(No Model.) 3 Sheets—Sheet 1.

O. SMITH.

WARP STOP MOTION FOR LOOMS.

No. 546,977. Patented Sept. 24, 1895.

Fig. 1.

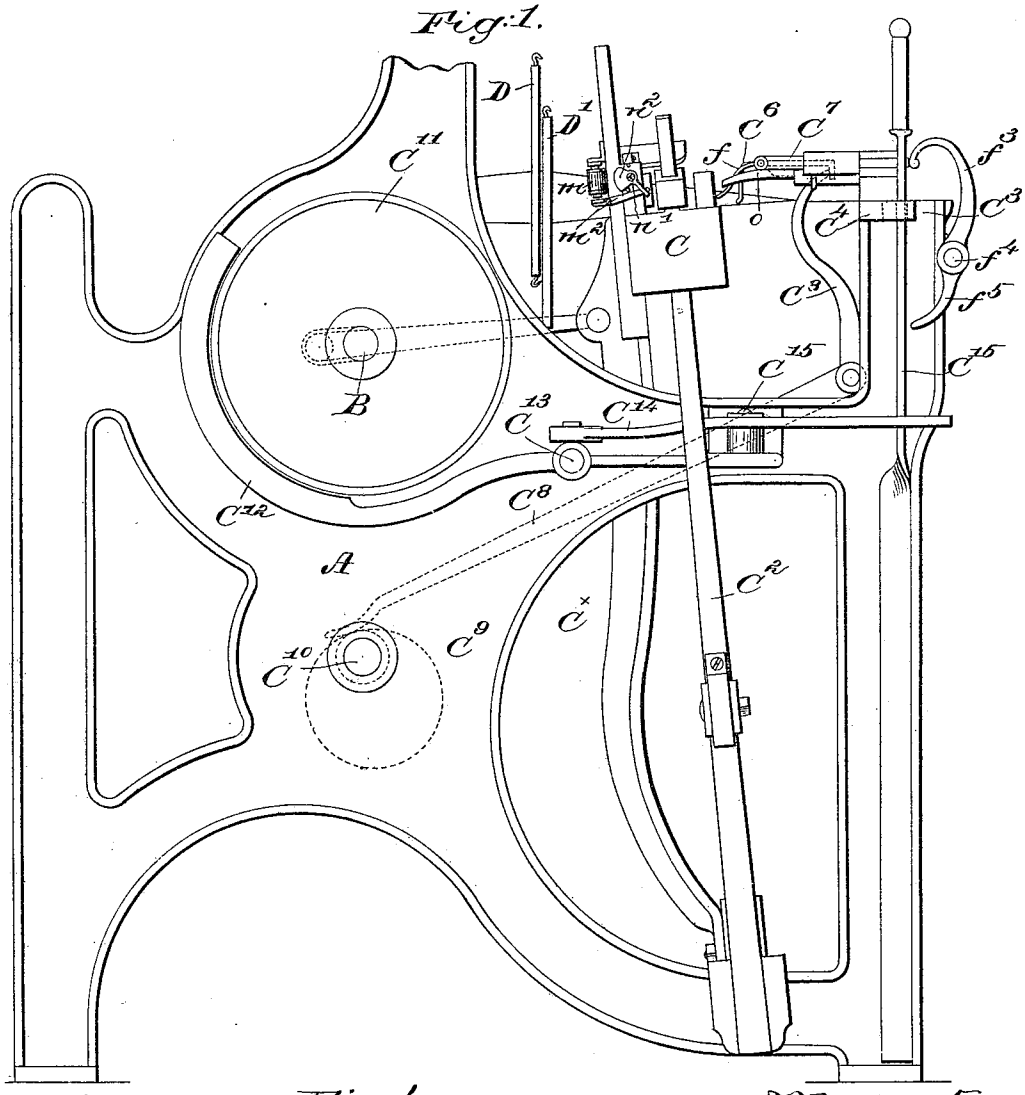


Fig. 4.

