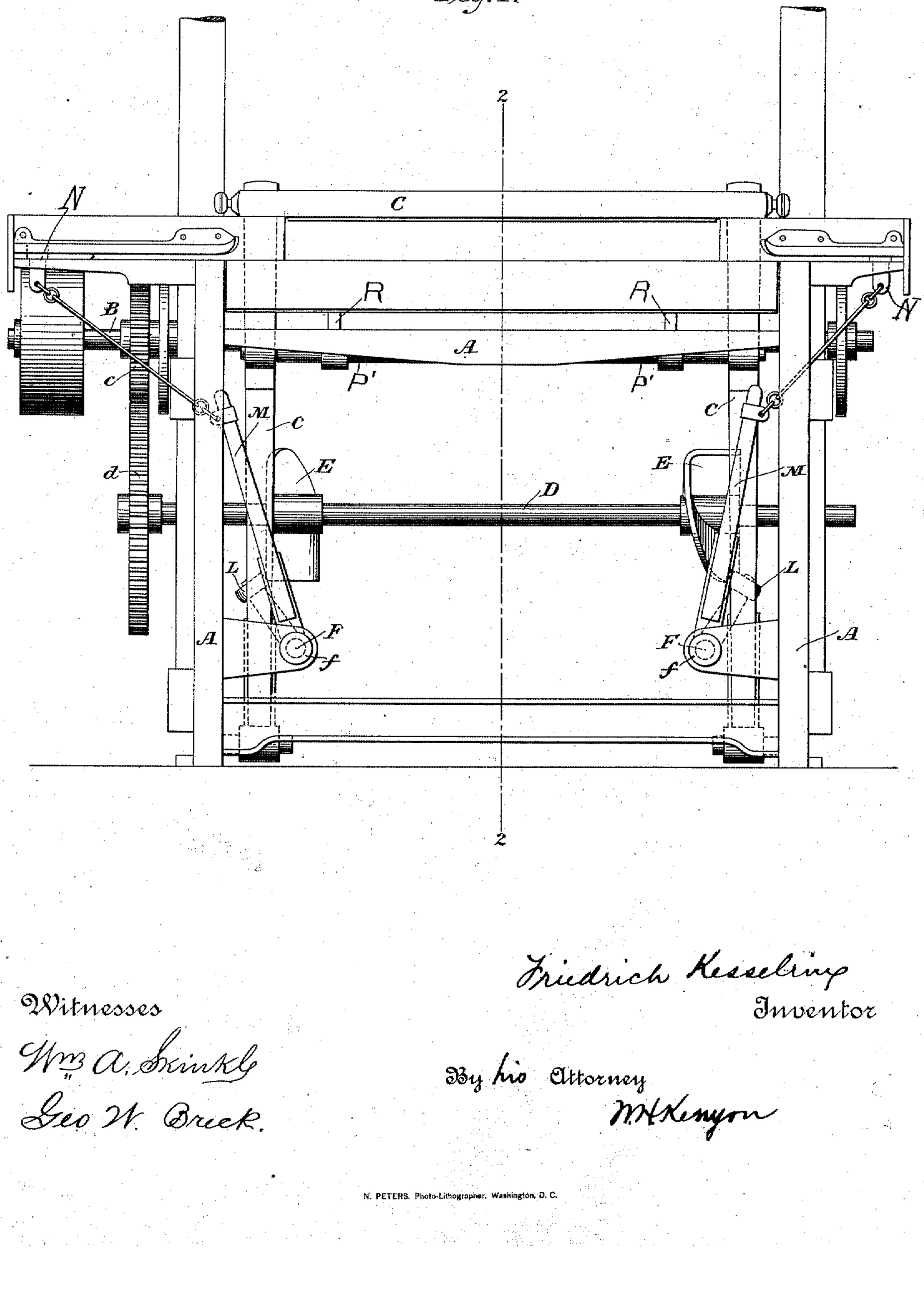
(No Model.) 2 Sheets—Sheet 1.

# F. KESSELRING.

## SHUTTLE DRIVING MECHANISM FOR LOOMS.

No. 332,400. Patented Dec. 15, 1885.

*Fig. 1.*




Witnesses
Wm A. Skinkle
Geo H. Brock.

