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Patented Aug. 15, 1899.

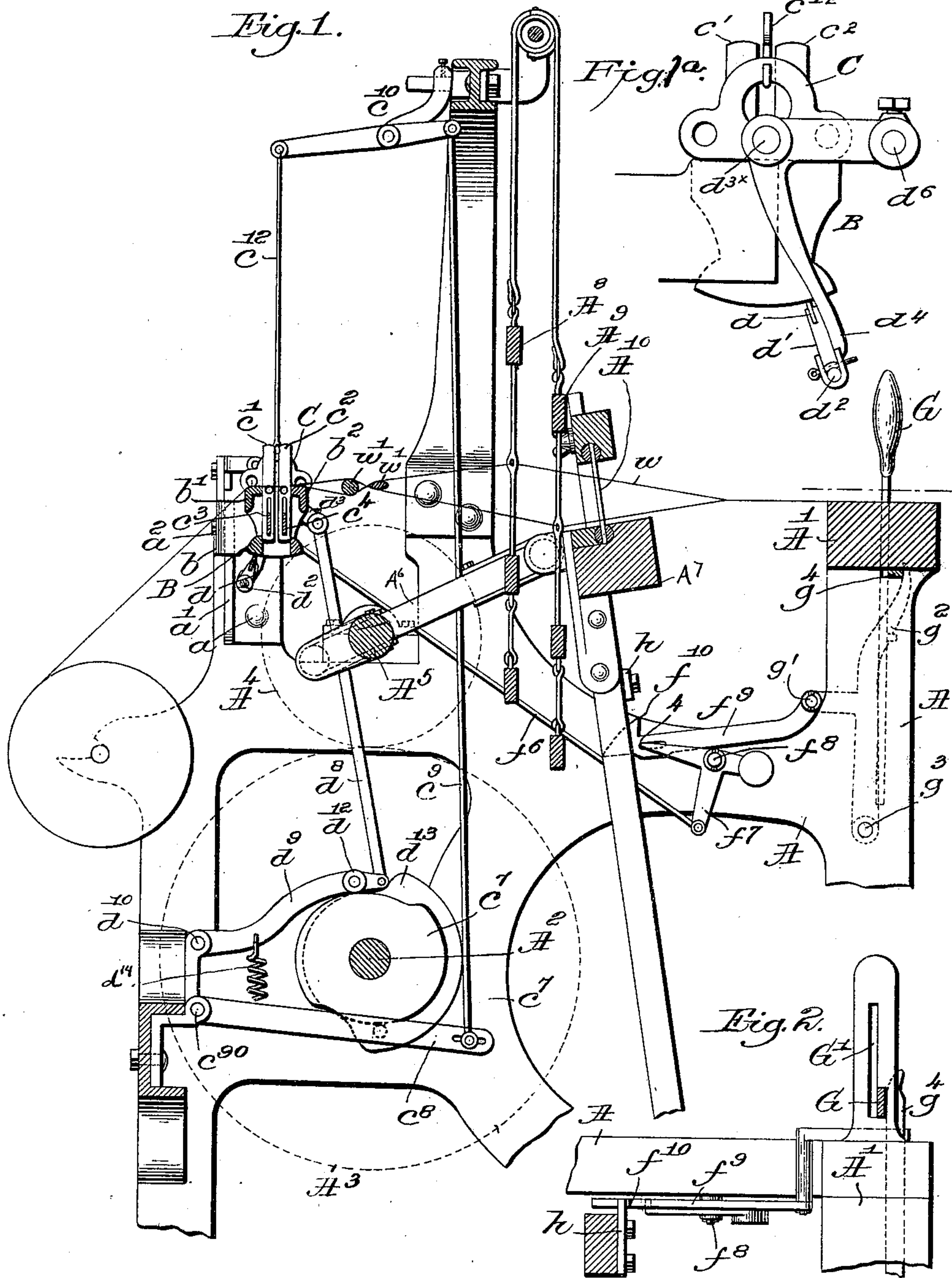
H. WYMAN.

WARP STOP MOTION FOR LOOMS.

(Application filed July 23, 1898.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses:
Fred S. Grunkef.
James W. Wigham.

Inventor:
Horace Wyman.
By Wesley Gregory,
attys.

