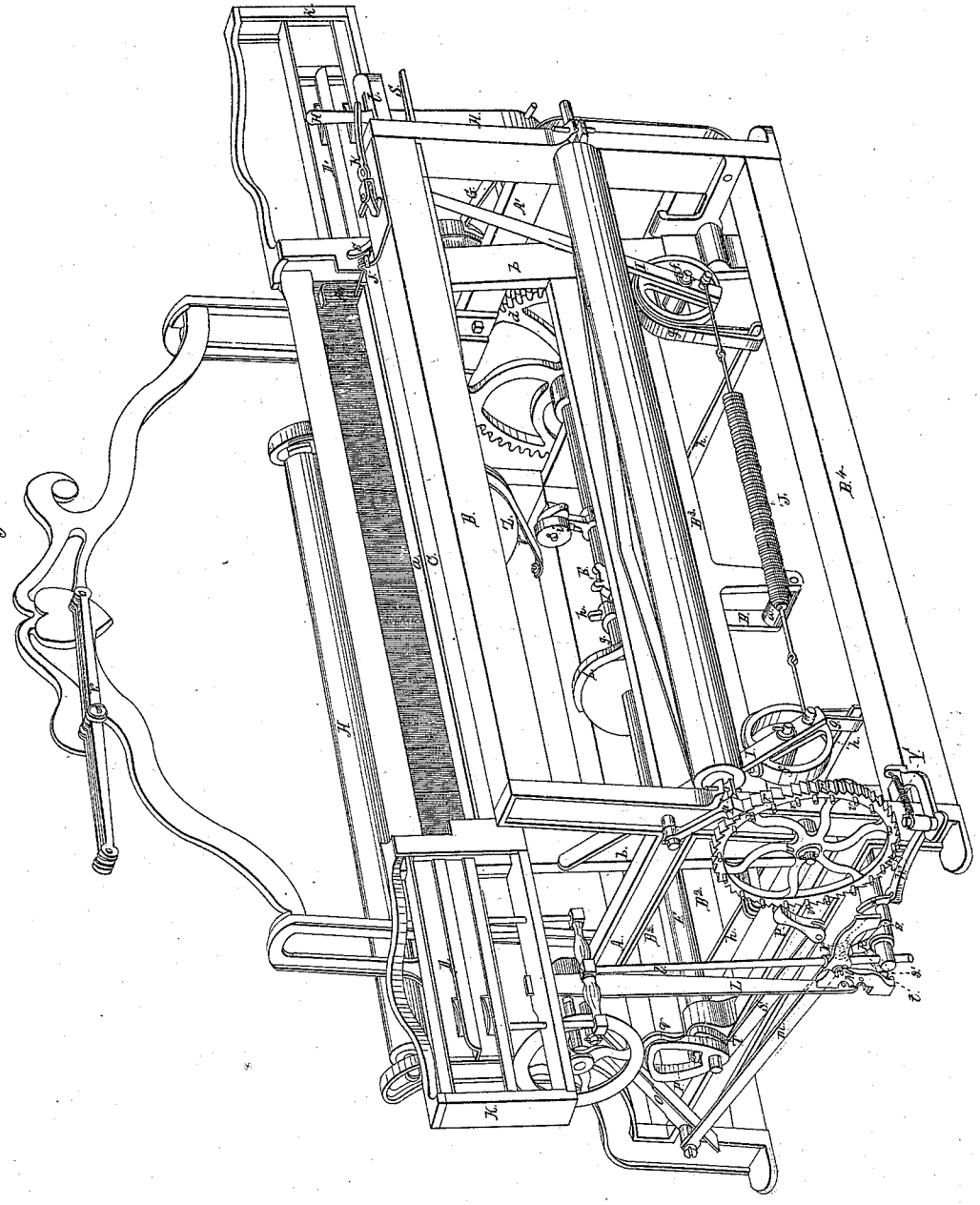
Jenks & Goodyear
Loom.

Sheet 1-4 Sheets.

No. 8874.

Patented Apr. 13, 1852.

Fig. 1.



Sheet 2-4 Sheets.

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No. 8,874. Patented Apr. 13, 1852.

