(No Model.)

3 Sheets—Sheet 1.

M. F. FIELD.

WARP DRAWING-IN MACHINE.

No. 600,670 Patented Mar. 15, 1898.

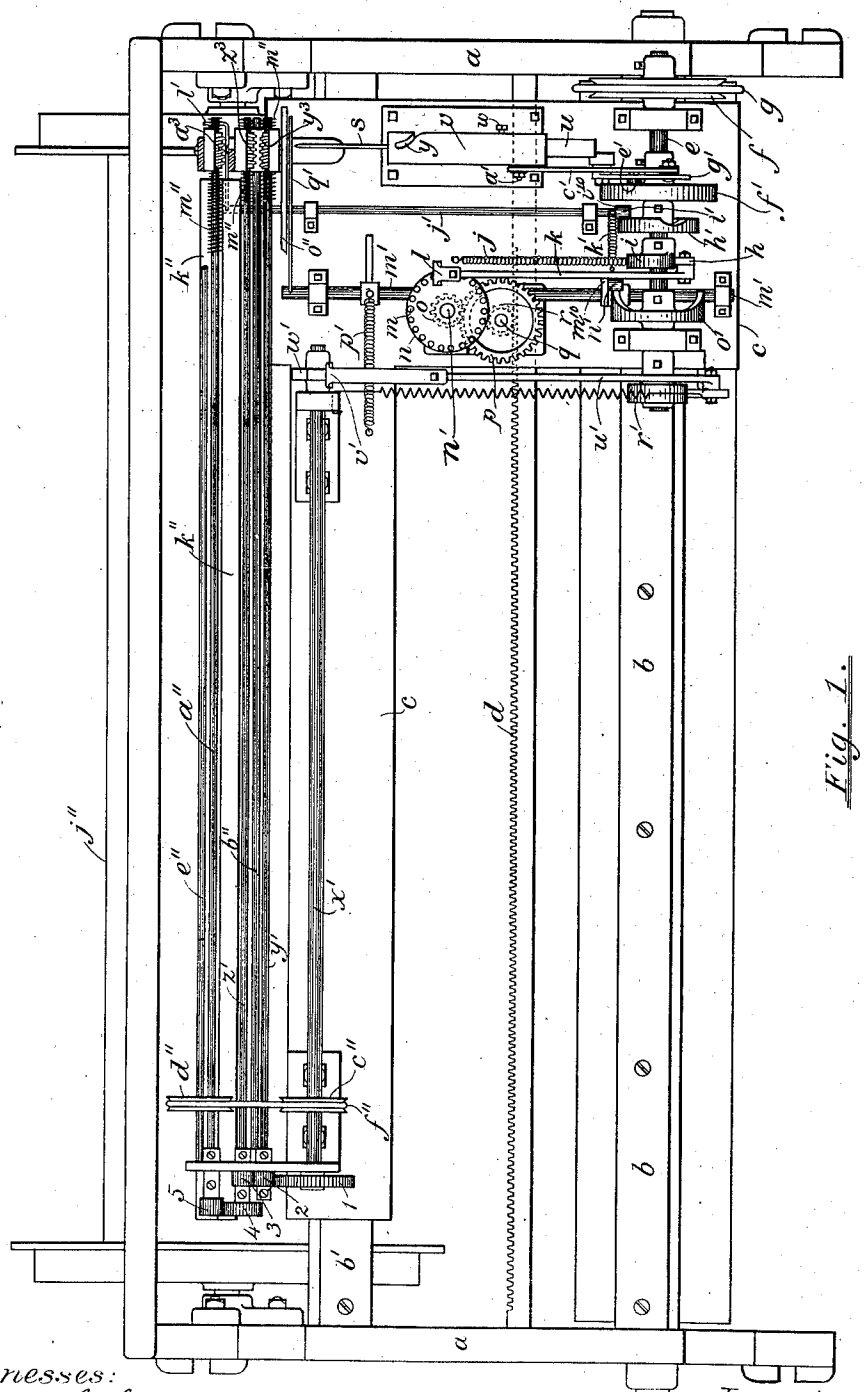


Fig. 1.

Witnesses:
Saml G. Stephens.
Charles V Blocker.

Inventor:
M. F. Field,
By Crosby & Goddard,
Attys.