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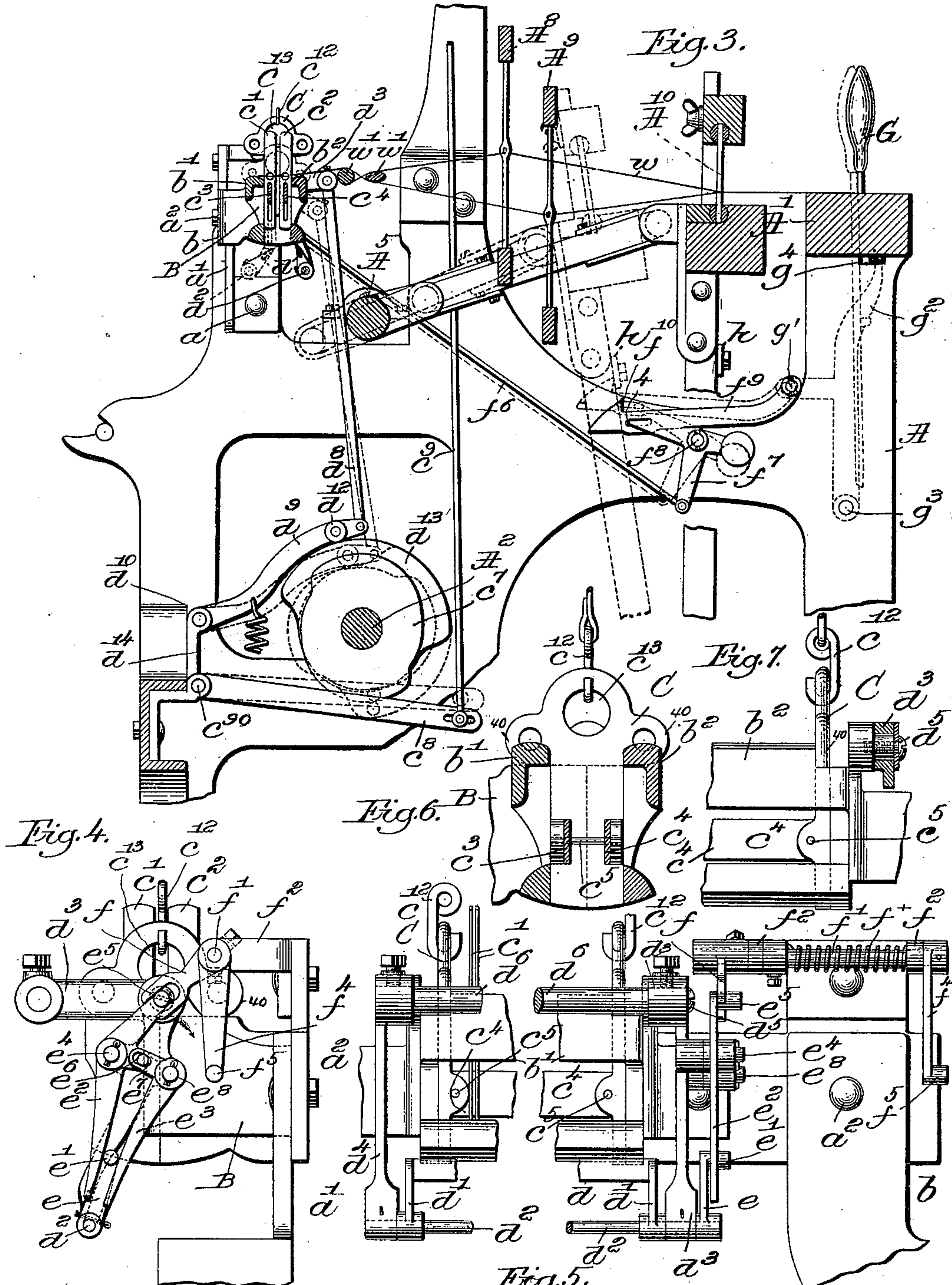
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witnesses:
Fred S. Grunke.
James W. Wigham.

Inventor:
Horace Wyman.
by *Henry H. Rogers* Attys.

UNITED STATES PATENT OFFICE.

HORACE WYMAN, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO THE
CROMPTON & KNOWLES LOOM WORKS, OF SAME PLACE.

WARP STOP-MOTION FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 631,242, dated August 15, 1899.

Application filed July 23, 1898. Serial No. 686,660. (No model.)

To all whom it may concern:

Be it known that I, HORACE WYMAN, of Worcester, county of Worcester, State of Massachusetts, 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 and figures on the drawings representing like parts.

10 In the loom herein to be described the warp-threads are shown as led through eyes of drop devices located near and preferably back of the harness-frames, said devices being entirely independent of said frames and the lay, there being preferably one row of drop devices for each half of the warp, said drop devices being slightly separated at their upper ends. The feeler-rail cooperating with said drop devices is adapted to be moved in one direction during one full forward-and-backward stroke of the lay and in the opposite direction during the next full stroke of the lay, said feeler-rail starting, preferably, to move in one direction immediately after the reed operates at the fell of the cloth. As herein shown, the feeler-rail in its back stroke following the stroke of the reed at the fell, feels for a drop device between it and the warp-beam, and after the next stroke of the reed at the fell the feeler-rail is moved toward the breast-beam and feels for a drop device between it and the breast-beam, such arrangement enabling the parts of the frame between which the drop devices slide to receive against them the pressure of the drop devices when the feeler-rail acts against them.

