(No Model.) 5 Sheets—Sheet 1.

E. GATES.

ELECTRICALLY OPERATED REED FOR LOOMS.

No. 565,448. Patented Aug. 11, 1896.

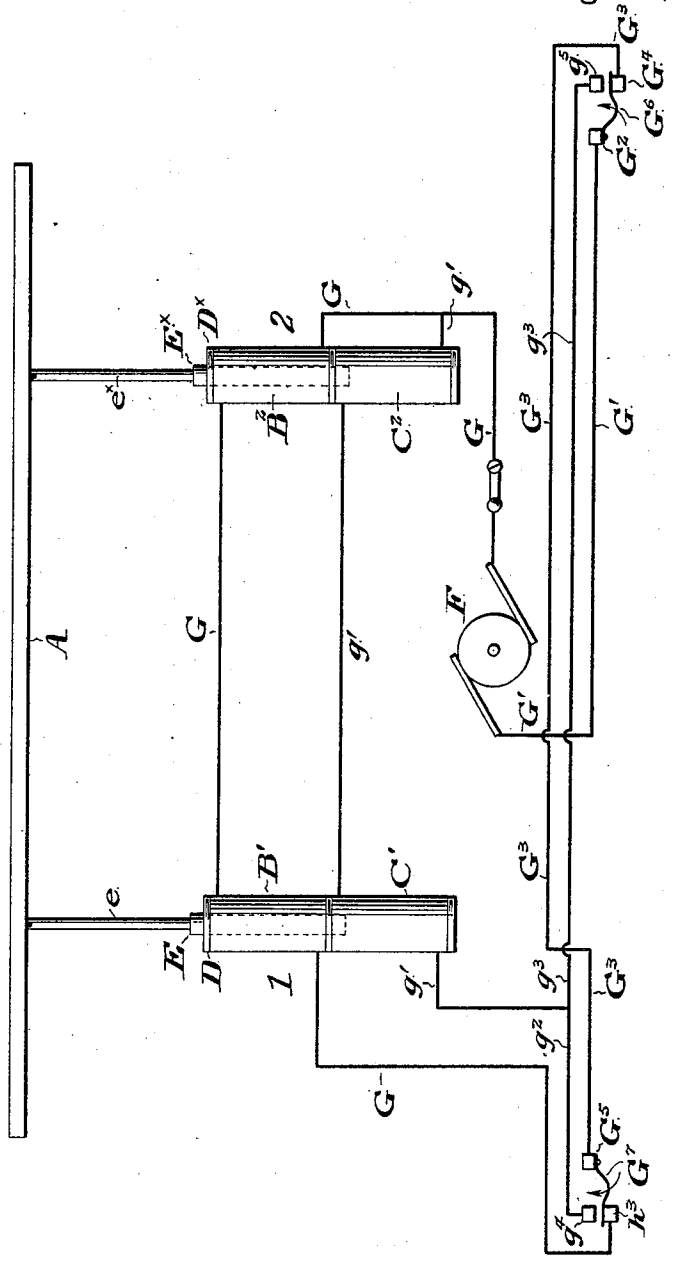

FIG. 1.

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E. GATES.

ELECTRICALLY OPERATED REED FOR LOOMS.