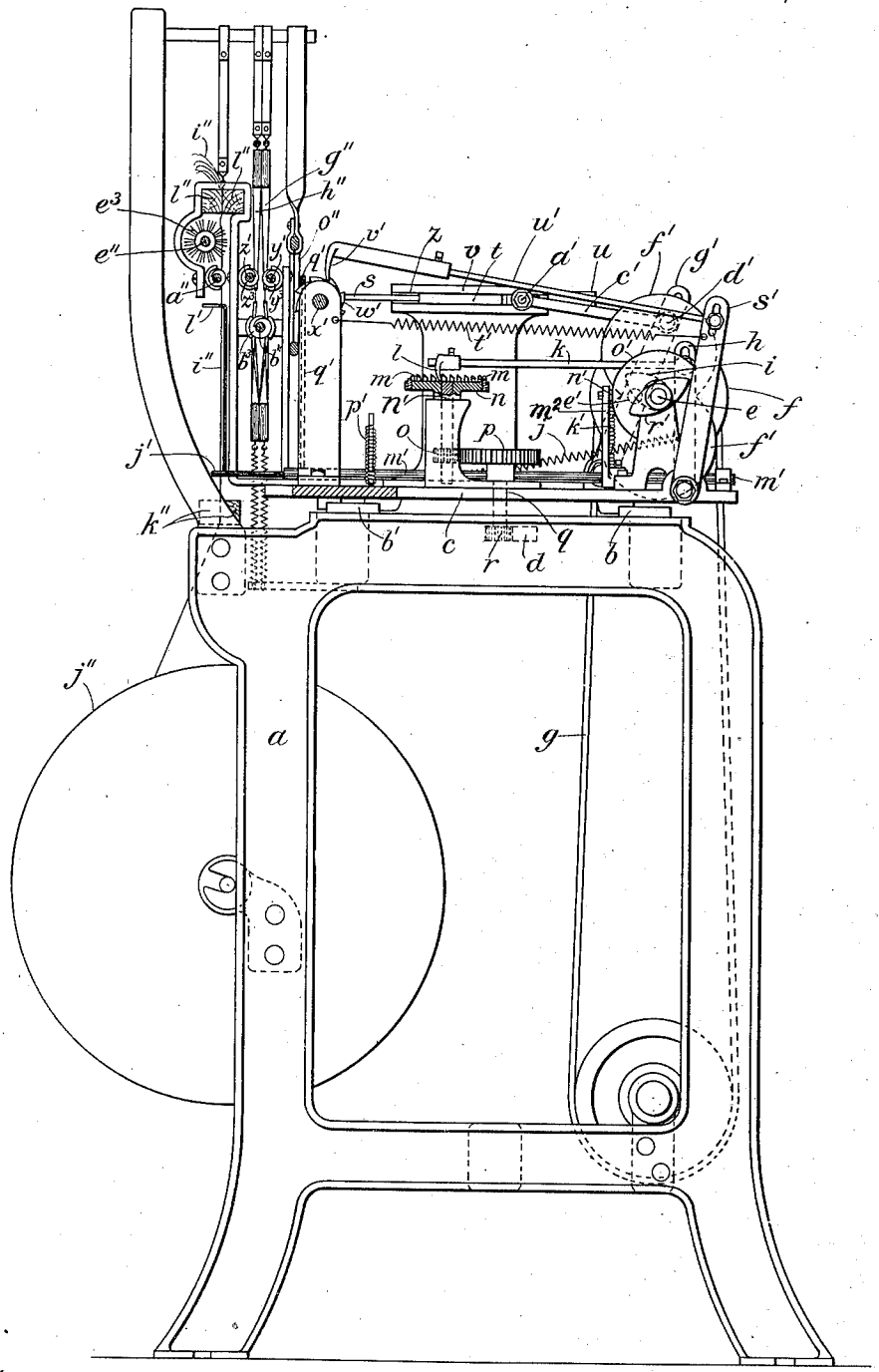
(No Model.)

3 Sheets—Sheet 2.

M. F. FIELD.

WARP DRAWING-IN MACHINE.

No. 600,670 Patented Mar. 15, 1898.



Witnesses:
Saml G. Stephens.
Charles B. Crocker.

Fig. 2.

Inventor.
M. F. Field.
By Crosby & Goddard,
attys.

(No Model.)

3 Sheets—Sheet 3.

M. F. FIELD.

WARP DRAWING-IN MACHINE.

No. 600,670. Patented Mar. 15, 1898.

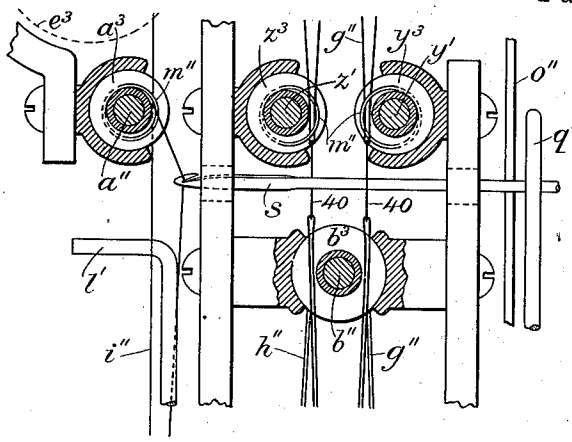


Fig. 3.

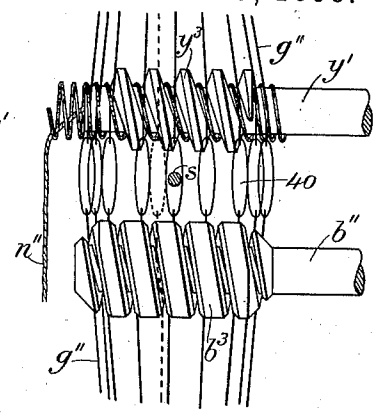


Fig. 4.