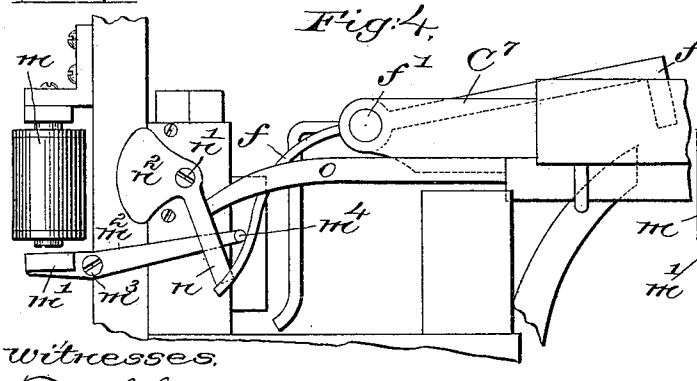
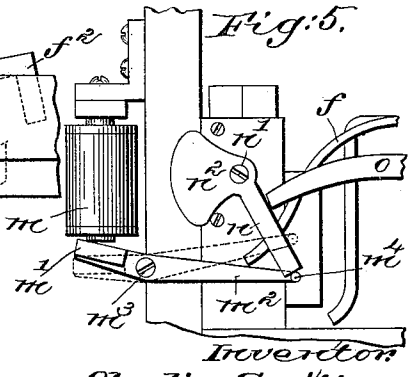


Fig. 5.



Witnesses.
Fred S. Gruntaf.
Edward F. Allen

Inventor.
Oberlin Smith.
by Lowry & Longon Attys

(No Model.) 3 Sheets—Sheet 2.

O. SMITH.

WARP STOP MOTION FOR LOOMS.

No. 546,977. Patented Sept. 24, 1895.

Fig: 3.

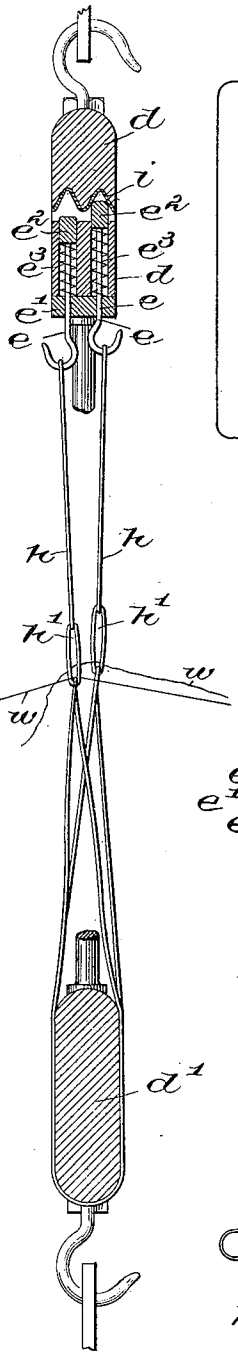


Fig: 4.

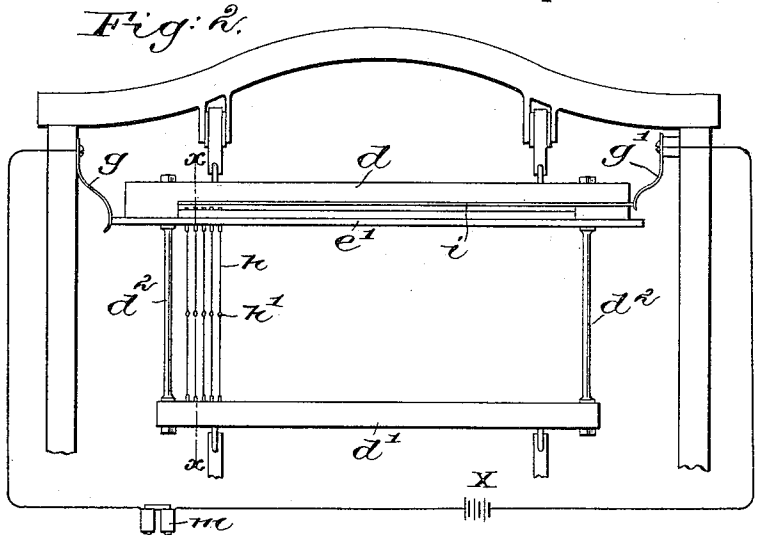


Fig: 6.