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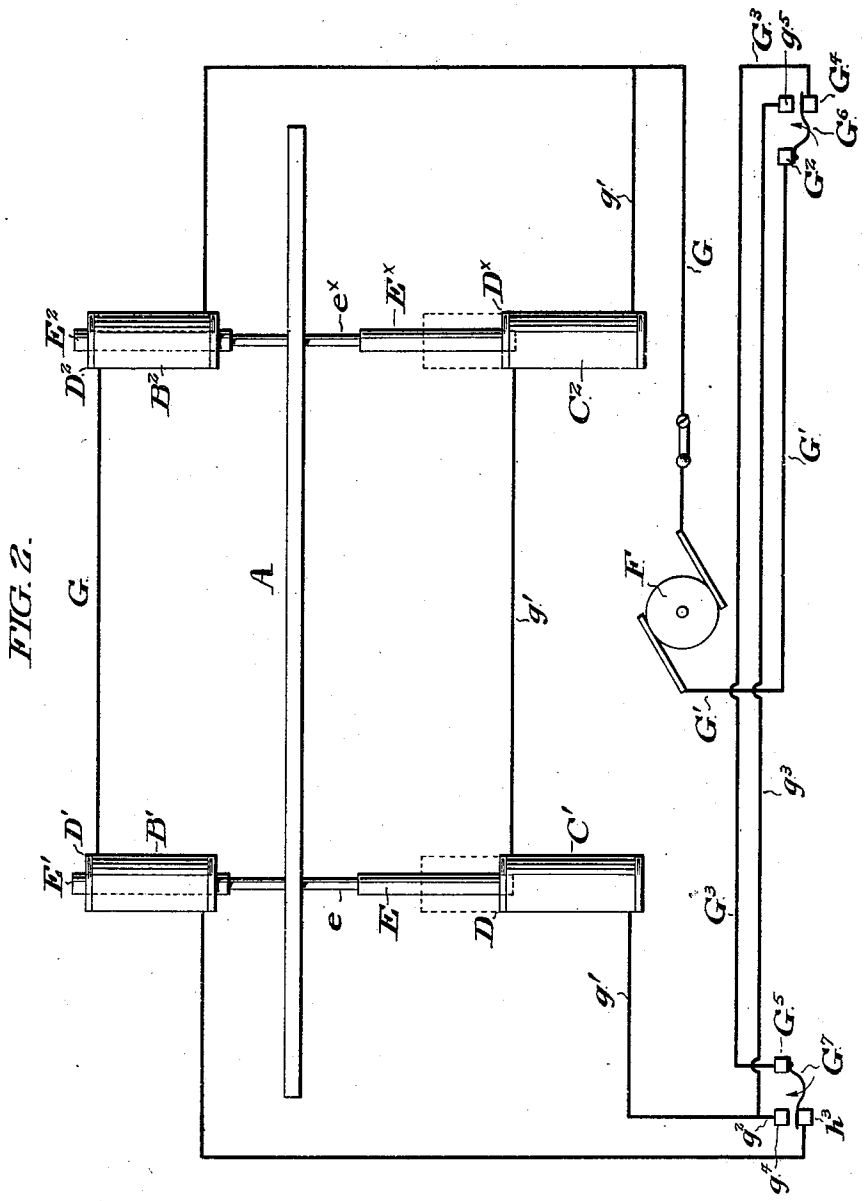

FIG. 2.