Friedrich Kesselring
Inventor

By his Attorney
M. Kenyon

(No Model.) 2 Sheets—Sheet 2.

# F. KESSELRING.

## SHUTTLE DRIVING MECHANISM FOR LOOMS.

No. 332,400. Patented Dec. 15, 1885.

*Fig. 3.*

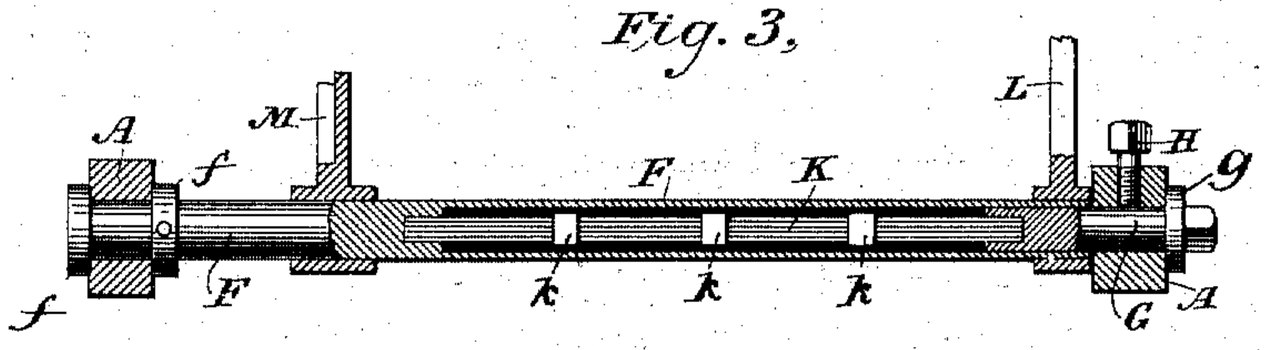
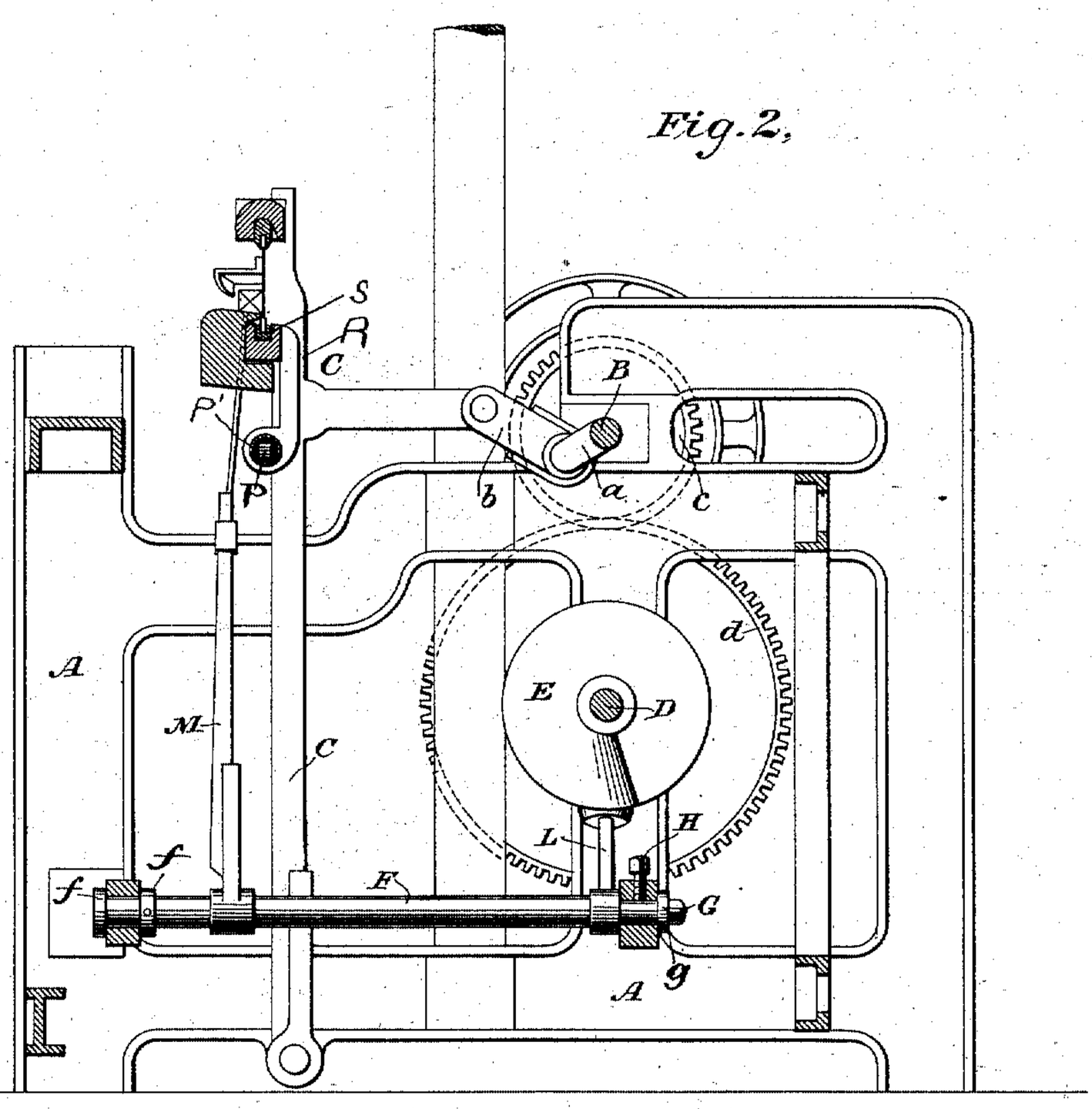