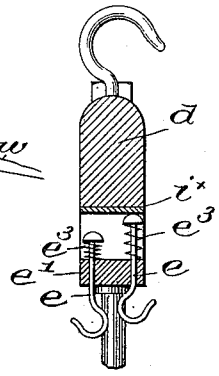


Fig: 7.

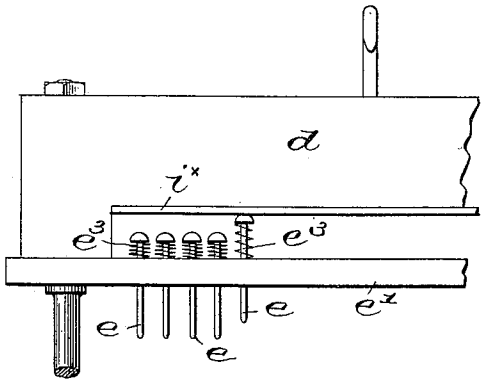
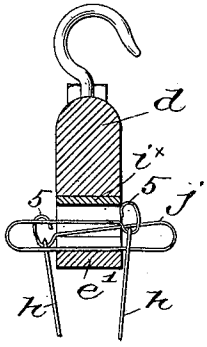


Fig: 8.



Witnesses:
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Edward F. Allen.

Inventor:
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by Crosby Gregory Attys.

(No Model.) 3 Sheets—Sheet 3.

O. SMITH.

WARP STOP MOTION FOR LOOMS.

No. 546,977. Patented Sept. 24, 1895.

Fig: 10.

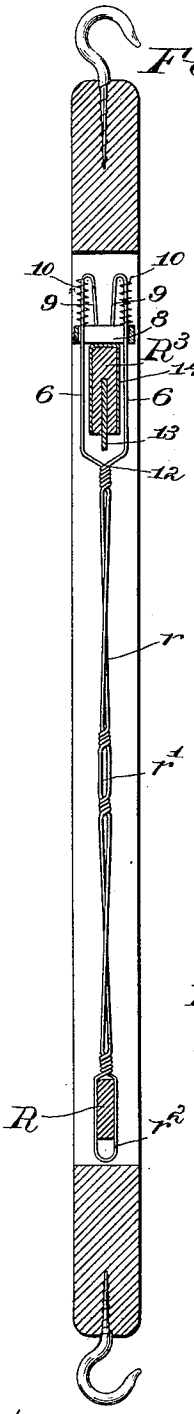


Fig: 11.

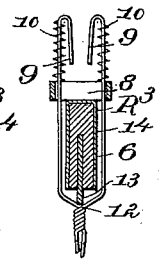


Fig: 12.

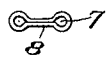


Fig: 13.