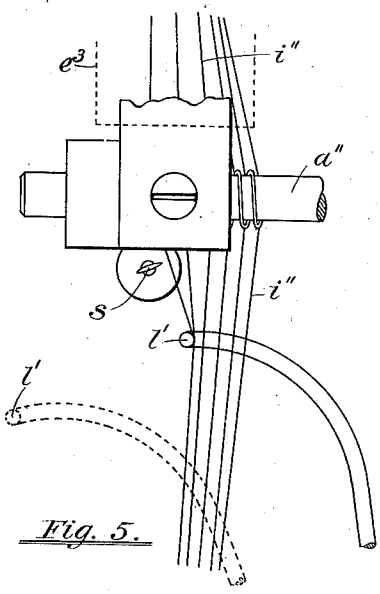


Fig. 5.

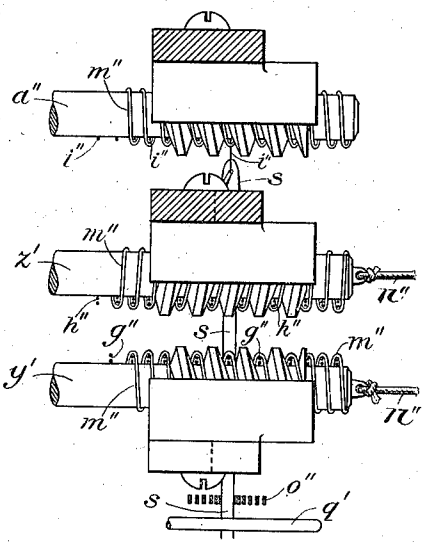


Fig. 6.

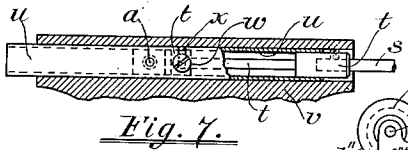


Fig. 7.

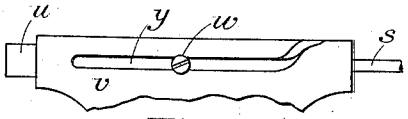


Fig. 8.

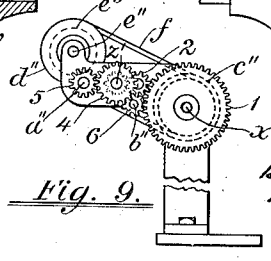


Fig. 9.

Witnesses:
Saml G. Stephens.
Charles Blocker.

Inventor:
M. F. Field,
By Crosby & Goddard
Attys.

UNITED STATES PATENT OFFICE.

MILLARD F. FIELD, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO JOHN CLARKE, TRUSTEE, OF SAME PLACE.

WARP-DRAWING-IN MACHINE.

SPECIFICATION forming part of Letters Patent No. 600,670, dated March 15, 1898.

Application filed June 21, 1897. Serial No. 641,574. (No model.)

To all whom it may concern:

Be it known that I, MILLARD F. FIELD, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Warp-Drawing-in Machines, of which the following is a description sufficiently full, clear, and exact to enable those skilled in the art to which it appertains or with which it is most nearly connected to make and use the same.

This invention has relation to machines for drawing the ends of the warp-threads into the eyes of the harness or heddles and through the reeds of a loom preparatory to setting up or commencing the weaving of a piece of cloth.

It is the purpose of the invention to provide improvements capable of use in the highest degree, whereby the warp-threads and harness-eyes may be spaced and held with certainty in a predetermined position, so that as the needle is reciprocated mechanically, as it will be, it will with certainty also enter the desired dents of the reed and the harness-eyes and catch the warp-threads and in its return draw the latter in.

It is also the object of the invention to provide other improvements incidental to the foregoing and to as far as may be organize a drawing-in machine which will perform its work as well as, if not better and more certain than, handwork as ordinarily done.

To these ends the invention consists of novel means for holding the heddles and warp-threads, so that they can be mechanically spaced with exactness.

The invention also consists of novel means for spacing the warp-threads and heddles or harness and controlling the latter as to position, so that the harness-eyes may be held with exactness in predetermined positions.

The invention also consists of novel means for moving the needle along the reed, heddles, and warp-threads and reciprocating it correspondingly to the spacing and control of the parts mentioned, so as to draw in the warp-threads in a predetermined order.

The invention also consists of novel means for holding the ends of the warp-threads to permit them to be released and drawn in when caught and pulled through the harness-eyes and dents of the reed.

The invention also consists of other improved means of importance in the organization of a machine of the character mentioned and in the carrying out of the improvements specially designated, all as I will proceed to set forth with the requisite clearness and exactness hereinafter.

Reference is to be had to the annexed drawings, and to the letters and figures marked thereon, forming a part of this specification, the same letters and figures designating the same parts or features, as the case may be, wherever they occur.

