(No Model.) 3 Sheets—Sheet 1.

A. D. EMERY.

DOUBLE TENSION DEVICE FOR LOOMS.

No. 503,456. Patented Aug. 15, 1893.

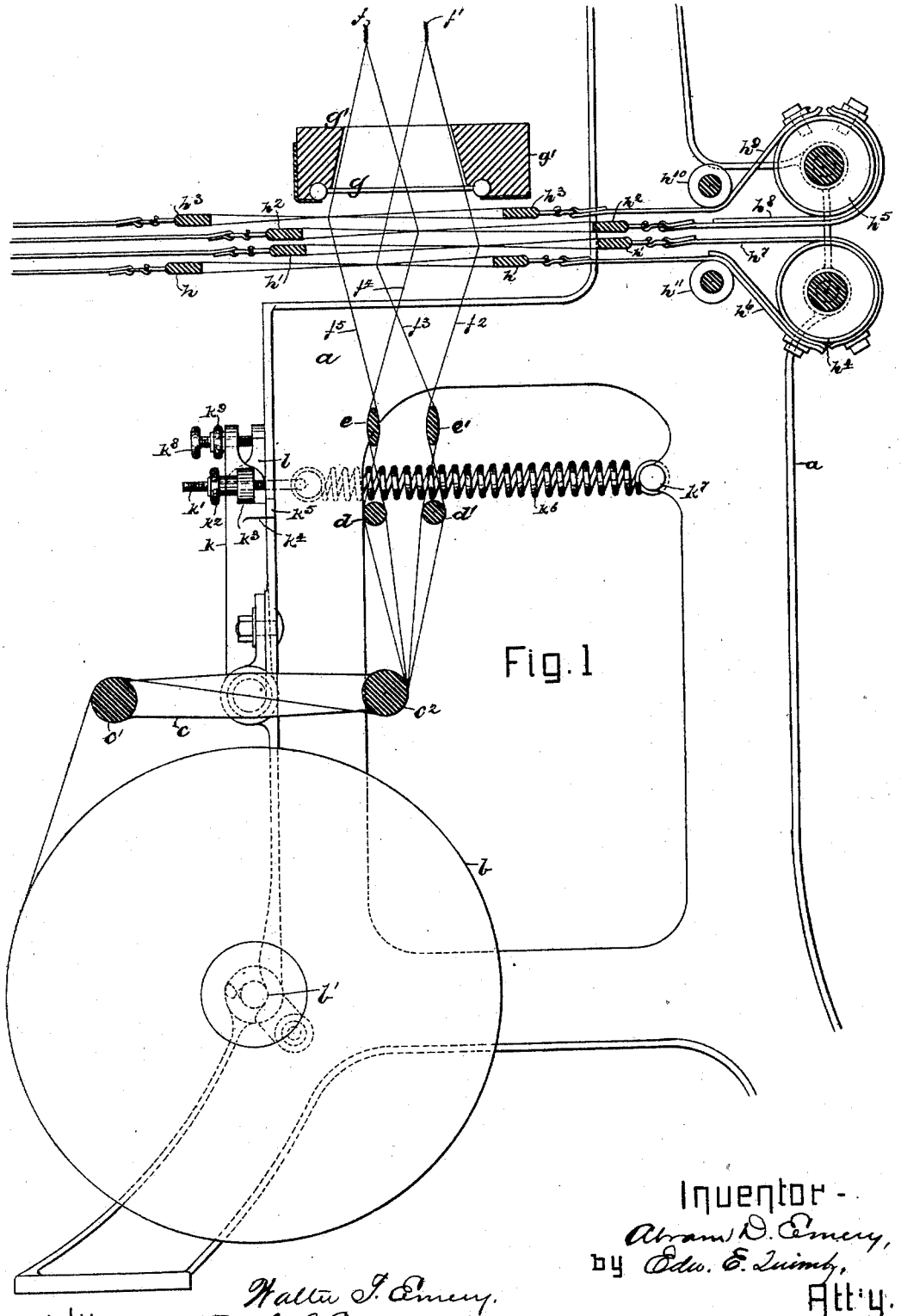

Fig. 1

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Fig. 2

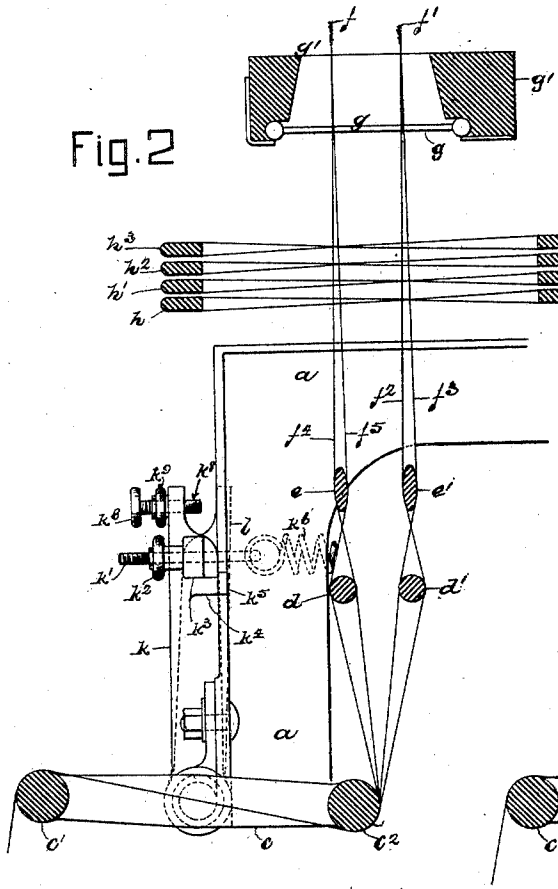

Fig. 3

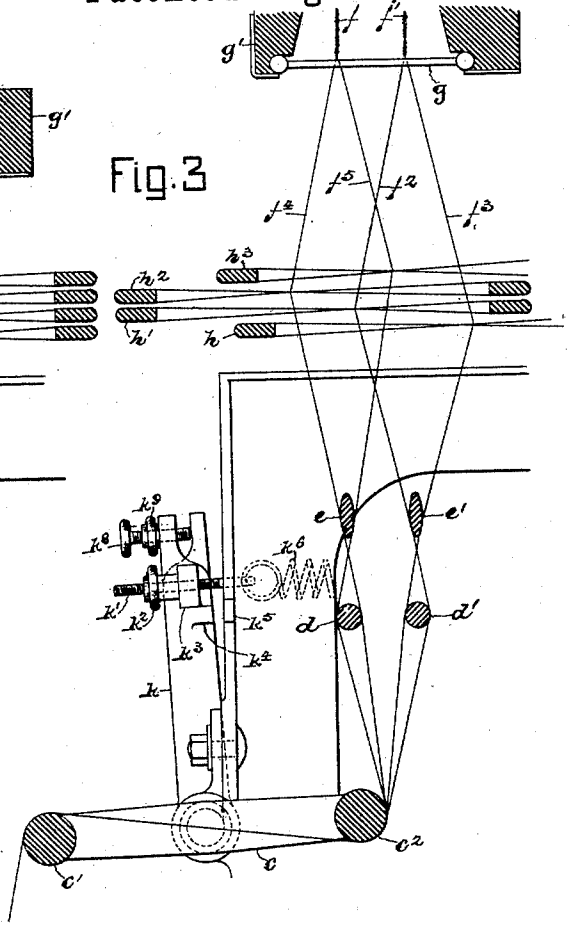

Fig. 4

