilinear path.

8. In a loom, the combination of a needle movable into and out of the shed, an oscillating member connected operatively to the needle, and means for oscillating said member, said means including a power arm rotating with a continuous and uniform motion, an intermediate member connected between its ends to the power arm, means for constraining one end of the intermediate member to move along a rectilinear path, and a connection between the other end of said intermediate member and the oscillating member, said connection including a toggle joint and a link connected to the pivot of said toggle joint.

9. In a needle motion for a shuttleless loom, the combination of a needle movable into and out of the shed of the loom, an oscilllating member operatively connected to the needle, a constantly and uniformly operating power arm, an intermediate member connected between its ends to the power arm and having one end free to follow the movement of the power arm and the other constrained to move with a reciprocating motion, and a link connected to the other end of the intermediate member and to the oscillating member to cause the latter to move to two extreme positions, the intermediate member being effective at each extreme position of the oscillating member to cause a retardation in the movement of the oscillating member when the needle is fully in and fully out of the shed.

10. In a needle motion for a shuttleless loom, the combination of a needle movable into and out of the shed of the loom, an oscillating member operatively connected to the needle, a power arm rotating with a continuous and uniform motion, an intermediate member connected between its ends to the power arm and having one end constrained to reciprocate along a rectilinear path and the other end free to follow the movement of the power arm, a mechanical device operatively connected to the oscillating member and to the free end of the intermediate member, said oscillating member being moved to two extreme positions in one of which the intermediate member causes a retardation in the movement of the oscillating member when the needle is in the shed and in the other of which the mechanical device is effective to produce a dwell in the movement of the oscillating member when the needle is out of the shed.

11. In a needle motion for a shuttleless loom, the combination of a needle movable into and out of the loom, and means for actuating the needle with a relatively short dwell at one end of its path and a relatively prolonged dwell at the other end of its path, said means including a power arm, an oscillating member rotating with a continuous and uniform motion, an intermediate member connected between its ends to the power arm, said member having one end constrained to reciprocate and the other end free to describe a closed path as the power arm rotates, an oscillating member operatively connected to the needle, a link connected to the free end of the intermediate member, and a mechanical device connected to the oscillating member and to the link to be actuated by the latter, the intermediate member being effective to produce the relatively short dwell and the intermediate member and mechanical device cooperating to produce the relatively long dwell.

WILLIAM D. KELLOGG.
JOHN FRADENBURGH.