*Fig. 2.*




Witnesses

Wm A. Skinkle.

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Friedrich Kesselring

Inventor

By his Attorney

W. H. Kenyon

# UNITED STATES PATENT OFFICE.

FRIEDRICH KESSELRING, OF ATHENIA, NEW JERSEY, ASSIGNOR TO CRAWFORD McCREERY, OF NEW YORK, N. Y.

## SHUTTLE-DRIVING MECHANISM FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 332,400, dated December 15, 1885.

Application filed May 22, 1884. Serial No. 132,422. (No model.)

*To all whom it may concern:*

Be it known that I, FRIEDRICH KESSELRING, a citizen of Switzerland, residing in Athenia, New Jersey, have invented a certain new and useful Improvement in Shuttle-Driving Mechanism for Looms, of which I declare the following to be a full, clear, and exact description, such as will enable any one skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

In weaving there is a practical limit to the speed which can be successfully given to the shuttle in its flight through the shed. If this limit is exceeded, the shuttle will not only have a tendency to fly out or to wabble in its course, but it will also have a tendency to tear or break such threads of the warp as may chance to be not properly raised up in the shed, instead of merely pushing such threads up in place out of its way; and, moreover, the too sudden and rapid demand upon the tension-regulating devices of the shuttle for the delivery of the filling or weft thread, and the rebound of the shuttle at its too sudden stoppage after running its course, tend to crinkle the filling-in thread before that thread can be battened up, and otherwise to interfere with its evenness and regularity and with the even tension of the edging or selvage of the goods. The rebound of the shuttle at the end of the course also results in a decided blow at the beginning of the next reverse movement, tending to make that movement more irregular and flighty. It is therefore desirable that the shuttle should be thrown with as slow and steady a flight as possible, and that the speed should be made up in the other movements of the loom, which occur between the end of one flight of the shuttle and the beginning of the next.

The slow and steadied motion given to the shuttle in hand-weaving is the best adapted to produce even and regular goods, and this is especially important in the line of silk goods.

Heretofore the shuttle has been thrown by the positive motion of cams, and also by the release of springs previously strained, and for this latter purpose various forms of springs have been used — to wit, extensible coiled springs, flat coiled springs, a series of such springs on a common shaft, &c. Instances of such mechanisms are to be found in the patents to L. E. Ross, No. 137,798, dated April 15, 1873; No. 143,257, dated September 30, 1873, and No. 233,551, dated October 19, 1880.