The feeler-rail is shown as connected with a rock-shaft mounted in suitable movable bearings, said rock-shaft having a projecting arm which is normally acted upon by an initiatory device connected to and moving in unison with an actuator shown as a rocker-arm, said initiatory device keeping the feeler-rail in substantially upright position and permitting it and its shaft to swing freely to and fro under the drop devices so long as the drop devices occupy their normal position; but as soon as a drop device comes into its abnormal position the feeler-rail in its movement meets the drop device and is arrested thereby, the arrest of the movement of the

feeler-rail causing the initiatory device to have imparted to it a secondary motion, so that it, through a suitable intermediate connection and shipper-releasing means, will effect the release of the usual shipper handle or device to stop the loom in usual manner.

The rocker-arm referred to as carrying the initiatory device is pivoted above the lower ends of the drop devices when in their normal position and between the two rows of drop devices, and said rocker-arm is joined by a rod with a second rocker-arm at the opposite side of the warp.

The initiatory device referred to has two motions, one in unison with the rocker-arm carrying it, as when the drop devices are in their normal position, the other or secondary motion being on or with relation to the rocker-arm after the arrest of a drop device in its abnormal position, the secondary movement of the initiatory device being requisite to start in motion the intermediate connection which controls the release of the shipper-handle or equivalent device.

I have added to a warp stop-motion using drop devices arranged side by side on a stringer-bar means to control the vertical position of the drop devices, whereby they may be lifted and sustained independently of the warp-threads during a portion of the time, the drop devices so suspended relieving the warp-threads from the weight of the drop devices and the strain and wear due to the friction or rubbing of the eyes of the drop devices against the threads, said drop devices being, however, permitted to descend at predetermined intervals, so that each drop device may feel by the upper edge of its eye portion for the thread which should be extended in said eye; but in case a thread should be broken or unduly slack the drop device which is not supported by the thread will continue its descent, and its lower end will stop in the path of movement of the feeler, arresting it and imparting secondary motion to the initiatory device to stop the loom.

As one form of shipper-releasing means I may employ an elbow lever or device, operatively joined with an intermediate connection actuated by the initiatory device, and a hooked lever jointed to an upright lever piv-

oted at the loom side and acting at its free end against a lever pivoted at the under side of the breast-beam, the latter lever when moved effecting the release of the shipper.

5 The movement of the elbow lever or device by the initiatory device puts the hooked end of the hooked lever in position to be struck by a projection which may be carried by or be moved in unison with the lay.

10 The loom-frame is provided with a guide extended across the loom, said guide presenting at its upper side bars to constitute a rest for the warp-threads, said bars occupying a position preferably in front of and behind the
15 drop device, said bars serving to support the warp-threads which are acted upon by the drop devices. These drop devices, entirely independent of the harness or shed-forming mechanism and of the lay, instead of being
20 continuously suspended on or by the unbroken warp-threads are temporarily lifted in the operation of the loom by suitable devices to be hereinafter described, such lifting of the drop devices removing the weight and
25 friction of said devices, at intervals during the running of the loom in weaving, from the warp-threads, this lifting taking place, preferably, when the warp-threads are subjected to substantially their greatest strain in weaving.
30 When the drop devices are lifted, as described, the threads in their eyes stand, preferably, substantially central with relation to said eyes, and said threads rest, as herein represented, upon the bars of the guide in front
35 of and back of the drop devices. These drop devices, however, are permitted to descend intermittently during the running of the loom to feel for and detect any breakage in the warp, and when said drop devices so descend
40 should a warp-thread be broken or too slack the drop device not properly supported by a warp-thread will continue its descent and will finally stop in the range of movement of a suitable feeler or feeler-bar, to be described,
45 and will arrest the movement of said feeler, thereby effecting automatically the release of the shipper and the stopping of the loom.

Figure 1, in cross-section, shows a sufficient portion of a loom with my improvements
50 added to enable my invention to be understood. Fig. 1^a is a detail showing one of the rocker-arms carrying the rock-shaft of the feeler, together with part of the guide supporting one end piece of a carrier sustaining the drop devices, said guide having extended
55 from it a pivot for the said rocker-arm. Fig. 2 is a partial top view of one corner of the loom to show the shipper-handle-holding plate and the dagger. Fig. 3, in full lines, represents a similar view to Fig. 1 with the lay in its upright position, the dotted lines showing the lay back and a drop device in its abnormal position to be struck by the feeler-rail. Fig. 4 shows a right-hand end view of
65 the guide, one end of the carrier therein, the actuator or rocker-arm for moving the feeler-rail, and the initiatory device carried by said

rocker-arm. Fig. 5 is an enlarged front elevation of the parts represented in Fig. 4, said parts being partly broken out to economize
70 space on the drawings. Fig. 6 is an enlarged partial section of the guide and end piece of the carrier; and Fig. 7 is a partial view of one end of the guide supporting the carrier, together with part of a rocker-arm for moving
75 the feeler and the link for moving said rocker-arm.