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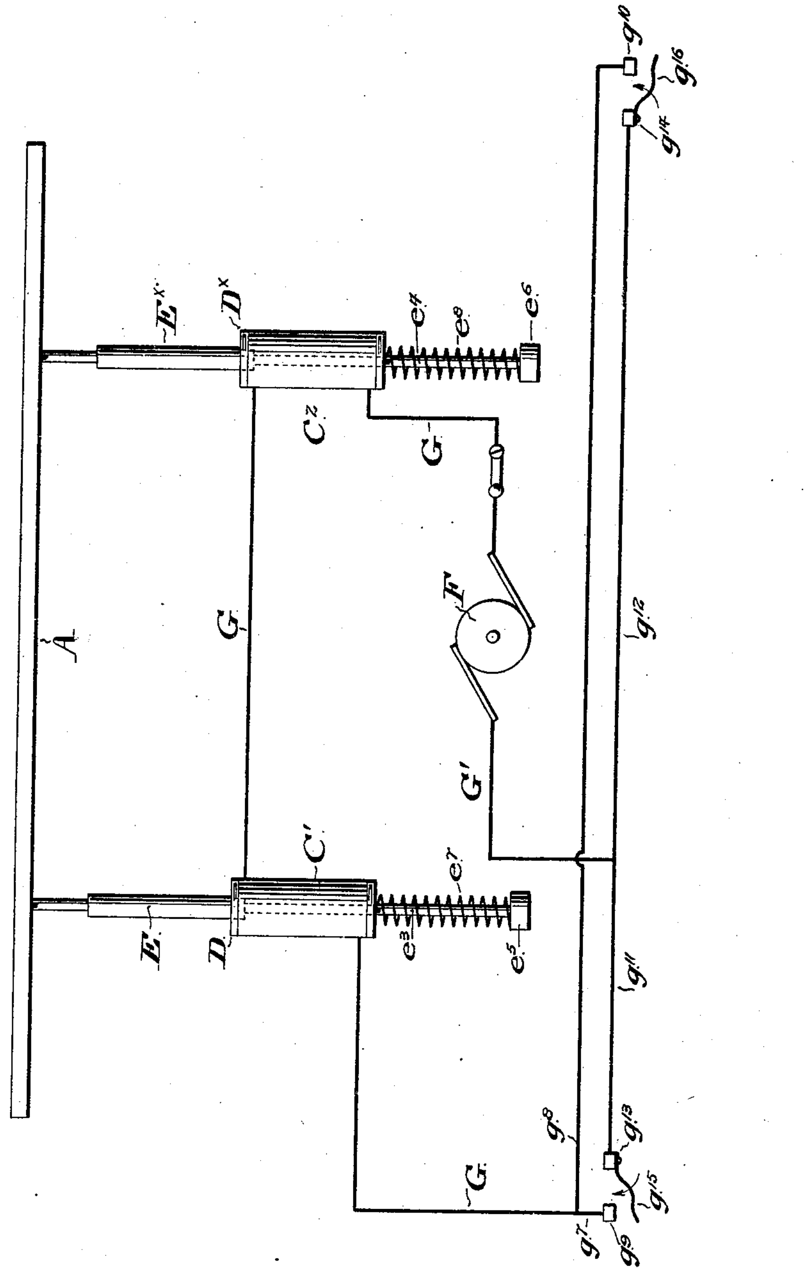
No. 565,448. Patented Aug. 11, 1896.

FIG. 3.



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E. GATES.

ELECTRICALLY OPERATED REED FOR LOOMS.

No. 565,448. Patented Aug. 11, 1896.

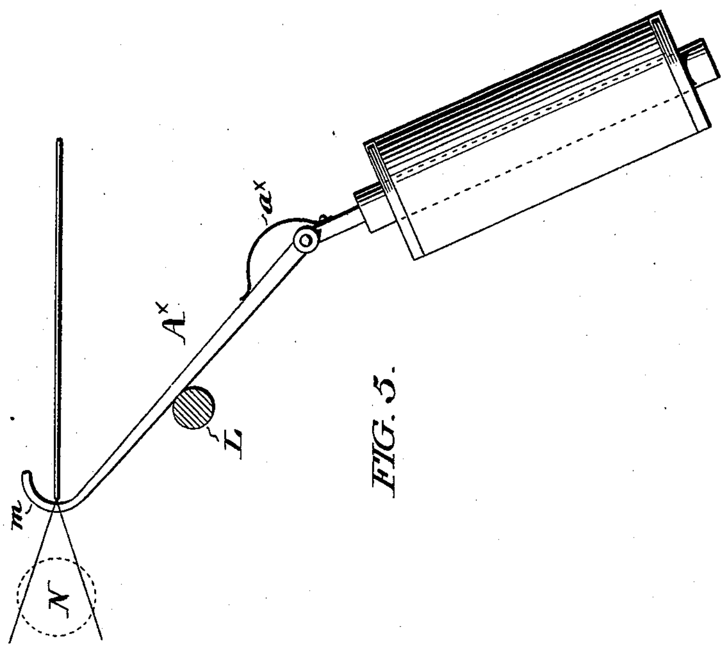

FIG. 5.