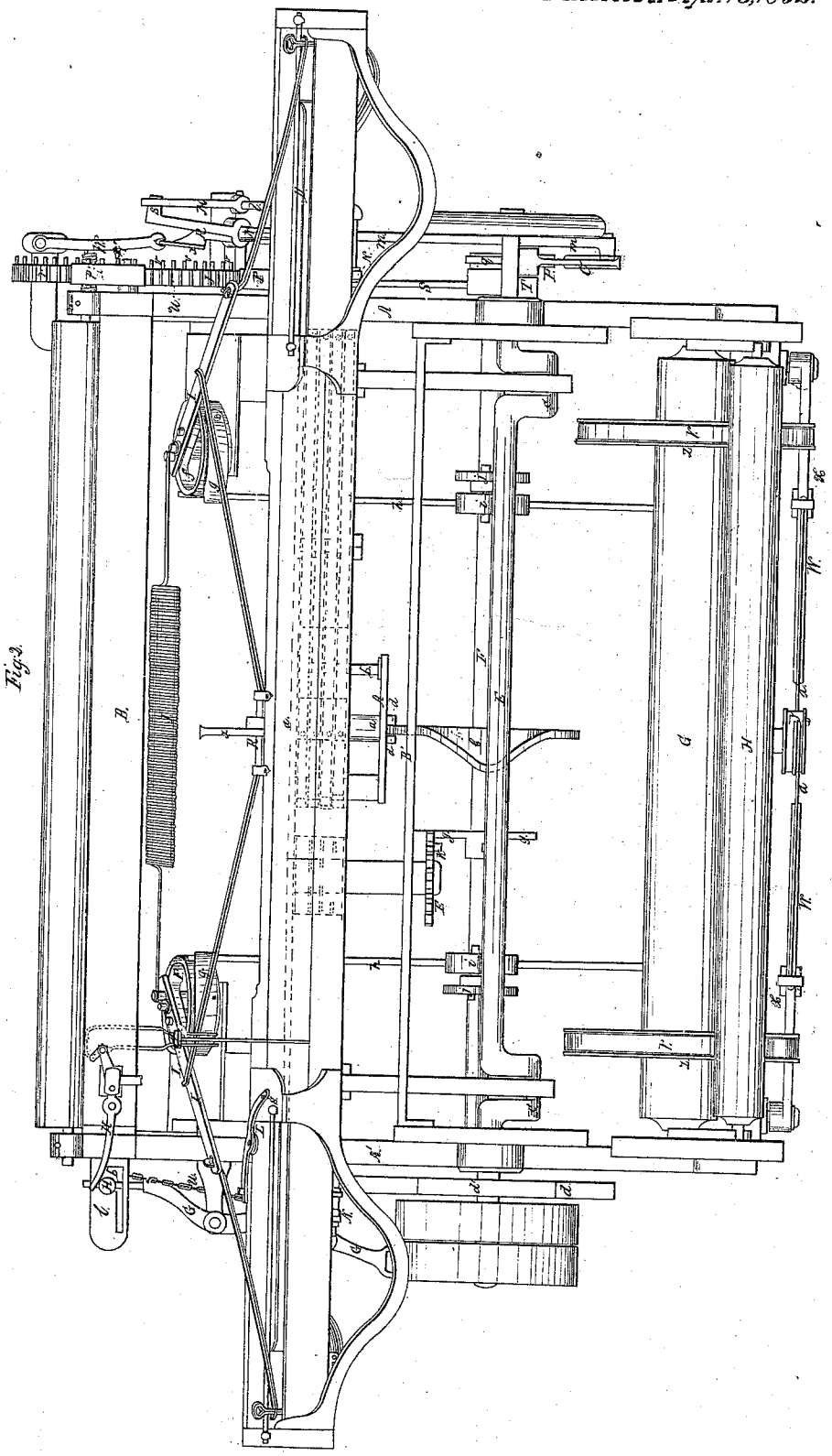

Fig. 3.

Sheet 3 - 4 Sheets.