The loom-frame A, its breast-beam A', the lower or cam shaft A², having a toothed gear (indicated by the circle A³) engaging a toothed
80 gear A⁴, (also indicated by a circle,) fast on the crank or lay shaft A⁵ for operating the pitman A⁶, connected with and moving the lay A⁷, the harness-frames A⁸ and A⁹, for forming the sheds in the warp w, and the reed A¹⁰, carried by the lay to beat the weft in at the fell,
85 and the shipper handle or device G, are and may be all substantially as usual in looms, and said shipper-handle will have coöperating with it any usual or suitable belt shipping or stopping mechanism, whereby when
90 said handle or device is knocked out of its usual holding notch by the arrest of the feeler by a drop device in abnormal position, as will be hereinafter described, said loom will
95 be stopped.

The end frames of the loom at or near its rear side have connected to them by suitable bolts a suitable stands a', which receive
100 bolts a², said bolts being passed through suitable ears b at the ends of and forming part of a guide B, shaped to present two bars b' b², extended substantially parallel across the loom, said bars constituting a rest for the warp, as herein shown, back of the usual
105 lease-rods W'. Coöperating with said guide and in the space between the bars thereof I have placed a series of drop devices c' c², mounted on stringer-bars, the ends of which are sustained by a suitable support or carrier, said drop devices being shown herein as
110 separated in two rows simply to accommodate a larger number of warp-threads. The stringer or lifter bars c³ and c⁴, one for each set or row of drop devices, are shown as sustained by the end pieces C C of a stringer-bar support or carrier, and they are represented as connected therewith in a detachable
115 manner by a pin c⁵, and each series of drop devices, as herein shown, receives one-half of the warp-threads, and each drop device has, as shown, two suitable eyes or openings, one for a warp-thread and the other for a stringer or lifter bar.

The end pieces C of the support or carrier
125 may be shaped to present suitable ears or shoulders 40 to, as herein shown, rest upon the bars b' b², to thereby determine the lowest position of the stringer or lifter bars as the drop devices descend to feel for the warp-
130 threads in their eyes or openings, said stringer-bars continuing to descend somewhat after the drop devices in their downward motion to feel for the threads in their eyes meet said

threads, the stringer or lifter bar descending until they break contact with the upper ends of the openings in the drop devices, leaving said drop devices supported wholly by unbroken warp-threads, as represented by the drop device c^2 in Fig. 3; but during the descent of a stringer-bar to enable the drop devices to feel for the warp-threads in their eyes or openings should a warp-thread be broken the drop device coöperating with it may descend to a lower position than the drop devices supported by unbroken warp-threads, and in such position the upper end of the opening in the drop device surrounding the stringer-bar, as shown by the drop device c' on the bar c^3 , will meet and sustain the said drop device c' in its lowest position, and in such lowest position the end of said drop device c' will be in position to be acted upon by a moving feeler, said drop device arresting the movement of the feeler and effecting the stopping of the loom.

As heretofore employed, eyed drop devices have been continuously suspended on or by the unbroken warp-threads, and the upper ends of the slots therein through which the stringer-bars are extended then stand normally above the upper edge of said bar. The support or carrier is free to be moved vertically between the bars b' b^2 . To move this carrier up and down, I have provided the loom with carrier-actuating means whereby said carrier for a considerable period of the time of the loom may be kept raised, so that the stringer-bars will occupy such position as to act upon the upper ends of the elongated slots through which they are extended and lift each of the drop devices, so that they will be put in a position substantially as represented in Fig. 1, wherein it will be seen that the warp-eyes of said devices will be so located with relation to the horizontal plane intersecting the upper edges of the two bars b' b^2 , that the warp-threads resting on said bars will stand substantially central in said warp-eyes, and in such position the upper sides of said eyes will not bear by their weight on the threads, nor will the undersides of the eyes rub against the under sides of the threads. The carrier is made to occupy an elevated position while the reed beats the filling into the fell, at which time the strain upon the warps is apt to be the greatest, and the warps are more liable to be broken; but the carrier is lowered at intervals during each complete stroke of the lay in order that the upper edges of said eyes may settle on and feel for the warp-threads extended therethrough, and in case a warp-eye is devoid of a warp-thread then that particular drop device from which the warp is absent will drop into position to be acted upon by the feeler-rail. This provision for relieving the warp-threads from the strain of the weight of the drop devices for a portion of the operation of the loom is of very considerable importance in reducing the frequency of warp-breakage.

The means herein shown for raising and lowering the stringer bar or bars and their supports consists, essentially, of a cam c^7 , fast on the usual under shaft A^2 , it acting on a lever c^8 , pivoted at c^{90} on a fixed part of the loom-frame, a connecting-rod c^9 , extended up to a rock-shaft c^{10} , having suitable arms, with one of which said rod is attached, the other arms of said rock-shaft receiving links c^{12} , which are represented as engaging eyes c^{13} of the end pieces of the support or carrier, so that said stringer bar or bars may have imparted to it or them a slight rising-and-falling movement in said guide, it being kept elevated for any desired length of time of the loom, that being determined by the shape of the cam c^7 . The drop devices feel, as stated, for the presence of the warp-threads in their eyes between successive picks.

