To all whom it may concern:

Be it known that I, JOHN F. DUSTIN, a citizen of the United States, residing at Fitchburg, in the county of Worcester and State of Massachusetts, have invented a new and useful Warp Stop-Motion for Looms, of which the following is a specification.

My invention relates to a mechanism for stopping a loom upon the failure or breakage of a warp-thread; and the object of my invention is to provide a simple, efficient, and durable warp stop-motion which can be applied to existing or new looms at comparatively-small expense.

One especial object which I have had in view in constructing warp stop-motions according to my present invention is to time the stopping devices so that they will not be affected by any undue slackness or variation in the tension of the several warp-threads.

To these ends my invention consists of the parts and combinations of parts of my warp stop-motion, as hereinafter described, and in the construction of a composite drop-heddle for use in connection therewith, as will be hereinafter explained.

In the accompanying two sheets of drawings, Figure 1 is a longitudinal sectional view showing sufficient parts of a loom to illustrate the application of my invention thereto. Fig. 2 is an enlarged fragmentary perspective view illustrating the construction of the heddles and heddle-frame. Fig. 3 is a similar view illustrating a slightly-modified form of construction. Fig. 4 is a perspective view illustrating a modified form of heddle which may be employed. Fig. 5 is a detail view illustrating the manner in which the heddles may be weighted to adapt them for use in connection with different grades of yarn. Fig. 6 is a diagrammatic view showing the position of the parts during the normal operation of the loom. Fig. 7 is a similar view showing the position of the parts when the stopping devices will be brought into action, and Fig. 8 is a perspective view of a guide-piece for holding the harness-frames in position.

My invention, although certain features thereof may be employed in different constructions, relates especially to that class of warp stop-motions which are controlled by drop-heddles—that is to say, to that class of warp stop-motions in which the heddles are mounted in their heddle-frames so as to be capable of an independent motion therein. In this class of warp stop-motions when a heddle-frame is moved down the tension of the warp-threads will tend to raise the heddles to their highest position in their heddle-frame. Whenever a warp-thread is broken, the heddle corresponding thereto will not be picked up or raised at this time, and the feeler or other devices controlled by the heddles will bring the stopping devices into action to stop the loom. In applying and using warp stop-motions of this character I have found in practice that their reliability depends in a large measure upon maintaining a substantially-uniform tension for the warp-threads—that is to say, in a warp stop-motion employing drop-heddles as ordinarily constructed it frequently happens that the stopping devices will be brought into action whenever a warp-thread becomes slightly loosened or slightly slack.

The especial object of my present invention is to provide a drop-heddle warp stop-motion which will not be readily affected by the changes in the tension of the warp-threads, and to accomplish this purpose I have arranged the devices for shifting or moving the feeler on its operative stroke at a time when the heddle-frame is in its lowest position—that is to say, in a warp stop-motion constructed according to my invention the position of the heddles in their frame will not affect the operation of the stopping devices except at a time when the heddle-frames have been brought to rest and are standing in their lowest position.

When a heddle-frame has been moved down so as to open the shed, the bend or deflection of the warp-threads will be sufficient to insure the lifting of each individual heddle out of the way of its feeler without regard to slight variations in tension, whereas in former constructions, so far as I am familiar with the same, the feeler is shifted or operated while the heddle-frame is still moving down, so that slight variations in the tension of the warp-threads will be much more liable to unnecessarily cause the stopping devices to act than in a warp stop-motion constructed according to the present invention.
My warp stop-motion which I have illustrated herein comprises a heddle-frame, heddles mounted therein, so as to be capable of an independent movement, a feeler moveably mounted in the heddle-frame, and means for actuating the feeler after the heddle-frame has reached its lowest position. In the special construction which I have illustrated, the feelers are moved or shifted in one direction by a stationary cam-plate when the heddle-frame is rising. For shifting the feelers in the opposite direction I provide a plate normally tending to move into position to shift the feelers, and connections controlled by the lay are provided for withholding said plate until after the heddle-frame has reached its lowest position. By controlling the movable shifting-plate from the lay I have provided a stopping mechanism which is timed to act when the heddles are in their lowest position, as in the normal operation of weaving the heddle-frames dwell or remain in their lowest position while the lay is moving back and then forward again to complete one pick. Referring to the drawings and in detail, A designates the side frame of a loom; B, the warp-beam thereof; D, the vibrating lay, and C the whip-roll. These parts may be of the ordinary or approved construction.