It has been found with all these different devices for throwing the shuttle that there is a practical limit of speed of the loom as a whole, the exceeding of which is attended with the various irregularities and uncertainties in the flight of the shuttle referred to above, resulting in imperfectly-woven goods. Cam-thrown shuttles tend particularly to be too rapid in their flight when the loom is driven fast, and the spring-thrown shuttles heretofore used tend particularly to be too unsteady in their flight when the loom is driven fast. The result in both cases is a necessarily slow-moving loom where goods of any degree of fineness and delicacy are being woven, and where the weaving must be careful and exact. Particularly is this true of the weaving of such delicate material as silk.

It is the object of the present invention to so improve the mechanism whereby the shuttle is thrown that the flight of the latter through the shed will resemble in character the flight of the shuttle imparted in hand-weaving, both in the slow creeping character of that motion and also in its firm and steadied and sustained character.

It is also the object of the invention to combine this shuttle-driving mechanism with mechanism so driving the lay and connected parts that the movements of the latter shall be slowed to permit of this slow flight of the shuttle and be speeded between the flights of the shuttle, as hereinafter described, whereby the speed of the loom as a whole may be increased, and this without reference to the character or delicacy of the goods that are being woven.

The invention, as hereinafter described and claimed, involving the combination, in the shuttle-driving mechanism of a loom, of a peculiar form of spring having peculiar qualities of motion, specially adapting it for this work, obviates the difficulties heretofore encountered, throws the shuttle with a continuing and steadying and thoroughly effective throw, resembling in character the throw

given to the shuttle in hand-weaving, and thereby enables the work to be done in a closer shed with all the advantages resulting therefrom, and permits of the pushing of the loom to a degree of rapidity and productiveness impracticable heretofore without deterioration in the quality of the work.

The invention consists in the mechanisms hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a front elevation of a loom embodying my invention, certain parts of the loom being broken away. Fig. 2 is a sectional side elevation on line 2 2 of Fig. 1. Fig. 3 is an enlarged detail view, in section, of the parts operating the picker stick.

A represents the frame of the loom.

B is the main driving-shaft, operating the lay C through and by means of the cranks *a* and links *b*, and operating the shaft D through gear-wheels *c d*, as shown.

The reed-frame has the usual spring-connection with the lay, as hereinafter described. The shaft D carries two cams, E E. Resting against each of these cams is an arm, L, with the usual roller, as shown in the drawings. These arms L on each side of the loom operate, through the rotation of the cams E E, to alternately strain and release the springs by which, through connecting mechanism, the picker-sticks are operated and the shuttle thrown back and forth.

F is a tube or pipe of suitable length—say eighteen to twenty-four inches—with a circular bore, but made solid for three or four inches at one end, the circular bore terminating at that end in a square recess of about one-half an inch in depth, and of any suitable size to receive snugly the square end of the spring hereinafter described, and to furnish a seat for the same and prevent its turning in its seat when twisted. This tube F is mounted at its solid end in bearings in an arm of the loom-frame, in which it turns freely, being secured against longitudinal movement through its bearings by collars *f f* in any usual way. The other end of the tube F fits snugly as a sleeve over a short shaft or plug, G, around which it turns freely. This plug G is mounted in bearings in an arm of the loom-frame, as shown, being secured against longitudinal movement through its bearings in any usual way, as by collar *g* and set-screw H. The end of this plug G which projects into the tube F has a square recess, similar to the square recess in the opposite end of the tube F, of suitable depth and size to receive snugly the other end of the torsional spring, hereinafter described, and to furnish a seat for the same and prevent its turning in its seat when twisted. The other end of the plug G, projecting beyond the arm of the frame in which it is carried, and on the other side of the same, is squared, so that it may be conveniently turned, as by a wrench. The arm of the frame carrying this plug G has a set-screw, H, adapted to be screwed down hard against the plug G, and thereby to hold it securely in any position to which it may have been turned. Any ordinary means of holding this plug in place when once adjusted, and preventing its revolving in its bearings during the operation of the loom, may be employed. I prefer the set-screw shown.