Of the drawings, Figure 1 is a plan view of the machine, some of the parts being shown as broken away and other parts omitted, as will appear from the full description hereinafter given. Fig. 2 is a longitudinally central sectional view of the machine, the frame being shown in elevation and some of the parts omitted from Fig. 1 being represented therein. Fig. 3 is a sectional detail view, drawn to an enlarged scale and looking from the end of the machine, showing the means for spacing the harness and warp-threads and holding the latter and the harness-eyes in certain position, so that the needle may be passed through a particular dent of or between "splits" in the reed through a particular or predetermined harness-eye, catch a particular or predetermined warp-thread, and draw the latter in through the said harness-eye and dent of the reed. Fig. 4 is a front view of so much of Fig. 3 as it is necessary to show in order to give a clear understanding of the invention so far as it relates to the spacing of the heddles or harness and holding the harness-eyes in certain position. Fig. 5 is a rear view of so much of Fig. 1 as it is necessary to show in order to explain the manner of controlling the warp-threads, so as that they may with certainty be caught by the needle. Fig. 6 is a plan view of most of the parts that are shown in Fig. 3. Fig. 7 is a longitudinal sectional view of the support for the immediate needle-operating means. Fig. 8 is a side view of what is shown in Fig. 7, the view being taken from the opposite side of what is represented

in Fig. 2. Fig. 9 is a detail end view of some of the means shown in Fig. 1.

In the drawings, *a* designates the frame of the machine, which may be of any suitable form and character and which supports rails *b b'*, upon which the carriage *c* travels, and a rack-bar *d* as a media by which the carriage is controlled.

e is what may be termed the "driving" or "cam" shaft journaled in suitable supports on the carriage and driven by any suitable means—as, for example, a pulley *f*, fast on the shaft *e* and operated by the belt *g*, passing thereover.

Pivoted upon the carriage at a proper point is an upright part *h*, held against a cam *i* on the shaft *e* by a spring *j*. To the upper end of the part *h* is pivoted the outer end of a rod *k*, the inner end of which is provided with a dog or pawl *l*, adapted, as the rod *k* is reciprocated to engage one of the incline-headed pins *m* (though it might as well be teeth) on the upper face of the wheel or disk *n*, and move the said disk to the extent of one tooth or pin at each reciprocation of the said rod. The shaft *n'*, upon the upper end of which the disk *n* is fixed, is journaled in suitable bearings on the carriage and has a pinion *o* secured to it, which pinion engages a gear *p* on an independent shaft *q*, the latter being provided on its lower end with a pinion *r*, which engages the teeth of the rack-bar *d*, and so the carriage is moved along on the rails step by step, its rate of movement being governed by the number of teeth or pins on the face of the disk *n*, and, of course, also by the extent of throw or movement of the dog *l*. The rate of each step movement of the carriage will correspond with the number of splits or dents to the inch in the reed.

s designates the needle which is passed through the reed and the harness-eyes and engages a warp-thread and draws it through the harness-eyes and reed. The said needle has its shank or rear end secured to a block *t* in a longitudinally-movable sleeve *u*, supported in a bearing *v* of the carriage *c*. The said block *t* has a screw *w* tapped therein, the shank of which screw extends through a partially-circumferential slot *x* in the sleeve and through a slot *y* in the bearing *v*. The said slot *y* at its outer part and for the greater portion of its length is straight and parallel with the sleeve and needle-shank; but at its forward part it is given a quadrihelical form, so that after the needle is moved forward through the reed and harness-eyes the shank of the screw *w* may act to give the said needle a quarter-turn axially in order that it may catch a warp-thread, and then after being given a quarter-turn back to its former position be drawn back with the warp-thread, as before explained. I have conceived various means for accomplishing this function, but that hereinbefore explained will be sufficient to give a clear idea of the invention.

The bearing *v* is provided on the side opposite to that shown in Fig. 8—as, for example, as shown in Fig. 2—with a slot *z*, through which extends a pin *a'*, on which is pivoted one end of a link-bar *c'*, the other end of the said link being pivoted on a pin *d'*, pivoted and adjustable in a slot in the upper end of a lever or piece *g'*, pivoted upon the base of the carriage. *e'* is an antifriction-roller, (see dotted lines in Fig. 2,) which is located on a stud projecting from the lever *g'* and which operates in the side or face of a double cam *f* on the shaft *e*, so that as the shaft *e* is rotated the needle will be reciprocated in a proper manner and time.