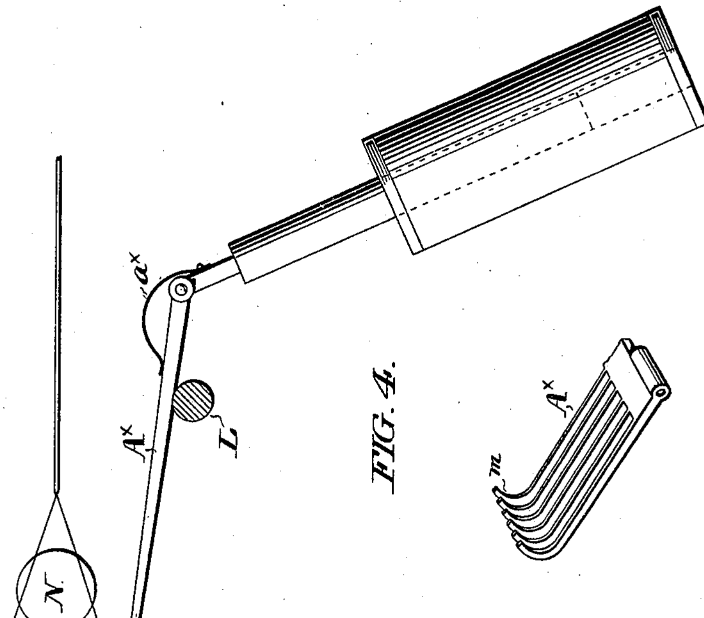

FIG. 4.

FIG. 6.

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INVENTOR:

BY HIS ATTORNEYS,

[signature]

J. Bonsall Taylor

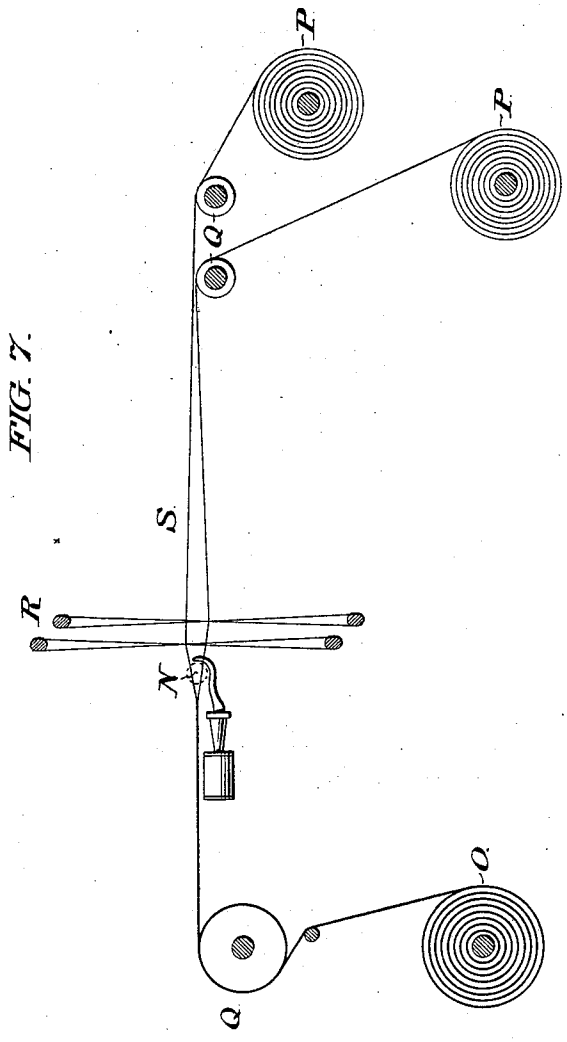
(No Model.) 5 Sheets—Sheet 5.

E. GATES.

ELECTRICALLY OPERATED REED FOR LOOMS.