K is the spring whose release from strain throws the shuttle. It is a torsional spring composed, preferably, of a number of plates or bands of spring-steel (eight I prefer to use) placed one upon the other and lubricated, so that there is little or no friction between adjacent plates when they move on each other. The precise measurements of the plates I find most efficient in practice, when eight of them are used together, are as follows: fourteen inches in length, thirteen thirty-seconds of an inch in width, and one thirty-second of an inch in thickness. These measurements may of course be varied. The plates are loosely held together by two or three encircling bands or loops, *k k*, of iron or other metal, without interfering with their freedom of motion on each other. The spring is carried within the circular bore of the tube or pipe F, one end being seated in the square recess in the end of the plug G and the other end being seated in the square recess in the opposite and solid end of the tube F. The plug G being held fast in its bearings and prevented from turning, it follows that the tube F can be turned in its bearings only against the resistance of the spring K. Owing to the peculiar construction of the preferred form of torsional spring K with layers or plates of steel, the tube F can be turned through a large angle. The tube F carries securely locked on it the arm L, which rests against and is operated by the cam E. The tube F also carries securely locked on it the picker-stick M, which, through the usual flexible connection, operates the picker N and throws the shuttle.

The operation of my improved device is as follows: The set-screw H being loosened, the plug G is turned with a wrench or other suitable means until the desired initial or normal torsional tension of the spring K is obtained, when the screw H is tightened, and the plug G thereby locked. The loom being started, the cam E forces back the arm L, thereby turning the tube F, throwing the picker-stick outward and straining the spring K. When the crest of the cam is passed, the arm L is released, and, under the action of the spring K, the arm L, the tube F, and the picker-stick M are drawn back and the shuttle is thrown through the shed. The mechanism is of course duplicated on each side of the loom. The lay C is driven by the shaft B, through or by means of the cranks *a* and links *b*. These cranks and links operate upon the pivoted or hinged lay-frame to thrust it very rapidly forward and very rapidly backward during portions of the revolution of the cranks, and during the intervening portions of the revolution of the cranks those parts operate to hold the lay-frame with but little motion—

that is to say, when the links *b* and crank-arms *a* are in the rearward position of revolution of the cranks, in which they coincide as to the direction of their lengths, and through a considerable angular distance on each side of that position, the ends of the links *b* which are pivoted to the lay-frame have little motion given to them, the motion of the ends of the crank-arms *a* in that position being largely consumed in vibrating the links *b* on the hinge-connection with the lay, and the length of the links *b* with reference to the length of the crank-arms *a* (only about double the length) causes this consumption of the motion of the cranks *a* to be large and the lay to be held comparatively motionless during quite an interval of time at the backward end of its stroke. When the links *b* and cranks *a* are in those positions in which they stand at right angles to each other, and through a considerable angular distance on each side of those positions, the ends of the links *b* which are pivoted to the lay-frame partake of substantially the full motion of the ends of the crank-arms *a*, wherefore the lay is driven rapidly backward and rapidly forward during these intervals. Again, the ends of the links *b* which are pivoted to the lay are farther from the horizontal line of the pivot of the lay-frame at the base of the frame of the loom than is the shaft B, wherefore it results that the dead-points in the motion of the lay ends of the links *b* are coincident in time, not with points one hundred and eighty degrees apart in the revolution of the cranks *a*, but with points more than one hundred and eighty degrees apart on the one stroke and less than one hundred and eighty degrees apart on the return-stroke, and, as shown by the positions of the cams E, the back-stroke of the lay just before the flight of the shuttle is the more rapid, and the forward stroke in beating up just after the flight of the shuttle is the slower of the two, all as is clearly shown on inspection of the parts in Fig. 2. I do not herein separately claim such mode or means of driving the lay. The lay C is thus so driven by means of the shaft B, cranks *a*, and links *b* that its motions, which are timed with respect to the motions of the shuttle, are very rapid on the to-and-fro thrust, but are slowed both during the flight of the shuttle, so as to give time for its slower movements, and also during the operation of battening up, being slower on the forward thrust than on the backward thrust, so that the rapid running of the loom may not injure the most delicate fabric. The reed-frame is also preferably mounted on the lay, with a soft firm spring holding it to its battening-up work, and the movements of the heddles in forming the shed are also, of course, to be properly timed to the new movements of the lay and shuttle.