Instead of the particular means for moving intermittently the independent drop devices to at frequent intervals relieve the warp-threads from strain and friction due to the weight of said drop devices I may employ any other usual or suitable means for such purpose, as I believe myself to be the first to lift a series of drop devices mounted on a vertically-movable stringer-bar independent of the shed-forming or harness mechanism to thereby lift said devices and remove their weight from the warp-threads extended through the openings of said drop devices and to then by the descent of said stringer-bar enable said drop devices to contact with and be sustained by unbroken warp-threads before said stringer or lifter bar completes its descent, whereby in case a warp-thread is broken the detector which coöperates with it will be permitted to descend into its abnormal position below the adjacent drop device sustained by unbroken warp-threads, said drop device in its abnormal position being met by a feeler which will effect the stopping of the loom, and hence the particular means used for such purpose is immaterial.

The feeler-rail d is carried upon arms d' , extended from a rock-shaft d^2 , said rock-shaft being herein shown as having bearings near its opposite end in extensions of rocker arms or levers d^3 d^4 , (represented as of elbow shape.)

The rocker arms or levers constituting actuators (see Figs. 5 and 1^a) are adapted to turn each about a like stud or pivot d^{3x} , said studs or pivots constituting the fulera for said arms.

These studs extend horizontally from opposite ends of the guide B, before described, and said studs or pivots are located above the lower ends of the drop devices when in their normal positions and within the space between the two sets of drop devices, such location of the said pivots or fulera insuring the proper sweep for the rocker-arms and enabling the feeler to be moved in a very small space between the lower end of the guide and the warp-beam, which latter may consequently

be arranged close to the guide. The rocker-arms constitute a support for the feeler rock-shaft.

The rocker arms or levers d^3 d^4 are connected across the loom by a rod d^6 , which receives upon it the upper end of a link or connection d^8 , joined to a radius-bar d^9 , pivoted at d^{10} on a fixed part of the loom-frame, said bar having a roller or other stud d^{12} , which is acted upon by a cam or equivalent device d^{13} , fast on the shaft A^2 , said bar having connected to it a spring d^{14} , which normally acts to keep the roller or other stud of said bar in contact with said cam or equivalent device. This cam, through the radius-bar and connection referred to, vibrates the rocker arms or levers in unison, and, as herein represented, the rock-shaft of the feeler-rail carried by said arms, together with the rail, is swung to and fro under the lower end of and close to the guide B until the said feeler-rail is arrested by a drop device in its abnormal position.

The rock-shaft carrying the feeler-rail has attached to it near one end an actuating-arm e , having a projection e' .

One of the rocker-arms or elbow-levers carries what I have herein designated as the "initiatory" device, meaning thereby a device which during the rocking motion of the rocker-arms, the drop devices being in their normal position, is moved only in unison with the rocker-arms; but when the feeler-rail is arrested by a drop device in its abnormal position then said initiatory device has imparted to it a secondary motion—that is, an independent motion on or with relation to the moving rocker-arm. This secondary movement of the initiatory device acts through a suitable intermediate connection, to be described, which will start and move suitable shipper-releasing means and effect the release of the shipper-handle and stop the loom.

I have herein shown the initiatory device as composed of a lever e^2 of the first order, mounted on a stud e^4 , carried by the rocker-arm d^3 , said lever having a cooperating part or device e^2 , shown as an elbow-lever mounted on a stud e^8 , also carried by the rocker-arm d^3 , said lever of the first order and its cooperating device e^3 being united by a pin-and-slot connection, the pin (represented as e^6) being shown as carried by the lever e^2 , the slot e^7 being made in a short arm of the part or device e^3 . The upper end of the lever e^2 normally occupies a position substantially in line with the pivot or fulcrum d^{3x} for the elbow-lever d^3 , and, as herein represented, said lever in order that it may be operatively joined with the intermediate connection to be described, has a stud e^5 , which stands horizontally in line with the pivot or fulcrum d^{3x} .

The intermediate connection herein shown consists, essentially, of a rock-shaft f' , having at one end an arm f , (represented as slotted to embrace the stud e^5), said rock-shaft being mounted in a suitable yoke f^2 , sup-

ported in a suitable stand fixed with relation to the guide B, said rock-shaft being surrounded by a suitable spring, as f^x , said spring, acting through said shaft and arm f , serving the purpose of normally keeping the upper end of the lever e^2 in its normal position with relation to said rocker-arm—that is, with the upper end of the lever substantially central to the pivot d^{3x} , and in this condition the lower end of the lever is maintained in contact with the projection e' , extended from the arm connected with the feeler-rail, and at the same time, with the lever e^2 in this position, the part or device e^3 bears against the opposite side of said projection.