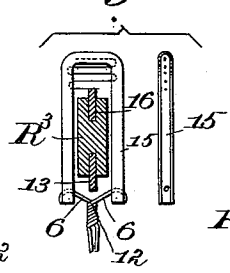
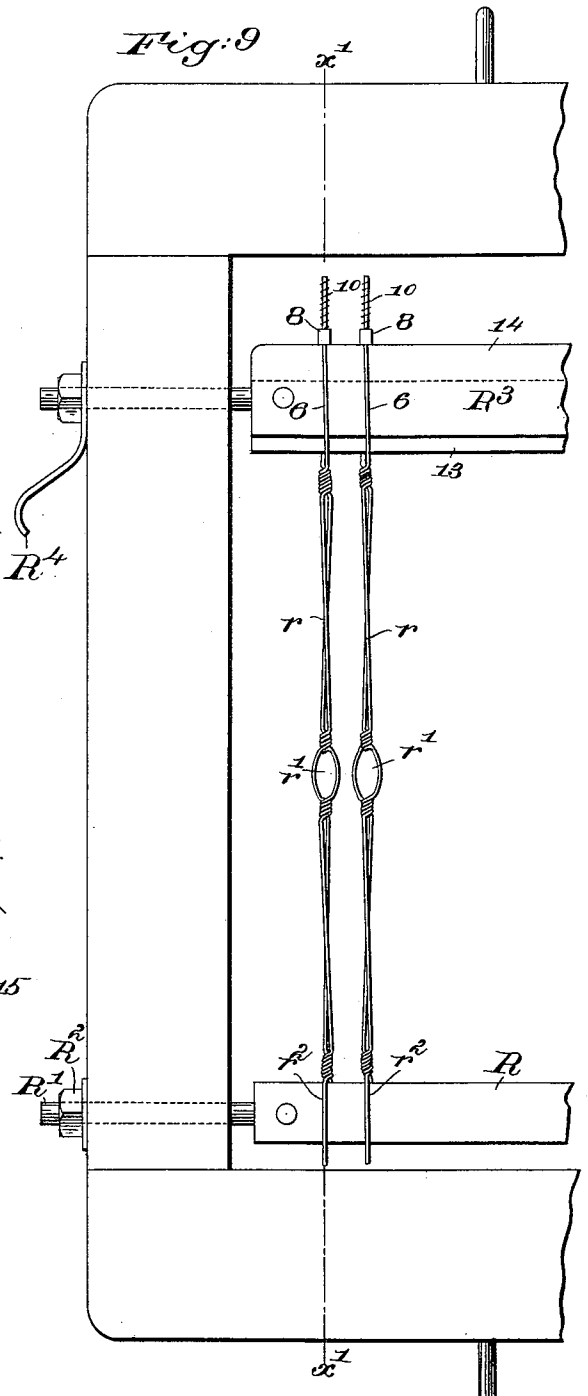


Fig: 9



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Fred L. Gunnell.
Edward F. Allen.

Inventor.
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by Crosby & Gregory Attys.

UNITED STATES PATENT OFFICE.

OBERLIN SMITH, OF BRIDGETON, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NORTHROP LOOM COMPANY, OF HOPEDALE, MASSACHUSETTS.

WARP STOP-MOTION FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 546,977, dated September 24, 1895.

Application filed February 29, 1892. Serial No. 423,226. (No model.)

To all whom it may concern:

Be it known that I, OBERLIN SMITH, of Bridgeton, county of Cumberland, State of New Jersey, have invented an Improvement in Warp Stop-Motions for Looms, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object to provide an improved warp stop-motion for looms.

In this invention the stopping mechanism for the loom is controlled by the tension of the warp-threads upon the heddles as the latter are moved in the formation of a shed in the warp-threads, the failure of any warp-thread to exert proper tension upon its heddle causing the stopping mechanism to be actuated to stop the loom. The varying tension of the warp-threads upon the heddles may be utilized in various ways to actuate the stopping mechanism of the loom; but in accordance with my invention, to be herein specifically described, the heddles are made movable in their frames or carriers, they being drawn from a normal into abnormal position against the action of suitable springs, which yield to the tension of the warp-threads when the latter are moved to form a shed, failure of a broken warp-thread to move a heddle into its abnormal position permitting the said heddle to effect the closure of an electric circuit, which will act through suitable electromechanical mechanism to stop the loom.

One part of this invention, therefore, consists in a loom containing the following instrumentalities, viz: A series of heddles through which the warp-threads are passed, a carrier for the said heddles, mechanism to move the same, and a stopping mechanism for the loom, actuated by the tension of the warp-threads upon the heddles when the said warp-threads are moved to form a shed.

Other features of this invention will be hereinafter described, and pointed out in the claims.