The method of mounting the reed-frame S on the lay which I prefer is fully shown in Letters Patent of the United States No. 312,128, granted me February 10, 1885. It is by means of a single torsional spring, P, (similar in construction and mode of mounting to the spring K,) inclosed by a tube, P′, which is mounted on the arms of the lay-frame, and carries the reed-frame by means of two supporting-arms, R R. I do not herein claim such mode or means of mounting the reed-frame on the lay.

The torsional spring of my invention has not only a very small amount of motion between its moving and its fixed parts in its regular operation as a spring, but, in addition, after being strained, it operates in moving the picker-staff to throw the shuttle without a too sudden loss of its elastic force—that is to say, it does not too soon return to its normal unstrained condition.

The character of the throw given to the shuttle by the mechanism described resembles the throw given to the shuttle in hand-weaving. It is imparted, not by a blow at the beginning of the stroke, causing the shuttle to leap away from the picker before the shuttle-box is one-third way traversed, as is the case in rapid work with many spring shuttle-driving mechanisms heretofore used, but by a continuously-accelerated motion, the picker traveling in contact with the shuttle through fully two-thirds of the length of the shuttle-box. Thus a steadier motion is given to the shuttle, from which it results, first, that the loom may be driven faster, and be thereby made more productive, and, secondly, that the shuttle may be thrown through a closer shed.

The spring K may be readily adjusted to any desired tension, and when it has become permanently twisted in one direction by use it is only necessary to take it out of the tube F and reverse it, as it works as well one way as the other. It may thus be used indefinitely long and the tension of the spring kept always the same.

Mechanisms of many forms being old for straining and releasing the spring by which the picker-stick of a loom is operated, I do not wish to confine myself to any particular form of such straining and releasing mechanism, nor to any particular manner of connecting it with the spring K or with the picker-stick, so long as the spring K is alternately strained and released, substantially as shown, and by means substantially the equivalent, for that purpose, of those shown, and the picker-stick is thereby operated, substantially in the manner and with the result described.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the picker-stick of a loom, of a torsional spring connected to said picker-stick and straining and releasing mechanism, substantially as and for the purposes set forth.

2. The combination, with the picker-stick of a loom, of a torsional spring connected to said picker-stick, straining and releasing mechanism, and a fixed plug having means of adjustment, as described, said spring being

connected to the straining and releasing mechanism and mounted in said plug, substantially as and for the purposes set forth.

3. The combination, with the picker-stick of a loom, of the plate torsional spring K, having protecting-tube F and connected to said picker-stick, and straining and releasing mechanism, substantially as and for the purposes set forth.

4. The combination, with the picker-stick of a loom, of the plate torsional spring K, having protecting-tube F, and straining and releasing mechanism, and a fixed plug having means of adjustment, as described, said spring being connected to the picker-stick and to the straining and releasing mechanism, and mounted in said plug, substantially as and for the purposes set forth.

5. The combination, with the picker-stick M, tube F, arm L, cam E, and shaft D, of a torsional spring, K, and plug G, substantially as and for the purposes set forth.

6. The combination, with the picker-stick M, tube F, arm L, cam E, and shaft D, of a torsional spring, K, plug G, and means, as described, of adjustably fixing said plug, substantially as and for the purposes set forth.

7. The combination, with the picker-stick of a loom, of a torsional spring connected to said picker-stick, and straining and releasing mechanism, and the pivoted lay having links *b*, and the shaft B, situated nearer the horizontal line of the pivot of the lay than is the lay end of the links *b*, and having cranks *a*, all connected, substantially as and for the purposes set forth.

FRIEDRICH KESSELRING.

Witnesses:
C. C. KOESTING,
W. C. KENYON.

Correction in Letters Patent No. 332,400.

It is hereby certified that Letters Patent No. 332;400, granted December 15, 1885, upon the application of Friedrich Kesselring, of Athenia, New Jersey, for an improvement in "Shuttle Driving Mechanism for Looms," was erroneously issued to "Crawford McCreery" as assignee; that said Letters Patent should have been issued to *Robert S. McCreery*, as assignee by mesne assignments; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 29th day of December, A. D. 1885.

[SEAL.]

H. L. MULDROW,
*Acting Secretary of the Interior.*

Countersigned:
R. B. VANCE,
*Acting Commissioner of Patents.*