The intermediate connection consists, further, of an arm f^4 , connected to the outer end of the rock-shaft f' , said arm having suitably connected with it, as by a projection f^5 , which serves simply as a connecting means, a rod f^6 , said rod actuating one form of shipper-release, it consisting, as shown, of a weighted three-armed lever f^7 , pivoted at f^8 , said lever having a suitable pin entering a slot 4 in a dagger f^9 , pivoted at g' on a lever or arm g^2 , in turn pivoted at g^3 at the loom side, the upper end of said lever g^2 when moved meeting a lever g^4 , arranged horizontally under the breast-beam, the movement of said lever releasing the shipper-handle G from its usual holding-notch in the plate g' . The intermediate connection terminates with the rod f^6 , it constituting the chief essential element of the said intermediate connection, and these elements may be changed and modified without departing from my invention.

The dagger f^9 has a hook or projection f^{10} , (see Fig. 1,) which when elevated may, as herein shown, be engaged by a suitable projection h , carried, as represented, by the lay, or instead thereof I may use any suitable moving device actuated in unison by or with the lay to engage the dagger at the proper time and cause it to be moved to release the shipper-handle from its usual holding-notch to stop the loom. The particular construction of the stop mechanism is immaterial, and instead I may use any other usual or suitable devices.

As stated, the feeler-rail is moved to and fro in the arc of a circle under the path of movement of the drop devices, and so long as said drop devices are in their normal positions the said feeler-rail is not arrested and the rocker-arms and the attached initiatory device in contact with an arm extended from the feeler rock-shaft are moved to and fro in unison and the intermediate connection stands in its normal position. Should, however, a drop device, due to breakage of a thread in its eye, descend into its abnormal position in the path of movement of said feeler-rail, the latter will be obstructed and arrested by the descended drop device. Should the feeler in moving backwardly toward the rear end of the loom meet a drop device in its abnormal po-

sition, (see dotted lines, Fig. 3,) the feeler will be arrested, but the rocker-arms will continue to move, carrying with them the feeler rock-shaft, and the projection e' of the arm e at the end of the rock-shaft will also be arrested, and consequently as the rocker-arms continue their movement the lever e^2 of the initiatory device, owing to its contact with arm e , then stopped, will have imparted to it a secondary movement about its pivot, which will cause the upper end of the lever e^2 to be moved into a position eccentric with relation to the stud or pivot d^{3x} , and this secondary movement of the initiatory device will cause its upper end, through the pin or stud e^5 or other equivalent suitable medium operatively joining said lever with the arm f of the intermediate connection, to start said intermediate connection in motion and cause the rod f^6 , forming a part thereof, to turn the lever f^7 , lift the dagger f^9 , and put it in position to be engaged by the projection h , before described, to effect the release of the shipper-handle and stop the loom. During this operation of the lever e^2 its lower end remains in contact with a projection e' , but the part or device e^3 retires from contact with the said projection e' . Should, however, the feeler-rail meet a drop device while said feeler is moving from the position Fig. 1 forward toward the breast-beam, (see dotted lines, Fig. 3,) then in such case the stopping of the feeler and its connected projection e' will first act upon the part or device e^3 of the initiatory device, holding it so that it cannot follow in unison with the rocker-arm, but will turn about its own pivot on said arm, such movement of the part or device e^3 turning the lever e^2 of the first order about its pivot and imparting to it its secondary motion, hereinbefore referred to, causing the intermediate connection described to be started in motion to effect the release of the shipper-handle.

From the foregoing it will be understood, so long as the feeler-rail is unobstructed, that the initiatory device will operate at one end upon the pin or projection e' of the feeler-rail, extended from the feeler rock-shaft, and the upper end of the lever e^2 of said initiatory device will stand coincident with the pivots d^{3x} of the rocker arm or lever, and as the said rocker arm or lever is moved to and fro the initiatory device will have only a movement in unison with said arm; but whenever, for any reason, a drop device falls and is struck by the feeler and the feeler is arrested then instantly the initiatory device is given its secondary motion to effect the release of the shipper handle or device and stop the loom. As stated, the independent drop devices have imparted to them intermittingly a rising-and-falling motion in the operation of the loom to thus relieve the warp-threads from their weight during part of the movement of the loom, and the said drop devices are permitted to descend and feel for the warps in their eyes, and in case said warps are ab-

sent or slack in said eyes then said drop devices have a further descending movement and fall and come into their abnormal position, where they are met by the feeler-rail, and the movement of the latter is arrested to stop the loom.

