L. S. BURBANK.

LOOM HARNESS MECHANISM.

APPLICATION FILED APR. 27, 1910.

972,810. **Patented Oct. 18, 1910.**

Fig. 1.

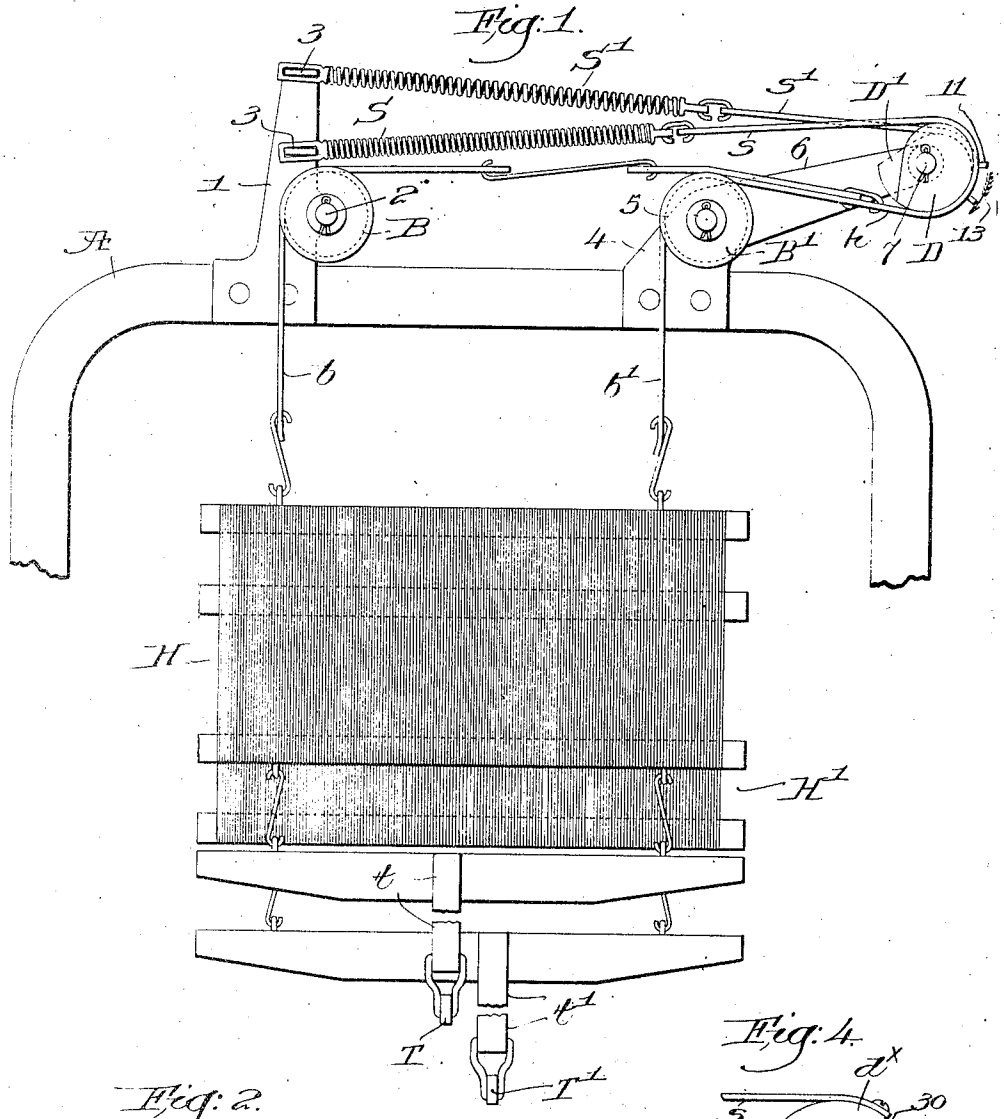


Fig. 2.