Figure 1 represents in end elevation a sufficient portion of a loom to enable this invention to be understood; Fig. 2, a front elevation of a portion of the loom-frame on a reduced scale, showing a carrier with several of the heddles in place and the devices for closing the electric circuit when the heddle-carrier is moved to form a shed in the warp-threads; Fig. 3, an enlarged section taken on the dotted line $x\ x$, Fig. 2; Figs. 4 and 5, detail views, illustrating the action of a portion of the stopping mechanism; Fig. 6, an enlarged sectional detail showing a modified construction. Fig. 7, a partial front elevation of the same. Fig. 8 represents in section yet another modified construction. Fig. 9, on an enlarged scale, represents a portion of the heddle-carrier with two wire heddles in place instead of the thread heddles illustrated in the preceding figures; Fig. 10, a section of the same, taken on the dotted line $x'\ x'$, Fig. 9; Fig. 11, a detail of a portion of one of the wire heddles in its normal position; Fig. 12, a detail to be referred to; and Fig. 13 represents in elevation and cross-section a modified construction of wire heddle to be referred to.

Referring to the drawings, A represents a portion of the end frame of the loom; B, the lay or crank-shaft; C, the lay; $C^{\times}$, the lay-sword operated from said shaft; C^2, the picker-stick; C^3, the breast-beam; C^4, a holding-plate having a slot for the shipper C^5 to move in and a notch to hold the said shipper in position; C^6, a weft-fork; C^7, a weft slide-bar; C^8, a weft-hammer; C^9, a cam on the shaft C^{10} to actuate the said weft-hammer; C^{11}, a driving pulley on the shaft B; C^{12}, a belt-controller mounted to slide on the rod C^{13} and actuated by the lever C^{14}, pivoted at C^{15}, it having its outer end in engagement with the shipper C^5; f^4, a rock-shaft having an arm f^3 adapted to be engaged and moved by the weft slide-bar C^7, and an arm f^5 adapted to push the shipper C^5 from its notch in the holding-plate C^4 when the said rock-shaft is rotated, all of which are and may be of any well-known or desired construction and arrangement and which may be actuated in usual manner, so they need not be herein further described.

D D′ represent the heddle frames or carriers for the heddles through which the warp-threads are passed, which heddles may be

either of thread or wire, or, in fact, of any other suitable or desired form, this invention not being restricted to any particular form or construction of heddle. I have, however, in Figs. 1 to 8, inclusive, illustrated my invention as embodying the usual thread heddle, while Figs. 9 to 13, inclusive, illustrate the invention in connection with a wire heddle.

Referring to Fig. 2, the heddle-carriers D D′ each consists of upper and lower frame-bars d d', connected at or near their ends by suitable connecting rods or bars d^2. The usual thread heddles h, having eyes h', through which the warp-threads are extended, have their lower ends passed about or otherwise secured to the lower frame-bar d', and at their upper ends said heddles are attached or hooped to the lower ends of the pins e, fitted to slide in the upper frame-bar d and the lower conducting-strip e', secured to the under side thereof, the said pins at their upper ends being provided with heads e^2 or otherwise suitably adapted to make electrical engagement with the contact-strip i, herein shown as formed to present a V-shaped surface with which the engaging ends or heads of the pins e may make electrical contact or engagement, the V-shaped surface insuring a bright contact. The pins e are moved into and retained in their uppermost or normal positions with their heads or engaging ends e^2 in electrical engagement with the contact-strip i by means of suitable springs e^3, interposed between the said heads and the conducting-strip e', through which the pins pass, (see Fig. 3,) the heddles when the pins are in their normal positions being thereby stretched taut. The conducting strip e', through which the pins e are passed, is shown extended at one side of the carrier, and is adapted to make electrical engagement with a fixed spring-contact g on the loom-frame, whenever the heddle-carrier is moved into its elevated position, while the contact-strip i, with which the pins co-operate, is also extended, preferably, at the opposite side of the heddle-carrier, and is adapted to make electrical engagement with a fixed spring-contact g', also on the loom-frame, when the said heddle-carrier is raised, the said springs being arranged in circuit with the electromagnet m on the lay, which circuit includes a battery or generator x, as best shown in Fig. 2.