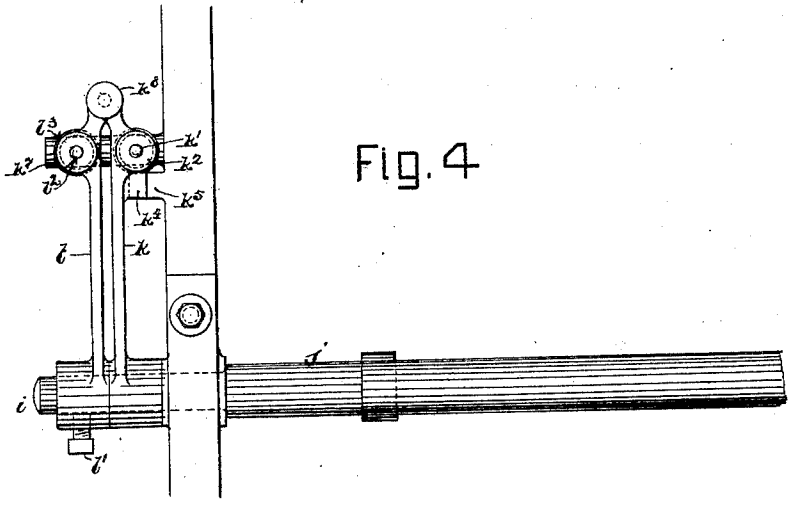

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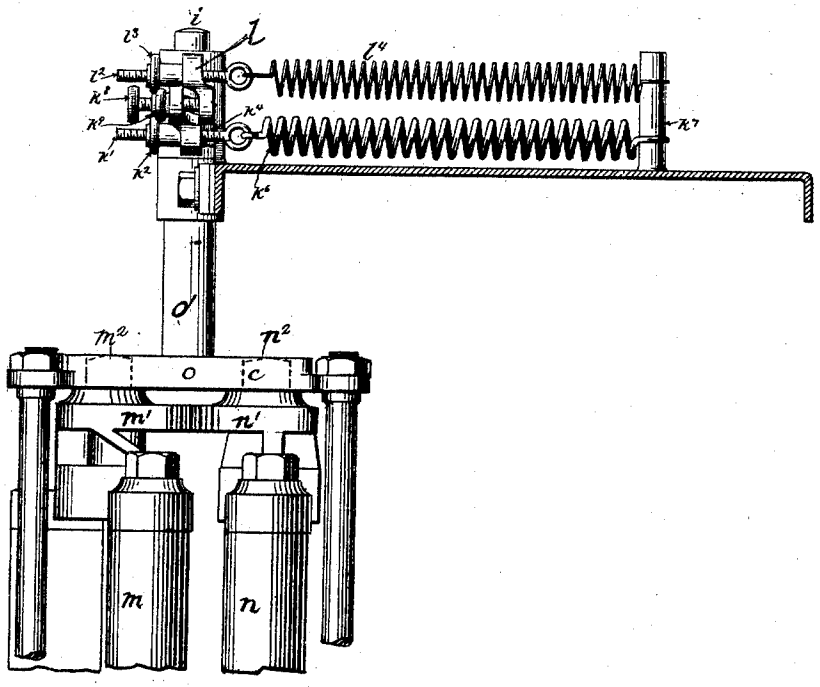
Fig. 5.



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UNITED STATES PATENT OFFICE.

ABRAM D. EMERY, OF TAUNTON, MASSACHUSETTS.

DOUBLE TENSION DEVICE FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 503,456, dated August 15, 1893.

Application filed September 29, 1890. Renewed December 1, 1892. Serial No. 453,683. (No model.)

To all whom it may concern:

Be it known that I, ABRAM D. EMERY, of Taunton, Massachusetts, have invented a certain Improvement in Double Tension Devices for Looms, of which the following is a specification.