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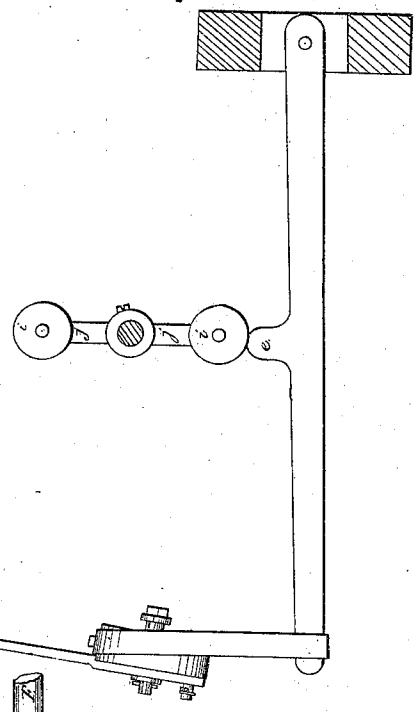
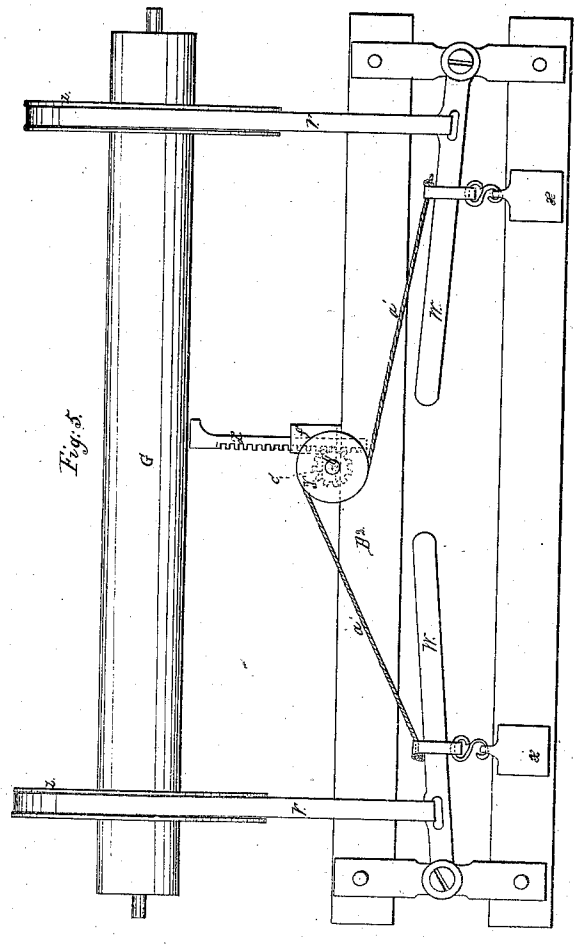
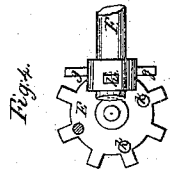
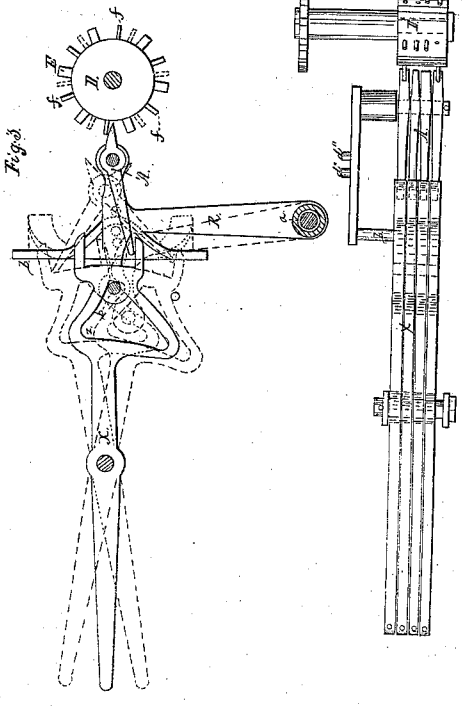