The heddle-frames F, as illustrated most clearly in Figs. 6 and 7, consist of side pieces 10, which are connected and secured together simply by transverse heddle-rods, and I prefer to dispense with the top and bottom pieces employed in the ordinary forms of heddle-frames, so as to provide a lighter construction, and to leave the bottom of the heddle-frames open, so that the heddles may be weighted or provided with pendants to adapt them for different grades of yarn, as hereinbefore described.

In my preferred construction, as illustrated in Fig. 5, the heddle-frames are connected by two sets of heddle rods or plates 12 and 13, so that two sets of heddles 14 may be strung thereon in different relative vertical planes. Secured in the heddle-frames between the heddle-rods 12 and 13 are toothed strips or rods 16. Movable mounted between the toothed strips 16 is a toothed feeler 17, having its teeth facing in an opposite direction. The heddles 14 are preferably twisted from wire in any of the ordinary manners, preferably the double-strand wire heddle being used, and secured or brazed in the upper part of the heddles 14 are metallic plates or projections 15, which extend over in position to cooperate with the feeler 17. The heddle-rod eyes of the heddles 14 are long enough to allow for a lost motion or drop of the heddles in their frame, and in practice I have found that the use of plain wire heddles having elongated eyes is objectionable, as the end of one heddle is liable to be pushed through the eye of a succeeding heddle or become interlaced therewith.

By providing the heddles 14 employed in a warp stop-motion constructed according to my invention with overhanging metal plates 15 I have not only constructed the heddles so that they will cooperate with the feeler arranged between the heddle-rods, as described, but I have also provided an efficient means for preventing the heddles from becoming misaligned. Moreover, I have illustrated the feelers are moved or shifted in one direction by a stationary cam-plate when the heddle-frame is rising. It is desirable to provide a plate normally tending to move into position to shift the feelers, and connections controlled by the lay are provided for withholding said plate until after the heddle-frame has reached its lowest position. By controlling the movable shifting-plate from the lay I have provided a stopping mechanism which is timed to act when the heddles are in their lowest position, as in the normal operation of weaving the heddle-frames dwell or remain in their lowest position while the lay is moving back and then forward again to complete one pick.

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The heddle-frames F, as illustrated most clearly in Figs. 6 and 7, consist of side pieces 10, which are connected and secured together simply by transverse heddle-rods, and I prefer to dispense with the top and bottom pieces employed in the ordinary forms of heddle-frames, so as to provide a lighter construction, and to leave the bottom of the heddle-frames open, so that the heddles may be weighted or provided with pendants to adapt them for different grades of yarn, as hereinbefore described.

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By providing the heddles 14 employed in a warp stop-motion constructed according to my invention with overhanging metal plates 15 I have not only constructed the heddles so that they will cooperate with the feeler arranged between the heddle-rods, as described, but I have also provided an efficient means for preventing the heddles from becoming misaligned.
eyes of the heddles, the upper edges of the heddle-rod themselves being notched or toothed, and I have illustrated such a construction in Fig. 3. As shown in this figure, each heddle-rod consists of two toothed sections 35, mounted between which are movable feelers 36, and where this construction is adopted the metallic pieces 30, secured or brazed in the upper parts of the heddles 140, need not project to one side as far as in the construction before described.

In some cases in order to diminish the length of the drop or lost motion of the heddles necessary to control a stopping mechanism constructed according to my invention I contemplate employing pivoted metallic pieces which are operated from but not rigidly secured to the heddles, and I have illustrated such a construction in Fig. 4. As shown in this figure, the heddle-eye 40 of the heddle 240 may be made shorter than in the constructions before described. Passing through a secondary eye 41 of the heddle 240 is a blade or metallic piece 250, a series of which blades may be pivoted upon a rod, as 43, to cooperate with a series of such heddles. In this construction it will be seen that the drop or lost motion of the heddle 240 will produce an increased motion of the metallic pieces 250, which cooperate with the feelers.

In some cases, where very stiff or wiry yarns are being woven, it sometimes happens that the light wire heddles are not heavy enough to insure the positive action of the stopping devices, and in order to adapt my warp stop-motion for all classes of weaving I contemplate in some instances weighting the heddles or providing them with pendants to insure their proper action even when coarse or wiry yarns are used. In such cases the heddles 14 are provided at their lower ends with weights or pendants 18, which may be detachably secured to the wires which form the heddles in any ordinary manner. Different lengths of weights 18 may be used to secure the necessary results, as desired.