This improvement consists in opposing a relatively small resistance to that portion of the rocking movement of the whip-roller or whip-rollers induced by the pull of the warp threads during the formation of the sheds, and in opposing a strong resistance to the continuance of such rocking movement induced by the increased pull of the warp-threads during the beating up of the weft. Hence, during the formation of the sheds, the warp threads are under such light tension that they oppose slight resistance to the movements of the harnesses and slide through the harness eyes with but little friction and little tendency to wear. Moreover, if by any accident the shuttle should be caught in the shed during the beating motion of the lay, there will be time for the stoppage of the loom by the operation of its stopping mechanism before the slack of those of the warp threads which are in contact with the shuttle is taken up sufficiently to break them. The amount of added resistance opposed to the pull of the warp threads induced by the beat, is prescribed by the degree of closeness with which the cloth is to be woven and may be regulated to suit either fine, coarse, open or close goods as may be desired. In ordinary looms, the tension is the same at all times, which causes considerable wear of the warp threads especially if they are composed of tender material. The present improvement renders it practicable to successfully weave with a softer and more tender warp than any before used.

A further and great advantage of the present improvement is that the cloth is not narrowed so much as in looms in which the warp threads are under constant strong tension. In the present case, the warp threads are under the strong tension which is required to beat against, only at the instant of the beat, at which time the reed keeps the warp threads in their proper relative positions. As soon as the beat is delivered and the lay retires, the warp threads are released from the strong tension and are then merely held under the slight tension which suffices to keep them in their proper positions during the formation of the sheds. It will thus be seen that, by the present invention, two results are accomplished which are not attainable in looms in which the warp threads are held under constant high tension, to-wit: The warp threads are held during the beat under the high tension, which it is necessary to beat against in order to weave even cloth free from lumps, while, during the formation of the sheds, they are held under such low tension as to prevent the narrowing of the cloth which would be caused by high tension at that time.

The invention is here illustrated as applied to double shed looms, but it will be of course understood that it is applicable to all looms.

The accompanying drawings representing the double tension device, and so much of the loom structure as suffices to illustrate the construction and mode of operation of the improvement, are as follows, namely:—

Figure 1 is a side view partly in section of a portion of a double shed loom employing a single whip-roller showing the double tension device in side elevation, and showing the sheddings open in position for the passage of the shuttles. Fig. 2 is a side elevation partly in section showing the double tension device, and showing the harnesses in their median positions, with the eyes in the act of passing one another, in which positions the tension device administers the smaller amount of tension to the warp threads. Fig. 3 is an elevation partly in section exhibiting the parts shown in Fig. 2 in the positions which they occupy at the time of the beating up of the cloth, at which time the greater tension is administered to the warp threads. Fig. 4 is a front elevation of the double tension device affording a side view of the whip-roller shaft, upon which the fast and loose arms of the double tension device are mounted. Fig. 5 is a top view of the double tension device showing the light and strong springs connected respectively to the fast and loose arms.

The drawings represent a portion, *a*, of the side frame of the loom; the warp roll, *b*, which revolves upon the axis afforded by the journal, *b'*; the balanced whip-roller, *c*, over the outer bar, *c'*, and under the inner bar, c^2, of

which the warp threads are led to the lease rods, d, d', and e, e', by which the warp threads are separated into the four groups required for weaving, side by side, the two fabrics, f and f'. The warp threads, f^2 and f^3 for weaving the fabric, f', pass across and between the two lease rods, d' and e'; similarly, the warp threads, f^4 and f^5, for weaving the fabric, f, pass across and between the lease rods, d and e. From the lease rods, e and e', the warp threads extend upward through the harness eyes and through the reed, g, attached to the lay, g'.

The sheddings are formed by appropriate reciprocating movements of the harnesses, h, h', h^2 and h^3, imparted respectively by the harness pulleys, h^4, and h^5. The harness, h, has attached to it the strap, h^6, which is secured to the pulley, h^4, and extends diagonally upward therefrom over the idler roller, h^{11}. The harness, h', has attached to it the strap, h^7, which extends around and over the pulley, h^4, and is also secured thereto. The harness, h^2, has attached to it the strap, h^8, which passes under and partly around the pulley, h^5, and is fastened thereto as shown. The harness, h^3, has attached to it the strap, h^9, which is led under the idler roller, h^{10}, and extends diagonally upward therefrom and is secured to the pulley, h^5. The harness pulleys, h^4, and h^5, are each partially rotated successively, first in one direction and then in the other, and by such partial rotatory movements impart endwise reciprocating motions to the harnesses. The harness, h, governs the warp threads, f^3; the harness, h', the warp threads, f^2; the harness, h^2, the warp threads, f^4, and the harness, h^3, the warp threads, f^5.