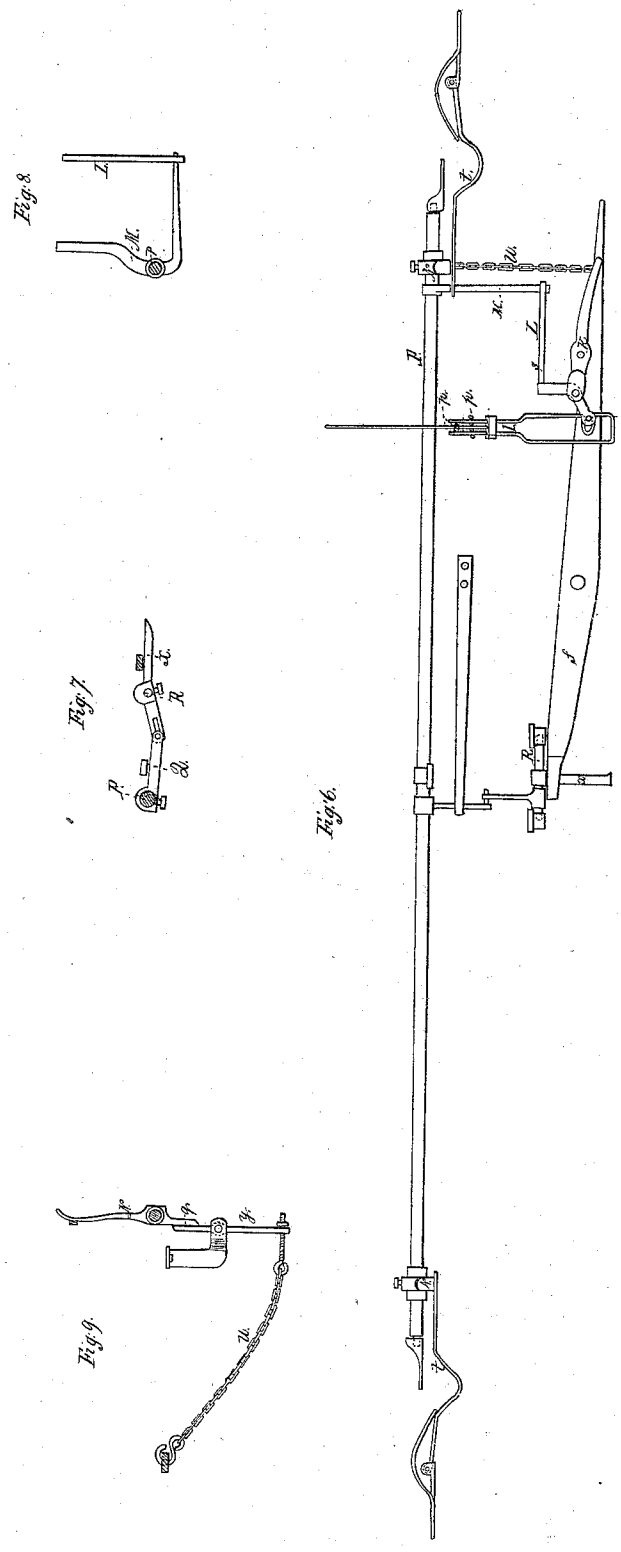
Sheet 4 - 4 Sheets.

Jenks & Goodyear.

Loom.

No. 8,874.

Patented Apr. 13, 1852.



UNITED STATES PATENT OFFICE.

BARTON H. JENKS, OF BRIDESBURG, AND ROBERT BURNS GOODYER, OF PHILADELPHIA, PENNSYLVANIA; SAID GOODYER ASSIGNOR TO SAID JENKS.

IMPROVEMENT IN LOOMS FOR WEAVING FIGURED FABRICS.

Specification forming part of Letters Patent No. 8,874, dated April 13, 1852.

To all whom it may concern:

Be it known that we, BARTON H. JENKS, of Bridesburg, in the county of Philadelphia and State of Pennsylvania, and ROBERT BURNS GOODYER, of the city and county of Philadelphia, also in the State of Pennsylvania, have invented certain new and useful Improvements in Looms for Weaving Plain and Figured Fabrics, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form part of this specification, and in which—

Figure 1 represents a view in perspective of such portions of a loom as are affected by our improvements. Fig. 2 is a plan of the same. Figs. 3, 4, and 5 are elevations of the heddle-motion detached. Fig. 6 is an elevation of the pace detached. Fig. 7 is a side elevation of the apparatus for operating the picker-sticks; and Figs. 8, 9, 10, and 11 are views of the stop-motion detached from the frame-work of the loom.

