(No Model.)

L. W. LOMBARD.

ELECTRIC SHUTTLE MOTION FOR LOOMS.

No. 514,088. Patented Feb. 6, 1894.

Fig. 1.

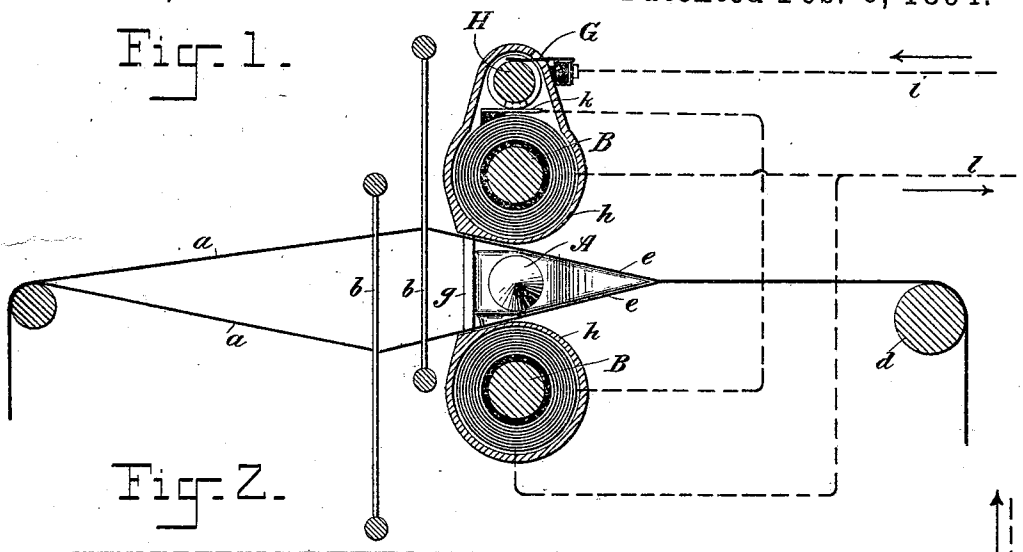


Fig. 2.

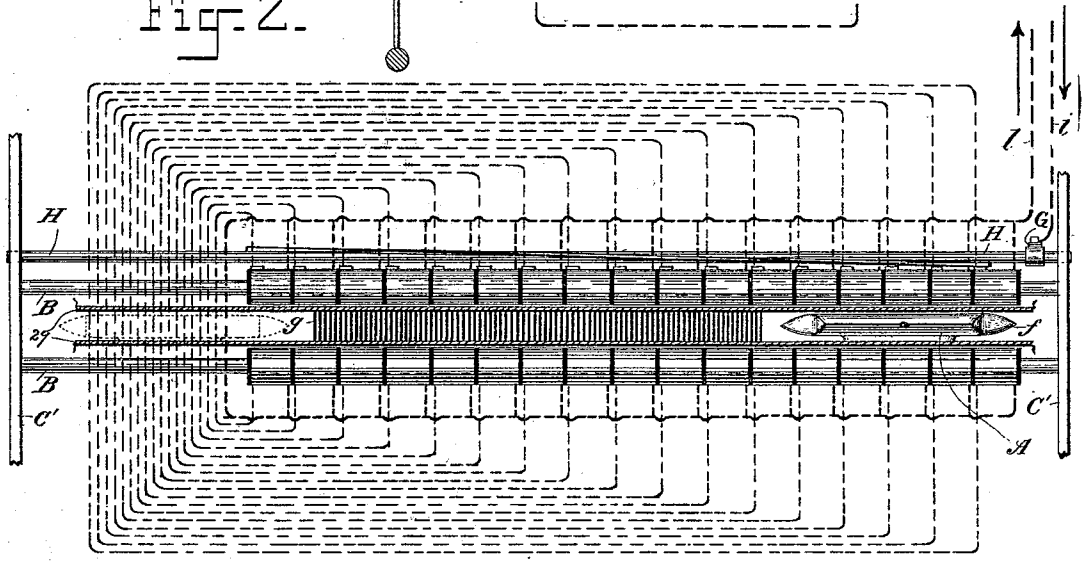
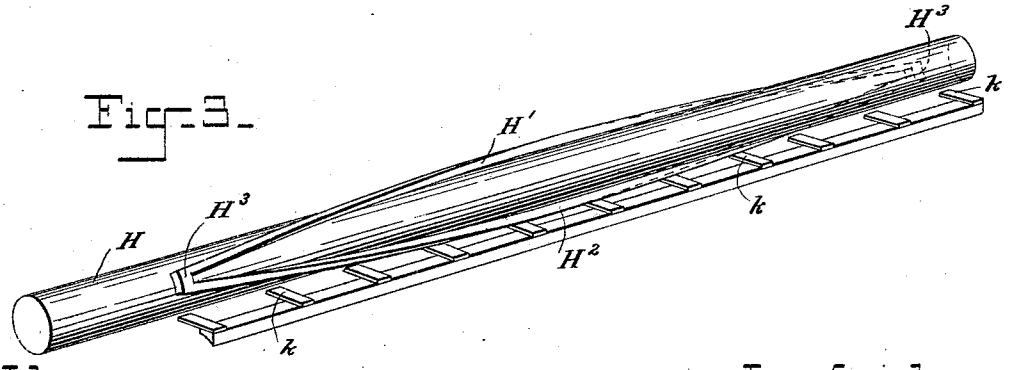