To insure the heddle-frames retaining their proper position in the loom, the guide-pieces illustrated in Fig. 8 may be employed, if desired.

As shown most clearly in Figs. 6 and 7, the guide-pieces 33 are adjustably fastened to the elbow-pieces 28 and 30 at the opposite sides of the loom, respectively, and detachably secured in the guide-pieces 33 I may, if desired, employ cross-rods 34, which extend across from the guide-pieces 33 at each side of and between the several heddle-frames and form an abutment which limits the lower plane of the shed, so that even if a thread is unduly slackened its heddle may be picked up out of the way of the feelers as the heddle-frames move down between the cross-rods 34.

I am aware that numerous changes may be made in the construction of my warp stop-motion for looms by those skilled in the art without departing from the scope of my invention as expressed in the claims. I do not wish, therefore, to be limited to the form which I have shown and described; but

What I do claim, and desire to secure by Letters Patent of the United States, is—

1. In a warp stop-motion for looms, the combination of a heddle-frame, a series of 75 drop-heddles mounted therein, a series of feelers mounted in and carried by the heddle-frame in position to cooperate with the series of drop-heddles, stopping connections controlled by the feeler, and means for actuating the feeler while the heddle-frame is stationary, substantially as described.

2. In a warp stop-motion for looms, the combination of a heddle-frame, heddles carried thereby and capable of an independent movement therein, a feeler mounted in the heddle-frame, connections controlled by the lay for actuating the feeler after the heddle-frame has reached its lowest position and stopping connections controlled by the feeler, substantially as described.

3. In a warp stop-motion for looms, the combination of a series of drop-heddles or detectors, a longitudinally-movable toothed feeler cooperating therewith, stopping connections controlled by the feeler, and connections from the lay for actuating the feeler during the dwell of the heddles, substantially as described.

4. As an article of manufacture, a wire 100 heddle carrying a metallic end plate, substantially as and for the purposes set forth.

5. The combination of a heddle-frame, two sets of heddles mounted in the heddle-frame in different relative vertical planes, a feeler 105 movably mounted in the heddle-frame between the two sets of heddles, said heddles being provided with overhanging projections or plates cooperating with the feeler and stopping connections controlled by the feeler, substantially as described.

6. The combination of a heddle-frame, two sets of heddles mounted in the heddle-frame in different relative vertical planes, toothed bars secured in the heddle-frame between the two sets of heddles, a toothed feeler movably mounted between said bars, the heddles being provided with overhanging projections or blades cooperating with the feeler and stopping connections controlled by the feeler, substantially as described.

7. The combination of a heddle-frame, heddles movably mounted therein, a feeler cooperating with the heddles, means for moving the feeler in one direction when the heddle-frame rises, a plate normally tending to move into position to shift the feeler in the opposite direction, connections from the lay for withholding said plate until after the heddle-frame reaches its lowest position and stopping connections controlled by the feeler, substantially as described.

8. The combination of a heddle-frame, heddles movably mounted therein, a feeler coop-
erating with the heddles, an adjustable cam-plate for moving the feeler in one direction when the heddle-frame rises, a plate normally tending to move into position to shift the feeler in the opposite direction, connections from the lay for withholding said plate until after the heddle-frame reaches its lowest position and stopping connections controlled by the feeler, substantially as described.

9. The combination of a heddle-frame, heddles movably mounted therein, a feeler cooperating with the heddles, an adjustable cam-plate for moving the feeler in one direction when the heddle-frame rises, a plate normally tending to move into position to shift the feeler in the opposite direction, a stopping-link connected to the plate, a projection or roller carried by the lay for normally raising and lowering the stopping-link to actuate said plate and stopping connections controlled by the stopping-link, substantially as described.

10. The combination of a heddle-frame, heddles movably mounted therein, a notched or toothed feeler cooperating with the heddles, an adjustable cam-plate for moving the feeler in one direction when the heddle-frame rises, a stopping-link having an incline on its lower edge for engaging a projection or roller carried by the vibrating lay, and a notch or projection on its upper edge cooperating with a projection or finger carried by the lay and stopping connections controlled by the stopping-link, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOHN F. DUSTIN.

Witnesses:

LOUIS W. SOUTHGATE,

PHILIP W. SOUTHGATE.