Our invention is divided into several parts, the greater number of which may be used separately and independently of the others, and may be applied to looms of various descriptions.

The first part of our invention has reference to the throwing of the shuttle; and it consists of mechanism by whose action both picker-sticks are moved simultaneously, in order that the shuttle may be thrown from either side of the loom at each stroke of the lay and that the momentum of the picker-motion at one side of the loom may be counterbalanced by that upon the opposite side thereof, whereby the jar and strain upon the loom are neutralized.

The second part of our invention has reference to the movement of the shuttle-boxes to bring any particular shuttle of a series into action; and it consists of a pattern-wheel acting in connection with a series of levers and cams, by means of which any particular shuttle-box of a series may be brought into the proper position for the throwing of the shuttle.

The third part of our invention consists of mechanism of peculiar construction, by means of which the heddles are worked to open and to close the shed.

The fourth part of our invention consists of mechanism for regulating the movement of the heddles according to the number and order of changes which are to be made.

The fifth part of our invention consists of a stop-motion for effecting the stopping of the loom whenever the weft-thread breaks.

The sixth part of our invention consists of a stop-motion for effecting the stopping of the loom whenever the shuttle is not in its proper shuttle-box at the time the lay beats up, and also whenever the shuttle is not ejected from the shuttle-box at the time the lay is completing its back-stroke; and the last part of our invention consists of a self-adjusting pace, by means of which the uniform tension of the warp-threads is maintained whether a greater or less quantity be wound upon the yarn-roll.

The several acting members of our loom, as represented in the accompanying drawings, are all attached to a frame, which is composed of two end plates, A A′, connected by suitable rails or beams, B B′ B², &c. The lay C, with its shuttle-race *a* and shuttle-boxes D D′, is supported near the front of the frame upon swords *b b*, whose lower extremities are pivoted to the sides of the loom-frame, and a suitable reciprocating movement toward and from the breast-beam B is imparted to it by the rotation of a crank-shaft, E, which is supported in suitable boxes secured to the loom-frame, and whose cranks *c c* are connected with the lay by link-rods. Beneath the crank-shaft is a second shaft, F, which extends from one extremity of the loom to the other, and is fitted with cams and other mechanism, by means of which the proper motions are imparted to the apparatus for shifting the shuttle-boxes to the picker-sticks which throw the shuttle and to the apparatus for moving the heddles. This cam-shaft is fitted with a cog-wheel, *d*, whose teeth engage with those of a similar wheel, *d′*, of half its size upon the crank-shaft E above, so that the cam-shaft is driven from the crank-shaft and at half the speed of the latter. At the hinder part of the loom-frame is the yarn-roll G, and above it is the whip-roll H, over which the warp-threads are passed toward the front of the loom.

The picker-sticks I I, by means of which the shuttle is thrown, are pivoted at their lower

extremities to brackets which are secured to the swords of the lay. Each is fitted with a smooth wheel, *f*, the periphery of which is encircled by a strap, *g*, whose extremity is made fast to the front end of a treadle, *h*. The two treadles are pivoted at their hinder extremities to the back rails of the loom-frame. Those portions of them which pass beneath the cam-shaft F have shoes *e*, secured to them which are struck at the proper moment to throw the shuttle by friction-wheels *i i*, that are pivoted to arms *j j*, projecting from the cam-shaft, and revolve with it. There are two of these arms in each set, so that each picker-stick is moved twice for each revolution of the cam-shaft, or once for each stroke of the lay, which is rocked by the revolution of the crank-shaft. The treadles effect the movement of the picker-stick inward to throw the shuttle. They are returned to their outer positions whenever the friction-rollers pass the shoes, on which they act by the action of a spring, J, whose opposite extremities are connected with the short arms of the picker-sticks. The upper extremities of the picker-sticks are connected with drivers in the usual manner; but as the construction and arrangement of drivers is well understood by loom-builders and forms no part of our invention, we deem it unnecessary to describe them here.