Fig. 1 shows the lay on its back stroke and the stringer-bars in their lowest position, the drop devices feeling for the warp-threads extended through their eyes, and at this time it will be understood that the warps may be subjected to their least strain; but at this time should a warp be absent or unduly slack in an eye of a drop device said drop device will not be held up by said warp-thread and will drop into its abnormal position, where it will serve to arrest the feeler and stop the loom. Fig. 3, however, by full lines shows the lay in its forward position and the stringer-bars elevated to at such time remove from the warp-threads the weight of the drop devices, so that the said threads are relieved from the usual strain due to the weight of said devices, and the warp-threads stand substantially central in the eyes of said drop devices, this position being that preferably when the warps are subjected to the greatest strain in weaving.

The rocker-arm d^4 , (shown in Fig. 1^a,) inasmuch as it does not carry an initiatory device, does not contain studs, such as e^4 and e^8 , common to the rocker-arm d^3 ; but said rocker-arm has a depending arm, which receives one end of the rock-shaft d^2 , carrying the feeler.

It will be obvious that the upper end of the lever e^2 might be provided with a hole to receive a stud extended from the arm f , such method of connecting the initiatory device with a part of the intermediate connections being the equivalent of the stud. The rocker-arm d^3 constitutes an actuator for said initiatory device. The initiatory device is represented as a compound lever, the ends of which contact with the pin or projection e' , connected with or forming part of the arm extended from the feeler rock-shaft, and the ends of the two levers may be moved toward or from each other and said pin or projection, as required, one lever moving the other.

I have herein shown and described a rocker-arm carrying an initiatory device which is turned by arresting the feeler mounted on the feeler rock-shaft to stop the loom; but herein said initiatory device and a rocker-arm carrying it and devices intermediate said initiatory device and the shipper-handle are not claimed, broadly, for the reason that they are made the subject-matter of other applications, Serial Nos. 703,959 and 703,960, filed January 3, 1898, said applications containing broad claims for a rocker-arm or actuator and an initiatory device the movement of which on or with relation to the actuator starts into operation devices for effecting the release of the shipper-handle or other device to stop the loom when a drop device is in its abnormal position.

The drawings herein represented illustrate the stringer or lifter bars and drop devices sustained in such manner that they may, if desired, be readily removed from the loom to facilitate threading into the warp-thread-receiving openings of the drop devices warp-threads from a warp-beam to be put into the loom; but no claim is herein made for such contrivance.

Herein I have shown pivoted upon the actuator a lever device which I have in another application, Serial No. 703,960, filed on the 3d day of January, 1898, shown and described specifically, and in yet another application, Serial No. 703,959, filed on the 3d day of January, 1898, I have shown a lever of a simpler form, which is therein claimed broadly.

Herein the levers e^2 and e^3 are not claimed, broadly, for the reason that the invention contained in said levers is made the subject of claim in said application Serial No. 703,960, the only claim in this application in which the levers appear being a limited one, wherein the rock-shaft carrying the feeler is mounted in bearings at the lower ends of elbow-shaped actuators.

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

1. In a warp stop-motion for looms, a series of slotted drop devices, a stringer or lifter bar upon which they are mounted, and a support for said bar independent of the harness-moving mechanism and lay, a feeler-rail, and means to move it to meet a drop device in its abnormal position, combined with means to raise and lower said stringer-bar intermittently and independently of the harness or shed forming mechanism and lay during the operation of the loom, substantially as described.

2. In a warp stop-motion for looms, a stringer or lifter bar support located back of the reed, a stringer or lifter bar, and a series of drop devices mounted on said bar, said support and drop devices being also independent of the harness-moving mechanism, a feeler-rail, and means to move it; combined with means to raise and lower said stringer-bar and its drop devices intermittently, substantially as described.

3. In a warp stop-motion for looms, a stringer-bar provided with drop devices, and a support for said stringer-bar independent of the harness-moving devices and reed; combined with means to automatically raise and lower the said stringer-bar and drop devices during the operation of the loom, to intermittently relieve the unbroken warp-threads from the strain of said drop devices, substantially as described.

4. In a warp stop-motion for looms, a stringer-bar, means to support it, a series of slotted drop devices entirely independent of the harness-moving devices and strung on said stringer-bar, said drop devices receiving warp-threads; combined with means to operate the support for the stringer-bar to raise

and lower said bar intermittently during the operation of the loom to thereby temporarily relieve the warp-threads from the weight of the drop devices when the warp-threads are subjected to considerable strain.

5. In a warp stop-motion, a stringer-bar, a series of drop devices slotted to embrace said bar, means to raise said stringer-bar intermittently to relieve the warp-threads from the weight and strain of the drop devices, and to then lower said stringer-bar and drop devices, enabling the eyes or openings in the latter to meet and feel for and be supported by unbroken warp-threads, such drop devices as are not properly supported by the warp-threads descending into abnormal position, and stop-motion means for the loom operated by a drop device in its abnormal position, substantially as described.

6. In a warp stop-motion, a stringer-bar, a support therefor, a series of drop devices mounted on said stringer-bar, said drop devices having slots of greater length than the width of said bar, said drop devices having each an opening for a warp-thread, means to move said stringer-bar and its drop devices in position to enable the drop devices to rest on unbroken warp-threads and to then lift said stringer-bar, causing the latter to meet the upper ends of the slots in the drop devices and lift them temporarily from the warp-threads when the latter are subjected to strain in weaving, to thereby relieve the strain on the warp-threads.