No. 565,448. Patented Aug. 11, 1896.

FIG. 7.



WITNESSES:

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F. Norman Dixon

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UNITED STATES PATENT OFFICE.

ELMER GATES, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRICALLY-OPERATED REED FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 565,448, dated August 11, 1896.

Application filed August 5, 1895. Serial No. 558,303. (No model.)

To all whom it may concern:

Be it known that I, ELMER GATES, a citizen of the United States, residing in the City and County of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Electrically-Operated Reeds for Looms, of which the following is a specification:—

In looms as heretofore constructed the reed has been supported upon and carried by an oscillatory frame, suitably connected to the main frame of the machine, and mechanism of any convenient character has transmitted motion from the driving shaft to the said oscillatory frame to occasion the timely and appropriate movement of the reed for the purpose of beating the weft up to the web.

The mechanism heretofore employed in the beating up of the weft has, however, been cumbrous weighty and costly, both in construction and operation.

It is the object of my invention to provide a loom with electrically-actuated, as opposed to mechanically actuated, mechanism for the purpose of beating up the weft, and to thereby dispense with the heavy and costly mechanical structures heretofore necessary.

In the accompanying drawings I show and herein I describe a good form of a convenient embodiment of my invention, the particular subject-matter claimed as novel being hereinafter definitely specified.

In the accompanying drawings,

Figures 1, 2, and 3, are views in top plan of a reed, assumed to be of ordinary construction, and of mechanism adapted to be electrically actuated, to effect the required reciprocation of said reed, and illustrative respectively of three different arrangements (shown in diagrammatic plan) of electric circuits through which the electrically-actuated mechanisms referred to are operated.

Figures 4, 5, and 6, are views of a modified form of reed shown in connection with electrically-actuated mechanism.

Figure 7 is a view in side elevation of a further modified arrangement of reed and reed-actuating device, shown in connection with the fabric winding beam, the warp beams, guide rolls, and a pair of heddles.

Similar letters of reference indicate corresponding parts.

Referring first to Figure 1, A is a reed frame supposed to be of ordinary construction.

1 and 2 indicate respectively two sets of coils or solenoids, each set consisting of two solenoids, those of set 1 being respectively designated B′ and C′, and those of set 2 being respectively designated B^2 and C^2.

The two coils or solenoids B′ C′ are preferably mounted upon a common spool D, and the two coils or solenoids B^2 C^2 are preferably mounted upon a common spool $D^\times$.

Within the hollow interiors of the spools D $D^\times$,—and which spools are conveniently, as shown, located in parallelism with each other in planes perpendicular with respect to the vertical plane of the reed A,—are contained respectively a pair of cores E $E^\times$ of suitable magnetic material, each provided with a core extension, respectively designated e $e^\times$, and the outer extremities of which extensions are fixedly attached to the reed A.

As will be readily understood by those familiar with electric science, when the coils B′ B^2 are thrown into circuit or energized while the coils C′ C^2 remain out of circuit or unenergized, the magnetic influence of the first named coils will act upon the cores E $E^\times$ and occasion their longitudinal movement to a position in which their centers coincide with the centers of the energized coils or solenoids, while, when the coils or solenoids first mentioned are cut of, and the coils or solenoids C′ C^2 are thrown into, circuit, the last named coils or solenoids will act upon the cores and occasion their movement in the opposite direction to a position in which their centers coincide with the centers of said last named coils.

When, then, the coils B′ B^2 and C′ C^2 are regularly alternately thrown into and out of circuit, the effect will, as is obvious, be to impart regular longitudinal movement of reciprocation to the cores and to the reed frame with which they are connected.

F indicates a dynamo, and G G′ the main conductors leading therefrom.

g' is a branch of the conductor G, the in-

termediate portion of which branch is bent to form, or is in circuit with, the coils or solenoids C^2 C' and beyond the coil C' is provided with the branches g^2 g^3 which terminate respectively in the terminals g^4 g^5.