Referring to Figs. 1, 4, and 5, the armature m' of the electromagnet m on the lay is carried by an armature-carrier m^2, pivoted at m^3 and herein shown as having its outer end turned to form a hook m^4, which when the armature is in its retracted position is adapted upon the forward movement of the lay to strike the downturned end of a warp-fork f, shown as pivoted at f' in the weft slide-bar C^7 and provided with a downturned or hooked end f^2, which normally lies in the path of movement of the weft-hammer C^8, but which when the warp-fork f is struck by the hook m^4 of the armature-carrier on the forward movement of the lay is raised out of the path of movement of the weft-hammer, as represented in Fig. 4. When, however, the armature m' is attracted by its magnet m, this carrier will be moved into the full-line position, Fig. 5, causing its hooked end m^4 to be caught beneath and held by a locking device n, pivoted at n' and actuated by a counter-weight n^2, such locking device being moved to release the armature-carrier just prior to the completion of the forward movement of the lay by an abutment o on the loom-frame.

Assuming that the heddle-frames D D′ are moved alternately at each pick of the loom, causing the threads controlled thereby to be moved alternately into the upper and lower planes of a shed through which the shuttle may pass, the operation of the stop-motion is as follows:

Referring to Figs. 2 and 3, as the heddle-carrier D is raised in usual manner into its position, Fig. 1, to move the warp-threads w controlled by it to form the upper plane of a shed, the tension of such warp-threads, if perfect and unbroken, will draw the heddles h through which they pass down and move the pins e into their lowermost abnormal positions, with their heads out of engagement with the contact-strip i, compressing the springs e^3, the portion of the heddles below the eyes at such times remaining slack, as represented. If, however, a warp-thread be broken, the heddle through which such warp-thread passes will not be drawn down by the tension of the thread as the heddle-carrier is raised, but will permit its spring e^3 to maintain its pin e in an elevated or normal position, as shown at the right, Fig. 3, in electrical engagement with the contact-strip i, so that when the circuit is closed between the switch-spring g and the conducting-strip e', and between the spring g' and the contact-strip i by the raising of the heddle-carrier, a complete closed circuit will be established through the magnet m, which may be traced as follows: from the battery X, Fig. 2, through the spring g', contact-strip i, through the pin e^2, which has not been moved by reason of the broken warp-thread, thence through the conducting-strip e', spring g, magnet m, and back to the battery. The magnet m will thus be energized and will attract its armature m', causing the latter to move the hook m^4 on the armature-carrier into its lowermost position, Fig. 5, where it will be caught and held by the locking device n, so that upon the next forward movement of the lay to beat in the weft the said hook m^4 will pass below the warp-fork f and fail to turn the same on its pivot, and the weft-hammer C^8 in its next forward movement will engage the hook f^2 on the said weft-fork and move the slide-bar C^7 to the right, Fig. 1, acting through the rock-shaft f^4 and its arms to move the shipper C^5 from its notch in the holding-plate C^4 to stop the loom in usual manner. The locking device n is moved by the abutment o, as illustrated by Fig. 5, to release the armature-car-

rier and permit it to resume its normal position, Fig. 4, after its hooked end m^4 has passed beyond the warp-fork f. The broken warp-thread being mended will, the next time the carrier D is raised, act to pull its pin e down away from the contact-strip i in like manner with the other unbroken warp-threads, to prevent the closure of the circuit and the stopping of the loom.