Fig. 3.



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ELECTRIC SHUTTLE-MOTION FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 514,088, dated February 6, 1894.

Application filed March 18, 1893. Serial No. 466,682. (No model.)

To all whom it may concern:

Be it known that I, LEVI W. LOMBARD, a citizen of the United States, and a resident of Lynn, in the county of Essex and State of Massachusetts, have invented a certain new and useful Electric Shuttle-Motion for Looms, of which the following is a specification.

My invention relates to the construction of looms for weaving, or other devices in which a shuttle is employed.

My invention is designed more particularly for application to looms wherein a shuttle is reciprocated in the shed, though in some of its features it might be employed with rotary looms.

The main object of my invention is to provide means whereby the shuttle may be reciprocated without reciprocation of any mechanical part other than the shuttle itself.

One part of my invention consists in the combination with one or more series of magnet coils disposed parallel to the shuttle race so as to provide a magnetic field for operating upon the shuttle, of a continuously rotating commutator having reversed spiral contacts causing a progressive and reciprocating shifting of the electrical activity in said coils.

Another feature of my invention consists in the combination of a shuttle constituting an armature, an actuating magnet or magnets therefor mounted on a fixed frame, a series of fixed reed dents, and a shuttle carrying a traversing lay.

The invention consists also in means for stopping the shuttle at each end of its traverse or throw.

My invention consists also in other features of construction more particularly hereinafter described and then specified in the claims.

In a machine constructed in accordance with my invention I am enabled to dispense not only with a reciprocating lay or batten, but also with the pickers and shuttle-boxes.

I have herein shown my invention as applied to a loom in which the shuttle reciprocates through the shed, but the manner of using such features of the structure as are applicable to rotary looms will be readily understood from the following description.

In the accompanying drawings:—Figure 1, is a sectional elevation on a line vertical to the play of the shuttle and through that portion of a loom to which my invention is applied. Fig. 2, is a side elevation of the parts, and also illustrates diagrammatically the connection of the coils. Fig. 3, is a perspective view of the commutator or circuit changer by which the shifting of the magnetic field of a number of actuating magnet coils may be produced.

In the drawings, *a*, are the warp threads, *b*, the heddles; *e*, the shed and *d*, the cloth beam.

A, is the shuttle constructed to operate as the armature of an electro-magnet or magnets.

By the term "armature" as herein used by me, I mean to include any device adapted to be moved by a shifting or varying magnetism from one point to another.

The electro-magnet herein shown is composed of a series of electro-magnetic coils arranged parallel to the shuttle race, as shown, and with the axis of the coils forming a continuous line parallel to the shuttle's play or traverse.

The electro-magnet may obviously be with or without a core, but I prefer to employ a core to intensify the magnetic effects. Any number of coils may be employed. In the present instance I have shown a considerable number all mounted upon a core rod or bar extending transversely of the warp. When two magnets or sets of magnets are used, I preferably employ one above and one below the shed whereby the shuttle will be mechanically centered, as it were, to prevent it from rubbing or wearing upon the warp threads, as it will do if left to the action of gravity. This feature of the machine is not, however, claimed broadly by me herein as it forms the subject of claims in another application for patent filed by me of even date herewith, Serial No. 466,681.

My present invention may be carried out by otherwise disposing the electro-magnets with relation to the shuttle's traverse, or even by employing an electro-magnet placed above the shed only or otherwise arranged so as not to have the effect of lifting or removing the weight of the shuttle from the warp threads.

The core rods on which the coils are mounted

are indicated by the letter B, and they are sustained in any proper manner in side rods C′, which constitute a fixed part of the frame of the loom and are not, as in another application for patent filed by me, carried by the swinging batten or lay.