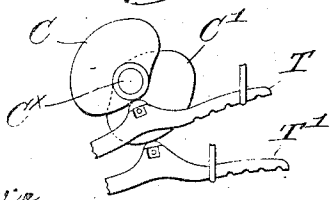


Fig. 3.

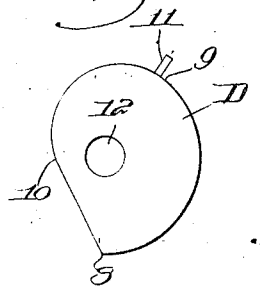
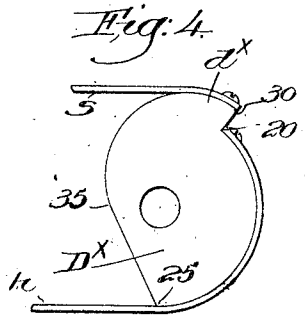


Fig. 4.



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UNITED STATES PATENT OFFICE.

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LOOM HARNESS MECHANISM.

972,810. Specification of Letters Patent. Patented Oct. 18, 1910.

Application filed April 27, 1910. Serial No. 557,877.

To all whom it may conc rn:

Be it known that I, LOUIS S. BURBANK, a citizen of the United States, and resident of Hopedale, county of Worcester, State of Massachusetts, have invented an Improvement in Loom Harness Mechanism, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates particularly to that type of shed forming mechanism wherein the loom-harness is moved positively in one direction and is spring-actuated in the opposite direction.

My invention has for its object the production of loom-harness mechanism of such type so constructed and arranged that the alternate expansion and contraction of the actuating spring is materially reduced in extent and the variations in tension more evenly distributed or equalized throughout the movement of the harness in either direction.

As the movement of a harness is individualized or effected independently of its fellows in a set my invention is adapted for use with any desired number of harnesses.

In the present embodiment of my invention the harness is depressed by usual cam-actuated means, and it is lifted by the contraction of an overhead lifting spring fixed at one end and connected at its other end with the top of the harness, the intervening connections including means to minimize the elongation and contraction of the spring and to substantially equalize the tension thereof as the harness rises and falls.

As is well known to those skilled in the art the resistance or tension of the usual coiled lifting spring gradually increases with the elongation as the harness is depressed, while such tension gradually decreases as the spring contracts during the lifting of the harness, and not only is the change in the length of the spring very extensive but the movement of the harness is neither smooth nor regular, because of the wide variations in tension. The springs tend to jump, and they are as a rule short-lived, the breakage apparently being due to crystallization of the metal resulting from rapid, sudden and marked variations in tension. By my present invention I am enabled to overcome these objections, and as the changes in the length of the spring are very much reduced in extent and the tension thereof substantially equalized throughout the stroke of the harness the tendency to crystallize is minimized so that very little breakage occurs.

The various novel features of my invention will be fully described in the subjoined specification and particularly pointed out in the following claims.

I have illustrated my invention in connection with a two-harness set, as sufficient for a complete understanding thereof but it will be apparent hereinafter that the invention is equally well adapted for use with any desired number of harnesses.

Figure 1 is a front elevation of a sufficient portion of the shedding mechanism of a loom embodying one form of my invention, the depressing cams being omitted; Fig. 2 is a side elevation on a smaller scale of the harness-cams and the usual treadles coöperating therewith; Fig. 3 is an enlarged view of what I have termed the compensator, to be referred to; Fig. 4 is a similar view of a slightly modified form of compensator, to be referred to.