The conductor G itself is as to its intermediate portion bent to form or is in circuit with the coils or solenoids B^2 B', and beyond the coil B' ends in a terminal h^3 in the vicinity of the terminal g^4.

The main conductor G′ is provided with a terminal G^2 in the vicinity of the terminal g^5.

G^3 is a connecting conductor, provided at one end, in the vicinity of the terminals g^4 h^3, with a terminal G^5,—and at the other end, in the vicinity of the terminals G^2 g^5, with a terminal G^4.

G^7 is a switch tongue extending from the terminal G^5 between the terminals g^4 h^3, and normally in contact with the terminal h^3,—and G^6 is a switch tongue extending from the terminal G^2 between the terminals G^4, g^5, and normally in contact with the terminal G^4.

From an examination of the arrangement shown in Figure 1, it will be understood that the branch g' and the coils with which it is in circuit, and the conductor G and the coils with which it is in circuit, are arranged in multiple circuit, and it will be understood that when the switch tongues G^6 G^7 are in the position shown in said figure, the circuit which includes the coils B^2 B' will be closed through the conductor G, switch tongue G^7, connecting conductor G^3, switch tongue G^6, and conductor G′,—and said coils will therefore be energized and the cores drawn to a position in which their centers coincide with the centers of said coils (which position said cores are shown as occupying) with the result that the reed frame A will be held in its outermost and normal position.

When, however, the switch tongue G^7 is carried into contact with the terminal g^4, while the switch tongue G^6 remains in the position shown in Figure 1,—the circuit which includes the coils B' B^2 will be thrown open, and the circuit which includes the coils C' C^2 will be closed through the branch wire g', branch wire g^2, switch tongue G^7, connecting conductor G^3, switch tongue G^6, and conductor G′,—or when, on the other hand, the switch tongue G^6 is carried into contact with the terminal g^5 while the switch tongue G^7 remains in the position shown in Figure 1, the circuit which includes the coils B' B^2 will similarly be thrown open, and the circuit which includes the coils C' C^2 closed through the branch g', branch wire g^3, switch tongue G^6 and conductor G′,—with the result in either case that the coils or solenoids C' C^2 will be energized and the cores E $E^\times$ be drawn to a position in which their centers coincide with the centers of said coils, whereby the reed frame A will be carried to its innermost position.

The switch tongues G^6 G^7 may be operated by any convenient instrumentality, but I prefer to arrange said tongues and the terminals with which they are operatively associated as described, in juxtaposition to a moving part of the loom so as to be automatically operated by it, and I prefer to locate the terminals g^4 h^3 G^5 and the switch tongue G^7 at one, and the terminals g^5 G^4 G^2, and the switch tongue G^6 at the other, end of the shuttle race, and to so set the switch tongues, which are, as stated, respectively normally in contact with the respective terminals h^3 G^4, that they extend into the path of the shuttle and are respectively encountered and deflected by said shuttle at the respective ends of its throw.

As a result of this arrangement the shuttle will at the termination of its throw to the right hand deflect the spring tongue G^6 into contact with the terminal g^5 and thereby throw the coils B' B^2 out of circuit and the coils C' C^2 into circuit to effect the drawing in of the cores and the corresponding movement of the reed frame A, and will at the termination of its throw, to the left, (the spring tongue G^6 having in the meantime automatically reseated itself against the terminal G^4 as soon as the shuttle released it upon leaving said right hand end of the race, thereby throwing the coils B' B^2 into circuit and restoring the reed frame to its outer position) deflect the spring tongue G^7 into contact with the terminal g^4 and again throw the coils B' B^2 out of, and the coils C' C^2 into, circuit to effect another drawing in of the reed frame, and so on.

The arrangement shown in Figure 2 of the drawings is identical in principle with the arrangement shown in Figure 1, with the exception that the coils B' B^2, are wound upon auxiliary spools structurally independent of the spools D $D^\times$, being arranged in axial alinement with said spools D $D^\times$, while the core extensions e $e^\times$ are provided at their extremities farthest from said spools D $D^\times$ with auxiliary cores E′ E^2.