The shuttle may be made to constitute an armature by providing it at some point with an armature of soft iron or other good magnetic substance. This armature may be placed as at *f*, upon one end of the shuttle. The two sets of magnet coils are fed from the circuit *i*, *l*, by a commutator constructed to cause a progressive shifting of the electric activity in said coils backward and forward along the shuttle race. This commutator which has the advantage of admitting a continuous rotary movement always in the same direction to produce this reciprocation of the magnetic field or magnetic action may be constructed as follows.

H, is a revoluble spindle or shaft, adapted to be rotated by any suitable mechanism, not shown, preferably by attachment to some part of the loom mechanism as, for instance, to a part which moves synchronously with the heddle shifting shaft. Connection between the commutator and feed wire *i*, is provided by a spring G, bearing on the revolving shaft of the commutator H. This spring may be attached to an insulating support fixed upon the casing B, as shown in Fig. 1, and projecting through an opening therein so as to bear upon the rotating spindle or shaft H, thereby making connection between the feed wire *i*, and the contacts carried by the cylinder. Upon the cylinder of rotation of said shaft is applied a reversed spiral wiping contact consisting of the two spirals H′, H², united at their ends in what I term a dwell contact H³, designed to produce a prolongation of the closure of circuit at such point. These reverse spiral contacts wipe upon a series of contact springs or brushes *k*, which are connected to the terminals of the coils. The effect of the reversed spiral is that after one spiral has made connection with the contacts *k*, successively, the next spiral on the continuation of the rotation reverses the order of connection. It is obvious that the spirals might be repeated any number of times in the cylinder of rotation, the alternate spirals being, however, reversed. The contacts *k*, being connected in regular order to one end of the several coils in the two sets, the remaining ends are connected as shown to the circuit wire *l*. This is indicated more fully in Fig. 2. One end of each of the upper coils connects to the horizontal line forming a continuation of circuit *l*, and the same ends of the lower set of coils connect with a similar wire which is joined to the one above and so to wire or connection *l*. The other end of each of the upper set of coils connects to a spring *k*, and from each of the latter a separate connection is taken to a similar end of one of the coils at the opposite side of the shuttle race so that contact with any spring *k*, forms connection simultaneously with the coil above and the correspondingly situated coil below, the circuit being completed through both of said coils and to the opposite set of coil ends which, as before stated, connect with the wire *l*. Preferably the circuit closer or commutator is constructed to make connection with three or more of the brushes *k*, at once, in order to intensify or enlarge the magnetic field which acts on the shuttle armature.

The operation of the apparatus as embodied in a construction having the above described details is as follows: Assuming the shuttle to be in the position indicated in Fig. 2, in readiness to make a throw or traverse, the rotation of the circuit closer or commutator will, through the operation of the spiral rib which wipes on the brushes *k*, cause a coil or coils ahead of the armature on the shuttle to become active, and the latter will advance. As the circuit closer rotates the field of activity of the coil progresses and the shuttle is drawn forward until the first spiral has revolved so far that the dwell rests upon the final contact *k*, of the series. The shuttle will thereby have been thrown to the end of its path or to the position indicated in broken lines but will be prevented from passing beyond such point through the retention of activity in the final coil of the series which results from the maintenance of the connection of such coil by the connection of the end of the first spiral with the end of the second or reversed spiral. This contact is prolonged sufficiently, moreover, to hold the shuttle stationary for such time as may be required to operate the shed, when, on the continuance of rotation the electrical activity in the coils will advance in the opposite direction through the continued rotation of the commutator, and the shuttle will be caused to advance until its armature reaches the field of the last coil where it will be held and prevented from further movement by the continuation of the activity through the dwell contact. By the continued rotation of the commutator it will be seen that a reciprocating movement of the shuttle, more or less rapid, according to the speed of rotation of the commutator, may be produced.

The electro-magnets may be inclosed in shields *h*, which in the case of the upper magnet may be extended to close in the commutator. In Fig. 2, the shields are detached excepting such portions as are adjacent to the shuttle race which portions are shown in the sections.

As will be seen the magnetic field extends beyond the reed on one side in order to allow the shuttle to clear the warp and permit proper movement of the shed without compelling it to pass beyond the limits of the magnetic field. This inequality in the extent of the field is rendered necessary by the fact that the shuttle has the armature on one end only.