On the shaft *e* there is a cam-flanged disk *h'*, against which an antifriction-roller *i'* on an upwardly-extending arm i^{10}, connected with the outer end of a rock-rod *j'*, bears, the said roller being held in contact with the said cam-flange by means of a spring *k'*, connected with the rock-rod and the carriage. The said rock-rod extends through below the lower harness-bars and at its inner portion is provided with an upward extension i^{11} and at its end is provided with an angular finger *l'*, (see Fig. 5,) so as to engage the next succeeding warp-thread to be acted upon and draw it aside before the needle passes it and then release it, so that the hook may certainly take it as the needle is withdrawn. In some instances—as, for example, when the atmosphere is dry and the warp-threads are smooth or hard-twisted—this warp-thread-placing device just described may be entirely dispensed with.

m' is a rock rod or shaft mounted in suitable bearings on the carriage and provided on its outer portion with an upright arm m^{10}, bearing on its end an antifriction-roller *n'*, which rests against a cam-flanged disk *o'*, the said roller being held against the said cam by a spring *p'*, connected at one end with the rock-rod and at the other end with the carriage. At its inner end the rock-shaft *m'* is provided with an angular finger *q'*, which extends up in front of the reed in position so as to be actuated to knock off the end of the warp-thread drawn in by the needle from the hook thereof.

r' is a cam on the shaft *e*, which cam acts against the upper end of a lever *s'* or bar pivoted at its lower end on the carriage. The lever *s'* is held against the cam *r'* by means of a spring *t'*, connected at one end to the said lever and at the other end to a stationary part of the carriage.

Pivoted to the upper end of the lever *s'* is a rod *u'*, provided on its inner end with a dog *v'*, which is adapted as the rod *u'* is reciprocated to engage the teeth of the ratchet-wheel *w'* on the shaft *x'*, journaled in bearings located in uprights connected with an extension of the carriage-base and so impart a rotary motion to the said shaft *x'* to the extent of one tooth of the said ratchet-wheel at each reciprocation of the rod *u'*.

On the outer end of the shaft *x'* is a gear-

wheel 1, which engages and operates the pinion 2, fast on the end of the upper-heddle screw-rod y', and the pinion 2 engages a pinion 3, fast on the end of the upper-heddle screw-rod z'. The screw-rod z' is provided with a gear 4, which engages and drives a pinion 5, fast on the end of the warp screw-rod a''. A pinion 6, fast on the end of the lower-heddle screw-rod b'', is engaged and driven by the pinion 2 on the rod y', the rod b'' being slightly out of parallelism with the other rods to prevent the pinion 6 from being engaged by the pinion 3, or, in other words, the necessary arrangement of the said pinions results in arranging the rod b'' slightly out of parallelism with the other rods. This, however, is an unimportant feature and is merely mentioned to explain the reasons why the said rod is represented out of parallelism.

On the shaft x' is a pulley c'', about which and a pulley d'' on the brush-shaft e'' passes a belt f'', in order to drive the said brush-shaft.

g'' designates the forward set of harness, and h'' the rearward set of harness, each harness or heddle being provided with a harness-eye and harness-cords extending in opposite directions from the same, as is usual.

i'' are the warp-threads, which extend from the warp-beam j'' up between sanded or otherwise-provided guide-bars k'' k'' and still farther upward, so that their ends are frictionally though loosely held between the bars l'' l''.

m'' represents a helical coil of wire, between each two helices of which the end of a warp-thread is laid, preferably when the same is dressed, and after all of the warp-threads have been so placed the ends are arranged between the two friction-bars l'', as before explained, a cord having first been run through the coil to keep the warp-threads in place—*i. e.*, from slipping out from between the helices. The coils will of course be of sufficient length to extend the entire width of the warp or lease, and the latter may be of any usual or desired width, it being understood that there will be a correspondence between the width of the lease or warp and the operative parts of the length of the coils. Helical coils of wire m'' also engage the cords of each set of harness or heddles above the harness-eyes, and a cord, as before described, is run therethrough to keep the harness-cords in place between the helices of the coils, one such cord being shown at n'' in Fig. 4.

On the end of each shaft y' z' a'' b'' there is a screw or worm the thread upon which is of such structural character (fine or coarse) as may suit it in connection with the coil of wire to perform the functions of a spacer—that is, of spacing and positioning the warp-threads and harness-eyes. The first thread of the screw or worm may be made sharp on its edge, so as to the better enable it to enter between the helices of the coils. Once the warp-eye supports and the warp-threads as well as a coil of wire are engaged between two threads of the worm or screw they will remain therein with certainty until they pass the worm by the progress or passage of the latter along the length of the harness or width of the warp. The rods are of such a size as to adapt them to be passed readily through the helically-coiled spring, and when they are placed therein the retaining-cord n'' will be removed, and when the rods are operated to pass them along the heddles and width of warp the cords n'' may be attached to the rear end of each of the rods, and the latter will draw them in after themselves, so that as fast as a rod is removed from a coil a rod will take its place.

While in the drawings the coils of wire are not shown as extended the entire width of the lease or warp or of a length sufficient to extend from side to side of a warp, it will be readily understood by those skilled in the art that this in practice is done and that the coils are simply shown as broken off, it being deemed unnecessary to the understanding of the invention to show more than is illustrated. It will further be understood that the cords n' will extend through the coils from end to end and of course from side to side of the warp when the rods are withdrawn from the coils. Furthermore, any convenient form of means may be employed for attaching the cord n'' to the screw-rods. For example, a simple staple or loop or screw-eye may be connected with the end of the rod and the cord tied thereto, and as the rod is drawn through the coil the cord n'' will be drawn after it, so that as fast as the rod leaves the coil it will be replaced by the cord.