The reed frame A is, in the arrangement of Figure 2, mounted upon or connected with the core extensions e $e^\times$ at points of the latter intermediate of the cores E $E^\times$ and E′ E^2 instead of being connected to the extremities of the core extensions as in the arrangement shown in Figure 1.

The arrangement shown in Figure 3 is one in which the coils or solenoids B' B^2 and their circuit wire are omitted, and the cores E $E^\times$ provided with rearwardly protruding axial extensions e^3 e^4 conveniently equipped respectively with caps or projections e^5 e^6 and with spiral pull springs e^7 e^8 which connect respectively with said projections and the adjacent ends of the spools D $D^\times$.

The main line conductor G is bent to form or is in circuit with, both of the coils C' C^2, and is provided with two branches g^7 g^8 terminating respectively in the terminals g^9 g^{10}. The other main conductor G′, is provided with the two branches g^{11} g^{12}, ending respectively in terminals g^{13} g^{14} provided with the switch tongues g^{15} g^{16}.

As will be understood in the arrangement

shown in Figure 3 the spiral pull springs operate, (as do the normally energized coils B' B^2 of the arrangement shown in Figure 1,) to normally maintain the reed frame A in its outermost position, and, as will be further understood, when either of the switch tongues g^{15} g^{16} of Figure 3 is closed by the shuttle, the circuit which includes the coils shown is closed, and the cores drawn in, against the stress of said springs, to occasion the inward movement of the reed frame, the springs operating, as soon as said coils are thrown out of circuit by the springing open of a switch upon the removal of the shuttle, to force the frame A out into the position shown in Figure 3.

The various conductors and parts shown in the several figures are, in the mounting of the loom, to be located and arranged in such manner as convenience of manufacture and ease of operation may dictate, and the application of the circuits and mechanisms described to a loom of ordinary construction is a matter within the capacity of any ordinarily skilled constructor.

While I have for simplicity of description assumed the movement of the cores and reed to be in right lines, it is obvious that my invention is not to be considered as restricted to constructions to which movement of that character is incident.

It is also obvious that any desired number of coils, either greater or less than the number indicated in Figure 3, may be employed in connection with a single reed frame.

The reed frame or reed A hereinbefore referred to I have assumed to be one of ordinary construction.

In Figures 4, 5, 6, and 7 however, I show a novel form of reed frame, the same consisting of a comb-like plate the teeth of which are curved upwardly at their free extremities to form the reeds proper, and in Figures 4 and 5 show said reed frame, which is designated $A^{\times}$, as balanced, so to speak, upon a transversely-extending bar L, and pivotally connected at its inner extremity to the outer extremity of the core extension of a core arranged in connection with a solenoid the axis of which is but slightly inclined from the vertical.

In this arrangement, which may when desired be resorted to in cases where it is desired to have the coils and cores occupy positions beneath and out of the way of the warp threads,—upon the projection of the core from the coil, the reed frame is moved bodily across the bar or pivot L to its outermost position, as shown in Figure 4, in which its upturned fingers *m* which constitute reeds and between which exist the reed spaces, are some distance beyond the edge of the fabric and outside the path traversed by the shuttle N in its movement,—while, upon the drawing in of the core, the frame is moved bodily backward across the bar or pivot L to its innermost position, shown in Figure 5, in which movement the upturned fingers catch the weft thread laid in by the shuttle and carry it against the edge of the fabric. $a^{\times}$ is a C-spring, one end of which is secured to the core extention, and the other bears upon the reed frame to maintain it down against the bar or pivot L.