Referring to Fig. 1 the overhead arch A, the guide-sheaves B, B′ over which pass the sides *b*, *b′* of the flexible bridle attached to the top bar of each harness, the front and back harnesses H, H′ and the stirrups *t*, *t′* connecting the bottom-bars of the harnesses with the treadles T, T′, and the depressing cams C, C′, Fig. 2, on the cam-shaft $C^{\times}$, may be and are all of well known or usual construction. It will be understood that a pair of the guide sheaves B, B′ will be provided to coöperate with the bridle of each harness, as is usual, although to avoid confusion I have not attemped to show the bridle for the back harness H′. An upright bracket 1 on the arch sustains the journal 2 for the series of sheaves B and above the latter the bracket has lugs 3, 3 one above the other for the shackles of the fixed ends of the overhead, coiled lifting springs S, S′, one for each harness. At the opposite side of the arch A is arranged a second bracket 4 which supports the stud 5 for the series of sheaves B′, said bracket having an upwardly inclined, lateral extension 6 provided with a frontwardly projecting horizontal stud 7, on which are mounted the oscillating compensators, said compensators being arranged

side by side and each one forming a part of the connections between a lifting spring and its harness, each compensator being thus located above and at one side of its harness and substantially in the plane thereof, economizing space.

For convenience the compensators in Fig. 1 are indicated by the reference letters D, D′, but as they are alike only one need be described in detail. Each compensator is a cam-like member, made of suitable material of requisite thickness to provide a working edge or face of suitable width, having a segmental portion from 8 to 9 of uniform and relatively large radius, Fig. 3, and a portion of a gradually but rapidly decreasing radius from 9 to 10, a pin 11 fixedly secured to the compensator extending from the cam surface beween the points 9 and 10, as shown. The effective portions of the cam surface of the compensator are from 8 to 9, and from the pin 11 to the point 10, and it will be seen that the radius of said latter portion decreases from the pin 11 to the point 10, while the radius of the segmental portion 8—9 is uniform. The compensators are mounted to oscillate on the stud 7 and herein I have shown a continuous fixible member between the free end of a lifting spring and the bridle of its harness, passed around the cam surface of the compensator and fixedly attached thereto by the pin 11, but for convenience I designate the part *s* of said member, between the spring and compensator, as the spring connector, and the part *h* between the bridle and the compensator as the harness connector.

Referring now to Fig. 1 it will be seen that the spring connector *s* passes around and coöperates with the part of the cam surface of the compensator between pin 11 and the point 10, while the harness connector *h* passes around and coöperates with the part 8—9 of uniform radius. The front harness H is up and its lifting spring S is contracted, but with sufficient tension still exerted to maintain the harness lifted. Now when said harness is depressed the pull transmitted through the bridle to the connector *h* and pin 11 operates to revolve the compensator D in the direction of arrow 13, Fig. 1, and as the harness descends the connector *h* will be given off at a uniform rate due to its coöperation with the circular arc 8—9 of the compensator until the compensator D assumes the angular position of the compensator D′, Fig. 1. As the compensator thus revolves the pin 11 acts through the connector *s* to stretch or elongate the spring S, but as the coöperating part of the cam surface of compensator D from pin 11 to point 10 is of gradually decreasing radius the lever arm acting on the harness connector *s* is gradually but quite rapidly shortening, as the decrease in radius is rapid. Consequently, for a given angular movement of the compensator the spring connector *s* is taken up to a much less extent than the harness connector *h* is given off, and there is a relatively small elongation of the spring as compared with the stroke of the harness, and as the lever arm between the axis of the compensator and the point on its cam surface at which the connector *s* engages is gradually decreasing the tension of the spring is equalized as it elongates. In other words, while the resistance of the spring tends to increase with its elongation the elongating force acts with a decreasing leverage, or effect, and a balancing or equalizing is thereby effected, so that the resistance offered by the spring to the descent of the harness is made substantially uniform throughout the stroke.

The position of the connector *s′* between the spring S′ and its compensator D′ is shown in Fig. 1 wherein the corresponding harness H′ is depressed, and it will be seen that said connector *s′* at such time very closely approaches the axis of the compensator D′. As the harness rises its compensator revolves oppositely to arrow 13, Fig. 1, and the harness connector *h* is taken up more rapidly than the spring connector is given off, and at the same time the leverage through which the contracting spring acts upon the compensator rapidly increases until the harness is at its high point, and while the lifting force or tension of the spring diminishes as it contracts it acts through an increasing lever-arm, thus effecting the equalization on the up-stroke of the harness. Owing to the cam-like acting surface of the compensator there is a differential longitudinal movement of the attached harness and spring connectors, in opposite directions, the former moving at a faster speed, and the leverage for the harness connector is greater than the maximum leverage for the spring connector, as will be manifest.