Referring first to the screws y^3 and z^3, respectively secured to the ends of the heddle-rods y' and z', it may be stated that the said rods are inserted in the coils m'' in place of the cords n'', as stated, with the cords of the heddles above the harness-eyes facing each other with respect to the rods and screws. Then as the rods and screws are turned the threads on the latter will enter between the helices and gradually spread the same and the harness-cords and their attached eyes, so as to adjust them as to position with the utmost exactness for the entrance of the needle or hook therethrough.

It will be understood that but a few—say about six—of the heddles in each set will be under the process of adjustment at a time and that as the screws pass along they will take, as it were, the heddles from their normal position, spread or space and position them, and leave them to resume their normal positions after passing them, drawing the cord n'' again into the helical coil after the screw, the cord being attached, as before stated, to the screw, as is shown, for example, in Fig. 4. It will also be observed by referring particularly to Figs. 3 and 6 that the bottom of the grooves between the threads on the screws or worms are of such form that one of the heddle-cords

above the eye 40 will be brought to line in a line directly in front of the other, so that the eye will be made to face the needle with the utmost exactness, and to enhance the certainty of this result a screw b^3 is secured to the rod b'', which extends between the harness-ranks or each harness of a set of harness, which screw b^3 engages the cords of the heddles below the eyes 40 as the heddles are spread and coöperates with the screws y^3 z^3 to still further space and hold the said eyes with absolute exactness in a predetermined position. The rod a'' passes through the helical coil, holding the ends of the warp-threads in the same way that the rods y' z' pass through the heddle-coils, as before explained, and the thread of the screw a^3 on the end of the rod a'' enters between the helices of the warp-holding coil, so as to space the warp-threads in exact accordance with the spacing of the harness-eyes. It will now be understood that with all of the parts properly timed, as they are, and the machine set in motion the needle s will enter the dents or openings between the splits of the reed o'' and pass through the eyes alternately of the front and rear sets of harness, catch the warp ends one after another and draw them out from between the friction-holding bars l'' and through the harness eyes and reed, when they are discharged from the hook of the needle by the knock-off finger q'.

It is to be particularly kept in mind that the means which impart motion or movement to the carriage also gives coördinating or harmonious movement to the means operating upon the harness and warps or their connections. In other words, as is herein shown, there is mechanism upon the carriage which gives movements to the rotary screws, coördinating with its own movements.

To insure the catching of the warp-thread by the needle after it passes through the reed and harness-eye, the warp-thread-placing finger l' may be employed, as hereinbefore explained, it being understood that the needle is turned over on its side, with its hook toward the warp-thread to be caught, as has been described. To further insure a proper position of the spaced warp-threads, so that they may correspond with the position of the spaced harness-eyes, a brush e^3 on the brush-shaft e'' acts on the warp-threads above the warp screw-rod a'' to take up the slack, if any there should be, in the warp-threads, so as to hold the latter substantially taut. The said brush is shown in Fig. 2 and by dotted lines in Figs. 3 and 5.

In some instances the brush may be dispensed with entirely, as may also the warp-placing finger, the lower harness screw-rod b'' and its screw b^3, as well as the knock-off finger.

It is contemplated by the construction shown in the drawings to draw two warp-threads through a single dent of the reed; but any other arrangement or method desired may be adopted by mechanically gearing the machine to suit the end in view.

In Fig. 4 but a single harness-eye and its supporting-cord in the rear set is shown by dotted lines. The needle s is shown in the said figure as passing through an eye of one of the front heddles. In its next operation it will be passed through the next succeeding heddle of the rear rank of harness, and so on alternately. After all of the warp-threads have been drawn in and the cords n'' drawn into the coils by the rods passing therethrough are secured in place the helical coils on the harness may be slipped up on the latter and be tied or otherwise secured there out of the way in the operation of weaving. The length of coil from which the warp-threads are drawn may be removed from its place.

It is to be noted that I do not limit my invention to the particular manner of holding the harness in order to space and otherwise control the same in order to render useful the spacing means shown and described; nor is it essential that the particular form of the first-mentioned means is dependent for its usefulness upon the exact construction of the last-mentioned means. It is to be observed also that the frame will be of such construction and size that the reed-harness, warp-beam, and warps may be supported therein substantially in the same relative positions as they will occupy in the loom, the frame being suitably equipped for such support, as may be most clearly indicated in Fig. 2.