Whenever a heddle carrier or carriers is or are raised to move their warp-threads into the upper plane of the shed, the circuit through the electromagnet m is closed between the springs g g' and the conducting-strip e' and contact-strip i on the frame, but the circuit is still broken between the several pins e and contact strip or strips i, provided all the said pins have been drawn down away from their contact strip or strips by the tension of the warp-threads, the magnet m at such times remaining de-energized and its armature m' remaining in its retracted position, so that the hook m^4 of its carrier will, at each forward movement of the lay, strike the warp-fork f and turn the same on its pivot to remove its hooked end f^2 from the path of movement of the weft-hammer C^8, so that unless the weft-fork C^6 fails to be properly moved by the weft-thread the operation of the loom will be permitted to continue. As soon, however, as a warp-thread becomes broken, it will fail to act through its heddle to pull down its pin e, and will permit the latter to remain pressed against the contact-strip i on its heddle-carrier to close the circuit at this point, so that when the circuit is also closed between the springs g g' and the strips e' and i a complete closed circuit will be established from the battery through the electromagnet m, energizing the latter, causing it to attract its armature m' and move the hook m^4 of the armature-carrier into its lowermost position, where it will fail to turn the warp-fork f on its pivot at the next forward movement of the lay, the weft-hammer C^8 then acting as described to stop the loom.

Figs. 6 and 7 represent the pins e as provided with heads of slightly different shape from the heads shown in Fig. 3, and adapted to contact with the flat contact-strip $i^\times$, such construction being less expensive to manufacture than the other.

Fig. 8 represents the heddles h as attached or hooked to the opposite ends of a spring j, bent as shown, the ends 5 of the spring normally resting in electrical engagement with the contact-strip $i^\times$, from which they are withdrawn by the tension of the warp-threads upon the heddles, if such warp-threads are unbroken. Should, however, a warp-thread be broken one of the ends of the spring will remain in electrical engagement with the contact-strip, as shown at the right in Fig. 8, to close the electrical circuit.

Figs. 1 to 8, inclusive, represent my invention as employed in connection with the usual thread heddles; but said invention is well adapted for use in connection with the usual wire heddles employed extensively in fancy work, and referring to Figs. 9 to 12, inclusive, r represents wire heddles formed in usual manner and provided with eyes r', through which the warp-threads are extended, said heddles at their lower ends having loops r^2, through which is extended the lower supporting-rod R, clamped in proper position by means of bolts R' and nuts R^2, (see Fig. 9,) the loops r^2 on the said heddles being slightly larger than the rod R to permit vertical movement of the heddles with relation to the said rod.

The wires 6 of which the heddles are composed are spread at their upper ends to straddle the upper supporting-bar R^3, the wires thus spread passing upwardly through eyes 7 in a yoke 8, (shown separately in Fig. 12,) the said wires having their ends turned inwardly and down, as at 9, to form stops to limit the movement of the heddles with relation to their supporting-rods, springs 10 being interposed between the yokes 8 and the overturned ends 9 of the wires, as represented in Fig. 10, which springs act to normally raise the heddles with relation to their supporting-rods and to maintain the point of union or contact 12 of the wires 6, where they are twisted together in the formation of the heddle, in electrical engagement with a contact-strip 13 on the upper supporting-rod R^3, said supporting-rod being provided with an exterior conducting-plate 14, insulated from the strip 13 by the insulating material of the rod, and upon which the yoke 8 rests, as shown in Fig. 11.

The normal position of the heddles is as represented in Fig. 11; but when the heddle-carrier is raised to move the warp-threads controlled by the heddles of the carrier into the upper plane of a shed, the tension of the warp-threads in the eyes r' will pull the heddles down against the action of the springs 10 until the movement is stopped by the overturned ends 9 of the wires, bringing up against the yokes 8, through which said wires are passed, such downward movement of the heddles withdrawing the point of contact 12 from the contact-strip 13 and breaking the circuit at this point, so that when the circuit is closed by the springs g g', previously referred to, when the heddle-frame is raised no current of electricity will traverse the circuit to energize the magnet m. Should a warp-thread be broken, however, it will fail to pull its heddle down as described, but will permit the same to remain in its position, Fig. 11, with its point of contact 12 in electrical engagement with the contact-strip 13, closing the circuit at this point, so that when the circuit is also closed through the springs g g', as the heddle-carrier is raised a complete circuit will be established through the electro-magnet m to energize the same and effect the stopping of the loom in the manner previously described.