In Fig. 4 the compensator D× has a segmental portion from 20 to 25, coöperating with the harness-connector *h*, as before, but the upper part of the compensator is built out, at *d*×, with a radius gradually decreasing from 30 to 35, forming the surface which coöperates with the spring connector *s*, a step being formed between the points 20 and 30.

The operation is the same as has been described, but by the construction shown in Fig. 4 I can get a very rapid and material variation in the radius of the part of the compensator which coöperates with the spring connector, which is desirable in some harness motions. It will be seen that a relatively small change in the length of the lifting spring is effected as it is elongated

and contracts, and this not only prevents the spring from thrashing about, but, in connection with the equalizing of the tension, obviates the tendency to rapid crystallization of the spring and consequent breakage.

The mechanism is very simple and effective, it consists of few parts, and it is compact and direct acting, and as the flexible connectors coöperate only with curved portions of the compensator there is no sudden or sharp bending, and thereby wear and tear is very much reduced.

Various changes or modifications may be made by those skilled in the art without departing from the spirit and scope of my invention as set forth in the claims annexed hereto.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. The combination with a vertically-movable loom-harness, and means to depress it, of an overhead lifting spring, an oscillating cam-like compensator located above and at one side of the harness, a flexible connector between the compensator and the spring, and a flexible connector between said compensator and the harness, the surface of the compensator coöperating with the harness connector having a uniform radius, and that part of the surface coöperating with the spring connector having a varying radius, the spring connector moving toward the axis of the compensator as the latter is turned to elongate the spring, said connectors extending inward from the top and bottom of the compensator and above the harness.

2. The combination with a vertically-movable loom-harness, and means to depress it, of an overhead, laterally extended lifting spring fixed at one end, an oscillating compensator having a cam-like edge and located at one side of the free end of the spring, a flexible connector between the free end of the spring and the compensator, engaging a portion of its edge and attached thereto, and a flexible connector between the harness and said compensator, engaging another portion of its edge and attached to the latter, the edge of the compensator coöperating with one of said connectors nearing the axis of the compensator from the point of attachment of said connector and the portion of the edge effectively coöperating with the other connector having a uniform radius, the compensator lying between the connectors.

3. The combination with a vertically-movable loom-harness, and cam-actuated means to depress it, of overhead sheaves, straps attached to the top of the harness and led over said sheaves, an oscillating compensator at one side of the sheaves, having a lower segmental portion of its face of relatively large and uniform radius and an upper portion of its face of a varying radius, the greatest radius of which is near the point of attachment of the spring connector with the said compensator, a flexible connector passing around portion of the latter having the uniform radius and attached to said straps and the compensator, a lifting spring above the sheaves and fixed at one end, and a flexible connector attached to the free end of the spring and to said compensator and passing over the part thereof having a varying radius, to reduce the changes in the length of the spring and equalize the tension thereon as the harness rises and falls, said connectors extending inward from the compensator and located one above the other.

4. The combination with a vertically-movable loom-harness, and cam-actuated means to depress it, of an overhead lifting spring, overhead sheaves, a bridle led thereover and attached to the harness, an oscillating, cam-like compensator at one side of the sheaves having a circular portion of relatively large radius and a portion of varying radius less than that of the circular portion, and a flexible member connecting said bridle and the spring and passing around said portions of the compensator, and fixedly attached to the latter between such portions, the circular portion acting upon that part of said flexible member leading to the bridle and the portion of varying radius acting on that part of the member leading to the spring.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

LOUIS S. BURBANK.

Witnesses:
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