My invention is not necessarily limited to the helical coil of wire and wire-extending screw hereinbefore shown and described. The helical wire is in effect a normally-contracted extensible coacting spacing member permanently engaged with the warp-eye supports and the loom-harness. The screw is the other coacting member or part of the spacing device and operates upon the helical wire progressively along the same to extend a portion only at a time of the first-mentioned spacing device and with the extension or spreading of the first-mentioned spacing member to space and position the heddle or harness eyes. It is understood that substantially the same relationship is sustained between the warp-threads, helical wire, and screw as between the two latter devices and the heddles or harness.

Having thus explained the nature of the invention and described a way of constructing and using the same, though without attempting to set forth all of the forms in which it may be made or all of the modes of its use, it is declared that what is claimed is—

1. A spacing and positioning mechanism for loom-harness or warp-threads consisting of a normally-contracted extensible spacing member adapted to engage the harness-eye supports or warp-threads, and a spreading member adapted to engage a portion at a time only of the first-mentioned member and spread or space the same, and means for moving the

spreading member progressively along the spacing member.

2. A spreading or positioning device for loom-harness or warp-threads consisting of a helically-coiled wire between each two helices of which the warp-eye supports or warp-threads are adapted to be separately placed, and a screw for acting upon the said coils successively or progressively to spread and adjust the warp-threads or warp-eye supports in predetermined position.

3. A spreading or positioning device for loom-harness or warp-threads consisting of a helically-coiled wire between each two helices of which the warp-eye supports or warp-threads are adapted to be separately placed, and a screw for acting upon the said coils successively or progressively to spread and adjust the warp-threads or warp-eye supports in predetermined position; combined with means for retaining the spacing member on the warp-eye supports when the said spacing member is not in use in warp-drawing.

4. A spacing and positioning mechanism for loom-harness consisting of a normally-contracted extensible spacing member adapted to engage the harness-eye supports at one side of the eyes, and a spreading member adapted to act upon a portion at a time only of the first-mentioned member and spread or space the same, and a coöperating warp-eye-positioning device adapted to engage the warp-eye supports at the opposite side of the eyes from that of the spacing member, and means for moving the spreading member and coöperating device progressively along the spacing member.

5. A spreading or positioning device for loom-harness consisting of a helically-coiled wire, between each two helices of which, the cords of the harness are adapted to be placed, and a cord n'' running longitudinally through the coils at one side of the cords to prevent their displacement.

6. A warp-drawing-in machine embracing in its construction, a reciprocating needle, a spacing member to engage the harness-cords and a rotary screw movable along the harness and adapted in its operation to engage the spacing member and spread the same and maintain the harness-eyes in the path of the said needle.

7. A warp-drawing-in machine embracing in its construction a spacing member for engaging the harness and a rotary screw movable along the harness and adapted in its operation to engage the spacing member to spread or space the same and bring the harness-eyes into desired position, combined with means for holding the harness-engaging means upon the harness to permit the former to be moved up and down the latter, combined with a reciprocatory needle or hook and its actuating means.

8. A warp-drawing-in machine comprising in its construction spacing members for engaging the warp-threads and harness and rotary screws movable along the harness and warp-threads respectively and adapted to engage the spacing members to spread or space the same and bring the harness-eyes and warp-threads into desired position, combined with a reciprocatory needle or hook and its actuating means.

9. A warp-drawing-in machine comprising in its construction spacing members for engaging the warp-threads and harness and rotary screws movable along the harness and warp-threads and adapted to engage the spacing members to spread or space the same and bring the harness-eyes and warp-threads into desired position, combined with a reciprocatory needle and means for operating the same to enter the eyes of the harness, engage the said warp-threads and draw the latter through the harness-eyes.

10. A warp-drawing-in machine comprising in its construction spacing members for engaging the warp-threads and harness and rotary screws movable along the harness and warp-threads and adapted to engage the spacing members to spread or space the same and bring the harness-eyes and warp-threads into desired position, combined with a reciprocatory needle and means for operating the same to enter the harness-eyes, engage the said warp-threads and draw the latter through the harness-eyes, and means for knocking off the warp-thread end from the hook of the needle after the said warp-thread is drawn in.

11. A warp-drawing-in machine comprising in its construction spacing members for engaging the warp-threads and harness, and rotary screws movable along the harness and warp-threads and adapted to engage the spacing members to spread or space the same and bring the harness-eyes and warp-threads into desired position, combined with a reciprocatory needle and means for operating the same to enter the eyes of the harness, engage the said warp-threads and draw the latter through the harness-eyes; means for giving the needle a partial turn axially, so that it may catch the warp-thread after it has passed through the harness-eyes, and means for knocking off the warp-thread end from the hook of the needle after the said warp-thread is drawn in.

12. A warp-drawing-in machine comprising in its construction adjustable means for engaging the warp-threads and harness, rotary screws to engage the warp-thread and harness-engaging means to spread and regularly space the same and bring the harness-eyes and warp-threads into desired position, and a carriage adapted to be moved along the harness and warp-threads and provided with means operatively connected with the screws to actuate the parts in unison, combined with a reciprocatory hook or needle and its actuating means.