The tension device is applied to the overhanging end, i, of the whip-roller shaft, j, and consists of the radius arm, k, loosely mounted upon the overhanging end, i, of the whip-roller shaft: and of the radius arm, l, which by means of a set screw, l', or other appropriate means, is tightly secured to the overhanging end, i, of the whip-roller shaft. A screw bolt, k', provided with the adjusting nut, k^2, is inserted transversely through the lug, k^3, projecting laterally from the free end of the loose arm, k. The inward movement of the arm, k, is arrested by the collision of the downward extension, k^4, of the lug, k^3, against the stop, k^5, affixed to the side frame, a, of the loom. The inner extremity of the screw bolt, k', is connected with one end of the contracting spiral spring, k^6, the opposite end of which is secured to a pin or other fixed member, k^7, upon the frame of the loom. The free end of the loose arm, k, is provided with a diagonally upward extension, which is transversely tapped to receive the set screw, k^8, provided with the jam-nut, k^9, the inner end of which screw is adapted to bear upon the face of a similar diagonally upward extension of the tight arm, l. A screw-bolt, l^2, provided with the exterior adjusting nut, l^3, extends through a lug projecting laterally from the free end of the tight arm, l, and at its inner extremity is attached to one end of the contracting spiral spring, l^4, the opposite end of which is secured to the fixed member, k^7, upon the loom frame. The spring, l^4, is of prescribed, moderate strength and by its constant action upon the fixed arm, l, tends to rock the inner bar, c^2, of the whip-roller downward, and thereby to administer a constant, moderate strain upon the warp threads.

In Fig. 2, the inner bar, c^2, of the whip-roller is shown as having been rocked into its lowest position,—the position that it acquires when the harnesses and the portions of the warp threads which pass through the harness-eyes, are in their median positions. It will be seen that, when the harnesses are in their median positions, the tight arm, l, is rocked inward, entirely clear from the inner end of the set screw, k^8, affixed to the upper end of the loose arm, k, which at that time is at rest, by reason of the bearing of the extension, k^4, of the lug, k^3, against its stop, k^5. During the formation of the sheds, the warp threads are extended by the harnesses, and the inner bar, c^2, of the whip-roller is pulled upward approximately into the position in which it is shown in Fig. 1, so that the upper end of the arm, l, is brought into contact, or nearly into contact, with the inner end of the set screw, k^8. When the beat takes place, there is a sudden, additional upward pull upon the warp threads, which rocks the inner bar, c^2, of the whip-roller, upward, and consequently rocks the tight arm, l, outward, so that by striking against the inner end of the set screw, k^8, it carries the loose arm, k, outward into the positions in which these parts are represented in Fig. 3, and thereby distends the stronger spiral spring, k^6. When the stronger spring, k^6, is thus enlisted into action, the greater strain is administered to the warp threads. The extent of such added strain may be varied by adjusting the set screw, k^8, turning it inward, if it be desired that the stronger spring, k^6, shall be brought into earlier and more energetic action; and turning it outward, if it be desired that the upper end of the tight arm, l, shall more nearly complete its outward movement during the beating operation, before acquiring contact with the set screw, k^8, and thereby communicating its outward movement to the loose arm, k, and thus distending the stronger spring k^6. It will be seen that the adjusting nut, k^2, upon the screw-bolt, k', affords a means of varying the tension of the spring, k^6, and that the similar adjusting nut, l^3, upon the screw-bolt, l^2, affords a means of adjusting the tension of the lighter spring, l^5. These features of adjustability are of course convenient, if the loom is to be employed from time to time in weaving fabrics of different characters requiring the administration of different degrees of tension to the warp-threads. If, however, the loom is to be constantly used for weaving the same kind of fabric, this feature

of adjustability can be dispensed with because, in such case, the lighter and the stronger springs can each be made of just the required strength for the particular kind of fabric which is to be woven.