Fig. 13 illustrates another modified con-

struction, wherein the ends of wires 6, of which the heddle is formed, are passed through eyes in the ends of a U-shaped channel-piece 15, a spring inserted between a metallic conducting-strip 16 in the supporting-rod R^3, and the end of the U-shaped piece 15 maintaining the heddle normally in its elevated position with the point of contact 12 in electrical engagement with the contact-strip 13.

If desired the warp-fork shown may be omitted and the armature-carrier, when in its downward position, made to act directly against a lug or arm on the weft slide-bar C^7 or the armature of the magnet utilized to effect the stopping of the loom in other suitable manner.

This invention is not limited to the particular construction, arrangement, or shape of the coacting parts herein shown and described, for it is evident the same may be varied without departing from the scope of the invention, and while I have herein illustrated my invention in connection with a simple or plain loom, it is evident such invention is applicable to any form of fancy loom, for the springs g g' will be of sufficient length fore and aft to co-operate with the several projecting ends of the contact and conducting strips of all the heddle-frames in the loom, of whatever number, so that whenever any one or more heddle-frames are raised to move certain warp-threads into the upper plane of the shed, such movement of the frames will at the same time place their contact and conducting strips in electrical connection with the electromagnet or stopping mechanism to effect the stopping of the loom should any of the heddles fail to be pulled down by the tension of any of the warp-threads through them.

In the drawings the contact-strips i, Figs. 2 and 3, and the contact-strips 13, Figs. 9 to 13, constitute fixed contact-strips, while the pins e in the one instance and the metallic or wire heddles r in the other instance constitute co-operating movable contact members moved by the tension of the warp-threads on the heddles.

My invention, obviously, is not limited to devices controlled by the tension of only those threads which are to be moved into the upper plane of the shed.

I claim—

1. In a warp-stop motion for looms, the combination of the following instrumentalities, viz:—a heddle carrier; a series of heddles carried thereby; pins to which the upper ends of the said heddles are attached; springs to move the said pins to maintain the heddles taut; and a V-shaped contact strip to co-operate with the said pins, substantially as described.

2. In a warp-stop motion for looms, the combination of a series of heddles; a carrier therefor, the pins e having heads e^2, the conducting strip e', springs e^3, and contact strip i, all to operate, substantially as described.

3. In a warp-stop motion for looms, the combination of the following instrumentalities, viz:—a series of heddles; a carrier therefor; a fixed contact strip on said carrier; movable contacts actuated by the tension of the warp-threads in said heddles; stopping mechanism for the loom; an electro-magnet to control the same in circuit with said fixed contact strip and movable contacts, and a device to interrupt the circuit of said magnet periodically, substantially as described.

4. In a loom the combination of the following instrumentalities, viz:—a series of heddles, a carrier therefor; a fixed contact on the said carrier; movable contacts actuated by the tension of the warp-threads in the said heddles; a stopping mechanism; an electro-magnet to control the same arranged in circuit with said fixed and movable contacts which circuit is normally broken at a point independently of the said movable contacts, and devices actuated by the carrier when it is raised to move the warp-threads into one plane of the shed to establish the continuity of the circuit of said magnet at the said point, substantially as described.

5. In a loom, the combination of the following instrumentalities, viz:—a series of heddles; a carrier therefor; a fixed contact on the said carrier; movable contacts actuated by the tension of the warp-threads in the said heddles; the springs g, g', magnet m in circuit therewith; and a stopping mechanism controlled by said magnet, substantially as described.

6. In a warp-stop motion for looms, the combination of the following instrumentalities, viz:—a lay; a series of heddles; a carrier therefor; and mechanism to move the carrier; an electro-magnet on the lay; devices controlled by the tension of the warp-threads in the said heddles to control the circuit of said magnet; an armature for the magnet, and a fork actuated thereby, substantially as described.

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

OBERLIN SMITH.

Witnesses:
JAMES J. REEVES,
HUGH L. REEVES.