13. A warp-drawing-in machine comprising in its construction coiled wires for engaging the harness-cords and warp-threads and rotary screws to engage a portion at a time of

the coils of said wires, to act upon and regularly space them and thus adjust the engaged warp-threads and eyes of the engaged harness-cords to the desired position, combined with a sliding carriage which supports and moves transversely of the harness, a reciprocatory needle to pass through the spaced eyes, engage and draw back the spread warp-threads, and mechanism to give coördinating operation to said screws and needle.

14. A warp-drawing-in machine comprising in its construction helically-coiled wires for engaging the warp-threads and harness, rotary screws to engage a portion of the said warp-thread and harness-engaging means to regularly space the warp-threads and bring the harness-eyes and warp-threads into desired position, a reciprocatory needle to pass through the eyes of the harness, engage the warp-threads and draw them in, and warp-thread-placing means to act upon each warp-thread to enable it to be engaged with certainty by the needle.

15. A warp-drawing-in machine comprising in its construction helically-coiled wires for engaging the warp-threads and harness, rotary screws to engage a portion of the said warp-thread and harness-engaging means to regularly space the warp-threads and bring the harness-eyes and warp-threads into desired position, a reciprocatory needle to pass through the eyes of the harness, engage the warp-threads and draw them in, warp-thread-placing means to act upon each warp-thread to enable it to be engaged with certainty by the needle, and means for knocking off the warp-thread from the needle after it is drawn in.

16. A warp-drawing-in machine comprising in its construction means for holding the warp-threads in position, a helically-coiled wire for engaging the warp-threads, means for engaging the helically-coiled wire to effect and control the regular spacing of the warp-threads, and a rotary brush to act upon the warp-threads to be spaced to take up any slack happening to occur in the same, combined with a reciprocatory hook or needle and means to actuate the same.

17. A warp-drawing-in machine comprising in its construction helically-coiled wires for engaging the harness and warp-threads between their helices, rods adapted to be passed through the said coils at one side of the harness and warp-threads engaged thereby, screws on the ends of the said rods to engage the said helices and regularly space and position the harness-eyes and warp-threads and hold the latter in position, and means for turning the screws, combined with a reciprocatory hook or needle and means to actuate the same.

18. A warp-drawing-in machine comprising in its construction helically-coiled wires for engaging the harness between their helices, rods adapted to be passed through the said coils at one side of the harness engaged thereby, screws on the ends of the said rods to engage the said helices and regularly space and position the harness-eyes, means for operating the rods and screws to pass them through the said coils of wires, and a cord n'' attached to the end of the said screws to be drawn into the coils after the screw or screws, combined with a reciprocatory hook or needle and means to actuate the same.

19. A warp-drawing-in machine comprising in its construction helically-coiled wires for engaging the harness and warp-threads between their helices, rods adapted to be passed through the said coils at one side of the harness and warp-threads engaged thereby, screws on the ends of the said rods to engage the said helices and regularly space and position the harness-eyes and warp-threads and hold the same in position; means for operating the rods and screws to pass them through the said coils or wires and along the warp-threads, and a reciprocatory needle adapted to enter the spaced eyes of the harness, catch a spaced warp-thread and draw it in.

20. A warp-drawing-in machine comprising in its construction rotary screws to engage the cords of each harness of a set, above the eyes and upon one side of each harness of the set, and a similar screw between the two harnesses of the set to engage the cords of the harnesses of the set to space the same and position the harness-eyes, the screws acting progressively upon a portion at a time only of the harness-cords.

21. A warp-drawing-in machine comprising in its construction a rotary screw having the thread at one end sharpened and graduated, and the bottoms of the grooves in the body portion formed so that they may receive the cords of the harness, one in front of the other, the said screw being positioned with respect to the harness to engage and spread the same, and maintain the eyes thereof in predetermined position, the screw acting upon a portion only of the harness at a time and progressively.

22. The combination, with the reciprocatory needle, of the block to which its shank is attached, the grooved sleeve in which the shank is adapted to turn, the support for the sleeve provided with a slot y, as described, and the screw, the shank of which passes through the said slot y and the slot in the sleeve and is tapped into the said block.

23. A warp-drawing-in machine comprising in its construction a reciprocatory needle for engaging and drawing in the warp-threads, rotary screws for engaging and spreading the harness and bringing the harness-eyes into desired position, a carriage and means for imparting motion thereto to move it along the harness and warp-threads, and mechanism on the carriage to coördinate its movements and those of said screws.

24. A warp-drawing-in machine comprising in its construction a reciprocatory needle for engaging and drawing in the warp-threads, devices extending along the harness and warp-

threads to engage the same, means movable along the warp-threads and harness to operate upon the said devices and spread the same and adjust the harness-eyes, a carriage upon which the said needle is mounted, means to move the carriage, and means on the carriage operatively connected with the warp-thread and harness-eye adjusting means, to coördinate their movements.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 15th day of June, A. D. 1897.

MILLARD F. FIELD.

Witnesses:
ARTHUR W. CROSSLEY,
ANNIE J. DAILEY.