In the modified arrangement of reed frame shown in Figure 7, the coil is located beneath and axially in parallelism with the direction of movement of the warp threads, and upon the outer end of the core piece, which is shown as cone-shaped, is directly mounted a reed frame of the construction shown in Figures 4, 5, and 6. In this arrangement my improved form of reed frame is reciprocated horizontally backwards and forwards in the manner described with relation to the ordinary form of reed frame shown in Figures 1, 2, and 3. In the arrangement shown in Figure 7 the reed frame may act, as will be understood, as the shuttle bar, or race.

The coils shown in Figures 4, 5, 6, and 7 may be connected up in circuits arranged in the manner illustrated in Figures 1, 2, or 3, of the drawings, or in any other preferred manner involving such departure thereform as may be within the spirit of my invention.

The reed frames shown in Figures 4, 5, 6, and 7, may be made of the full breadth of the fabric, or may be made in independent sections each operated by an independent electrically actuated mechanism.

In Figure 7 the cloth winding roll is designated O, the warp beams P, the guide rolls Q, the heddle frames R, and the warp threads S.

Having thus described my invention, I claim:—

1. In a loom, in combination, with a reed frame, a coil or solenoid, a magnetizable device, one of said devices being fixed and the other movable, the movable device being connected to said reed frame, an elecric circuit, and means for throwing said coil into and out of circuit,—substantially as set forth.

2. In a loom, in combination, a reed frame, a coil or solenoid, and a magnetizable device connected to said reed frame, an electric circuit, and a switch mounted in said circuit and arranged to be shifted by a moving part of the loom,—substantially as set forth.

3. In a loom, in combination, a reed frame, a pair of coils or solenoids, a magnetizable device or core connected with the reed frame, an electric generator, conductors by which said coils may be connected in multiple with said generator, and means for alternately opening and closing the multiple circuits,—substantially as set forth.

4. In a loom, in combination, a reed frame, a pair of coils or solenoids, a magnetizable device or core connected with the reed frame, an electric generator, conductors by which said coils are connected in multiple with said generator, a switch by which one of said multiple circuits is maintained normally closed, said switch being arranged in such position

as to be encountered by a moving part of the machine and moved to close the other of said circuits,—substantially as set forth.

5. In a loom, in combination, a reed frame, a pair of coils or solenoids, a magnetizable device or core connected to the reed frame, an electric generator, a first conductor leading from the generator and provided with two branches in circuit respectively with respective coils, a second conductor leading from the generator, a switch by which said second conductor is maintained normally in circuit with one of the branches of the first conductor, and means for throwing said switch to place said second conductor in circuit with the other branch of the first conductor, substantially as set forth.

6. In a loom, in combination, a reed frame, a pair of coils or solenoids, a magnetizable device or core connected to said reed frame, an electric generator, a first conductor leading from the generator and provided with two branches one of which is in circuit with one coil beyond which it ends in a terminal h^3, the other of which branches is in circuit with the other coil beyond which it is provided with the terminals g^4 g^5,—a second conductor leading from the generator and provided with the terminal G^2,—a connecting conductor leading from the vicinity of the terminals g^4 h^3 which are at one end of the shuttle race, to the vicinity of the terminals G^2 g^5 which are at the other end of the shuttle race, and provided at its respective ends with terminals G^5 and G^4, a switch tongue connected to the terminal G^5 normally extending across the shuttle race and in contact with the terminal h^3 but adapted to be deflected into contact with the terminal g^4,—and a switch tongue connected with the terminal G^2 normally extending across the shuttle race and in contact with the terminal G^4 but adapted to be deflected into contact with the terminal g^5,—substantially as set forth.

7. In a loom, in combination, a reed frame consisting of a plate having a series of fingers extending at right angles to its body, a coil or solenoid provided with a core or magnetizable device connected with said reed frame, and means for throwing said coil into or out of circuit,—substantially as set forth.

In testimony that I claim the foregoing as my invention, I have hereunto signed my name this 9th day of July, A. D. 1895.

ELMER GATES.

In the presence of—

F. NORMAN DIXON,

A. E. PAIGE.