As before stated the pickers and shuttle-

boxes of the ordinary construction are not required, the shuttle being held within and being prevented by magnetic attraction from leaving the magnetic field by energizing the final coil of the series through the dwell on the spiral commutator, as already explained.

The shields may be extended in longitudinal pieces 29, which are fastened or otherwise secured to said shields and serve to support the shuttle in the position shown by the dotted lines.

The reed *g*, which, as before stated, is stationary, unites the two series of magnets, being preferably attached to the inclosing shields.

The shuttle itself is provided with a lateral extension or wing adapted to reach the meeting point of the warp threads, as shown, and thereby to operate as a lay upon the filling or web as it escapes from the shuttle. The shuttle may be provided with a guide adapted to pass over the lower threads of the warp. The filling escapes through an opening in the side extensions. The casings of the magnets uphold and support the threads of the shed as shown and the shuttle moves in the space between the casings of the magnets as in the ordinary shuttle race or guide.

The reed keeps the threads of the warp separate and in proper relative position but the beating up of the filling is practically performed by the lateral extension of the shuttle. I do not, however, limit myself to the use of this lateral extension. The same arrangement of magnets and commutator could be used for operating other forms of shuttle or in machines where the reeds act to beat up the filling.

I do not limit myself to the number of armatures or location of the same upon the shuttle, as it is obvious that the commutator described might be used for changing the activity in a set of coils operated upon by a shuttle otherwise constructed.

It will be obvious that by my invention the use of the swinging lay or batten may be entirely dispensed with.

What I claim as my invention is—

1. In a loom, the combination substantially as described, of one or more series of magnet coils disposed parallel to the shuttle race, a shuttle operating as an armature in the magnetic field of said coils, and a continuously rotating commutator having reversed spiral contacts for causing a progressive and reciprocating shifting of the electrical activity in said coils.

2. In a loom, the combination with a shuttle constituting an armature and a series of magnet coils actuating the loom shuttle, of a commutator cylinder having a spiral rib or contact, and a series of contacts corresponding to the coil terminals and upon which it wipes in succession.

3. In a loom, the combination with the loom shuttle constructed as an armature, of a series of coils parallel to the shuttle race, a contact terminal for each coil, and a commutator having a spiral contact mounted on a rotary shaft parallel to the shuttle race, as and for the purpose described.

4. The combination with the loom shuttle operating as an armature, of an actuating magnet or magnets, and a commutator having a rotary member provided with a spiral wiper at the end of which is a dwell contact surface, as and for the purpose described.

5. In a loom, the combination with the loom shuttle operating as an armature, of an actuating electro-magnet or magnets, and a rotary commutator having reversed spiral wiping contacts united at their ends in a dwell contact, as and for the purpose described.

6. The combination with a series of magnet coils mounted parallel to the shuttle race and on a fixed part of the frame, the stationary reeds, and a shuttle constituting an armature and carrying a traversing lay.

7. In a loom, the combination of the two series of magnets mounted above and below the shed and upon a fixed support, the reed uniting said magnets, and a shuttle constituting an armature to said magnets.

8. In a loom, the combination of the two series of magnets mounted respectively at opposite sides of the shed, a casing for said magnets upholding or supporting the shed, and the shuttle constituting an armature and traversing in the space between the casings.

9. In a loom, the combination of the series of incased magnets, the reed joining the casings at the rear of the shuttle race, and the shuttle constituting an armature for said magnets.

10. In a loom, the combination with the two series of incased magnets mounted respectively above and below the shed, and the shuttle constituting an armature for said magnets, and operating in a shuttle race or guide formed between said magnets.

11. The combination in a loom, of a shuttle operating as an armature, an electro-magnet or magnets operating thereon and arranged beside the shuttle race or path of the shuttle to cause the same to traverse the shed, and a commutator for shifting or varying the current in coils of the magnet, said commutator having a dwell as described to prolong the magnetic state existing at the termination of the shuttle's throw, whereby the latter may be prevented from leaving the magnetic field or may be stopped at the end of its traverse.

12. The combination, substantially as described, of a shuttle constituting an armature, a series of actuating electro-magnetic coils causing the same to traverse the shed, and means for prolonging the action of the final one of said coils to stop the movement of the shuttle at the end of its throw.

13. The combination with a shuttle constituting an armature, of an electric coil, and a commutator or circuit closer for bringing the

coil into action to stop the movement of the shuttle after it passes the shed.

14. The combination with a shuttle constituting an armature, of an actuating magnet coil or coils and a commutator having a prolonged or dwell contact.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 16th day of March, A. D. 1893.

LEVI W. LOMBARD.

Witnesses:
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