7. In a warp stop-motion for looms, a series of drop devices each having slots or openings to embrace a stringer-bar, and an opening for the reception of a warp-thread; a stringer-bar independent of the harness-moving devices and of a width less than the length of the slot in said drop devices, and actuating means to impart motion intermittently during operation of the loom to said stringer-bar and its drop devices, whereby at times during the operation of the loom the drop devices have their weight removed from the warp-threads, and at other times they are lowered to feel for and detect the absence of a warp-thread in their eyes or openings, and to thereafter descend into abnormal position in case a warp-thread is broken, and stopping mechanism operated by a drop device in its abnormal position to stop the loom.

8. In a warp stop-motion for looms, a guide located back of the reed and outside the harness-moving devices, a stringer-bar, a series of drop devices mounted thereon, a feeler-rail, and means to move it, combined with means to raise and lower said stringer-bar and its drop devices intermittently in unison with the movement of the feeler-rail, to at times relieve the warp-threads from the weight of the drop devices, said feeler-rail being moved freely under said drop devices when in their normal positions, said rail being arrested to stop the loom whenever a drop device is in its abnormal position.

9. In a warp stop-motion for looms, a series of slotted drop devices, a stringer-bar upon which they are mounted to slide vertically, actuating devices to raise and lower said stringer-bar to relieve the entire series of warp-threads from the weight of the drop devices, and to then lower said stringer-bar that the drop devices may descend and feel for warp-threads in their eyes or openings, the drop devices which are sustained by unbroken warp-threads descending only into their normal positions, the drop devices not sustained properly by warp-threads descending into their abnormal positions, and stopping mechanism for the loom actuated by a drop device in its abnormal position.

10. In a warp stop-motion for looms, drop devices arranged in different vertical planes and each provided with a warp-receiving eye or opening and a slot, said eyes or openings receiving through them warp-threads, and the slots stringer-bars; combined with a plurality of sets of stringer-bars narrower than the slots through which they are extended in the drop devices, means for raising and lowering said stringer-bars intermittingly to at times relieve the entire series of warp-threads from the weight of the drop devices and at other times to let said drop devices descend to feel for the threads which should be in their eyes, and in case said threads are absent said drop devices descend into a yet lower position, and a feeler, and means controlled by the same when arrested by a drop device in abnormal position, to stop the loom.

11. In a warp stop-motion for looms, a series of slotted drop devices receiving warp-threads, a stringer-bar to sustain said drop devices in their abnormal position, said devices when sustained by unbroken taut warp-threads standing in their normal position, rocker arms or levers having at their ends bearings, a feeler rock-shaft sustained in the bearings of said rocker-arms and provided with a feeler, an extension from said feeler rock-shaft, means carried by one of said rocker-arms and movable in unison therewith to cause the feeler to be moved to and fro with said rocker-arms while the drop devices are in their normal positions, said means being moved on or with relation to the rocker-arm carrying it whenever the feeler is arrested by a drop device in abnormal position to thereby effect the stopping of the loom.

12. In a warp stop-motion for looms, a series of drop devices slotted at their lower ends and having above said slots warp-thread-receiving eyes, a rest for the warp-threads adjacent said drop devices, a stringer-bar occupying a position below said rest and the level of the warp at said rest, said bar being narrower than the slot in the drop device in which it stands, combined with means to raise and lower said stringer-bar, whereby said drop devices located in a vertical plane adjacent said rest, when said stringer-bar is in its lowered position, rest on and feel for the threads in their eyes, and when in its raised position the drop devices are all lifted to relieve the warp-threads of their weight, a drop device not supported by a warp-thread in the lowest position of the stringer-bar descending into its abnormal position, and means coöperating with the drop device in abnormal position to stop the loom.

13. In a warp stop-motion for looms, a constant rest for the under side of the warp-thread, said rest being located behind the open shed, a plurality of stringer-bars located below the said warp-rest, a plurality of series of drop devices each having a slot at its lower end of a length greater than the width of the stringer-bars and strung on said bars, and each having above said slots a warp-thread-receiving eye, said drop devices surrounding the warp-threads near said rest, means to raise and lower said stringer-bars in unison, the upper edges of said bars when raised meeting the upper ends of the slots in the plurality of series of drop devices and lifting them in unison to remove the weight of said drop devices from the warp-threads, the lowering of said bars permitting the drop devices to descend on and be sustained wholly by unbroken warp-threads, drop devices not sustained by warp-threads when said bars are being lowered descending into abnormal position, and stop-motion mechanism started into operation by a drop device in abnormal position to stop the loom.

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

HORACE WYMAN.

Witnesses:

JUSTIN A. WARE,
JOHN B. SYME.