Fig. 5 illustrates the applicability of the improvement to looms employing two whip-rollers. The whip-rollers, m, n, are geared together by the racks, m', n', so that when they rock upon their respective axes, m^2, n^2, they necessarily rock in opposite directions. The two whip-rollers are pivotally mounted upon cross-heads affixed to the opposed ends of two short shafts. One of these cross-heads, o, and one of the short shafts, o', are shown in Fig. 5. The shaft, o', constitutes the common axis for the whip-rollers and has affixed to it fast and loose radius arms corresponding to the radius arms l and k shown in the other figures.

In this class of looms, during the formation of the sheds, the whip-rollers rock in opposite directions, one slacking off the group or groups of warp threads which are to be extended, while the other takes up the slack of the warp threads, as they move from their extended to their median positions. When the beat takes place, the upward pull of the warp threads rocks the whip-rollers upon their common axis, o', and consequently sways the radius arms l and k and brings into action the springs l^4 and k^6 as before described.

It will be understood that, for the present purposes, it is immaterial whether the warp threads are delivered to the whip-roller or whip-rollers from one warp-roll or from two separate warp-rolls, because the present invention relates solely to the varying resistances opposed to the pulls of the warp threads upon the whip-roller or whip-rollers, during the formation of the sheds and during the beating up of the wefts respectively.

What is claimed as the invention is—

1. The combination as herein set forth of the harnesses, the lay and a whip-roller, with a radius-arm tightly affixed to the shaft of said whip-roller, a comparatively light spring for exerting a constant strain upon the free end of said tightly affixed arm, in one direction, a radius arm loosely mounted upon the whip-roller shaft and having a bend or projection extending across the path of motion of a part of said tightly affixed arm, a comparatively strong spring connected with the free end of said loosely mounted arm for exerting a strain in the same direction as that exerted by the said light spring upon the said tightly affixed arm, and a stop for arresting the motion of said loosely mounted arm, and thereby making its possible range of motion, in obedience to the action of said comparatively strong spring, less than the possible range of motion of the said tightly affixed arm in obedience to the action of the said comparatively light spring, substantially as and for the purposes described.

2. The combination, as herein set forth, of the harnesses, the lay and the whip-roller of a loom, with the radius arm, k, loosely mounted upon the whip-roller shaft, j, the spring, k^6, exerting its pull upon the free end of the loosely mounted arm, k, a stop, k^5, for arresting the motion of the said radius arm, k, in obedience to the pull of its spring, the radius arm, l, tightly affixed to the whip-roller shaft, j, the spring, l^4, exerting a constant pull upon the free end of the arm, l, the set screw, k^8, inserted through the diagonally upward extension of the loose arm, k, and adapted to bear upon the face of the similar diagonally upward extension of the tightly affixed arm, l, for the purpose of transmitting to the loose arm, k, more or less of the movement of the arm, l, in opposition to the pull of its spring, l^4, and thereby regulating the stage in the rocking motion of the whip-roller, c, at which the arm, k, is moved from its stop, k^5, and the spring, k^6, is enlisted into action to resist the rocking movement of the whip-roller, c.

3. The combination, as herein set forth, of the lay, harnesses, and the whip-roller, c, with the arm, k, loosely mounted upon the whip-roller shaft, j, and the arm, l, tightly secured thereto, the screw bolts k' and l^2 the springs, k^6, and l^4, and the adjusting nuts, k^2, and l^3, for adjusting the tension of said springs respectively.

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