The shuttle-boxes are arranged in series at the opposite extremities of the shuttle-race *a* and rock to and fro with the lay; but they may, if deemed best, be secured to some stationary part of the loom. In the present instance each series contains two shuttle-boxes, that being a sufficient number to elucidate our invention, and but one series is fitted with a shifting apparatus, as the other series may be shifted from the first by the employment of rods and levers to transmit motion from one to the other, or both series may be fitted with distinct shifting apparatus such as we are about to describe. The series of shuttle-boxes at each extremity of the lay is arranged to slide in guides formed in the shuttle-box frame K. It is supported upon the upper extremity of a sliding standard, *l*, whose lower extremity is passed through a hole formed in the gudgeon upon which the lay rocks, and is fitted with a cross-head, M, whose extremities project the one in front and the other behind the standard. The hinder edge of this cross-head has a series of notches or sockets, *o o*, formed in it, which correspond in number and in relative positions with the numbers and relative positions of the shuttle-boxes. A spring-stop, L, is also secured to the hinder part of the shuttle-frame and depends behind the cross-head, where it has a protuberance upon it to catch in and lock the cross-head with its standard and shuttle-boxes in place. This spring-stop is of such length that when it engages in any one notch of the cross-head the shuttle-box corresponding with that notch is in the proper position for the discharge or reception of a shuttle. An arm, N, is fitted to rock upon the gudgeon of the lay, and its upper extremity is connected by a rod, *m*, with a hanging treadle, O, that depends from a pivot secured to the adjacent end plate of the loom-frame within the range of a cam, P, secured to the adjacent extremity of the cam-shaft F. The cam in its revolution forces the treadle and the arm N, with which it is connected, backward. They are restored to their forward positions by the same cam, which in turning toward the front of the loom acts upon an arm, *q*, that projects from the treadle. The arm N, which is thus caused to rock upon the gudgeon of the lay, forms the pivot of a double-armed vibrating lever, R, which can be turned laterally upon the rocking arm to bring either one of its wrists *s s'* in a position to act upon the corresponding extremity of the cross-head M on the shuttle-box standard *l*. The forward wrist, *s*, acts upon the under side of the cross-head, and, as the arm N is rocked backward by the treadle P, raises the whole series of shuttle-boxes. The hinder wrist, *s'*, when in operation acts upon the upper side of a projection, *t*, formed upon the adjacent face of the cross-head, and as the arm N is rocked backward depresses the series of shuttle-boxes.

The positions of the wrists are regulated by a pattern-wheel, U, which is pivoted to the side of the loom-frame and whose periphery is formed into ratchet-teeth *r*, upon which a reciprocating finger, *p*, is arranged to act. This finger is pivoted to the front extremity of a lever, S, whose hinder extremity is depressed at the proper moment to turn the pattern-wheel by a cam, T, on the cam-shaft, while, as the cam in its revolution passes the finger-lever, the front extremity of the latter, being the heavier, sinks to draw the finger backward upon the toothed periphery of the pattern-wheel to permit it to engage with a new tooth thereon. The backward movement of the pattern-wheel meanwhile is prevented by a dog, *p'*, which bears upon the periphery of the wheel and engages with the ratchet-teeth. The outer face of the pattern-wheel is studded with pins *v v v*, which as the wheel is turned act upon a shoe, *e'*, that is secured to an arm, W, which at its front extremity is pivoted to a bracket on the loom-frame and at its hinder extremity is forked to embrace a circular segment, *x*, secured to the hub of the double-armed lever R. The arm W is drawn toward the face of the pattern-wheel by a spring, *y*, and the operation of the apparatus is such that when one of the pins of the pattern-wheel forces the arm W outward, it, acting upon the segment *x*, turns the double-armed lever R to the position required when the forward wrist *s*, is to raise the series of shuttle-boxes, and when the pattern-pin passes the shoe of the arm W the latter is drawn by the spring *y* toward the face of the wheel to turn the double-armed lever to the position required when the hinder wrist, *s'*, is to depress the series of shut-

tle-boxes. As the wrists are secured to the opposite arms of the same lever, the movement of one toward the cross-head necessarily moves the other out of the range thereof, so that but one acts at a time. In the loom represented there are but two shuttle-boxes in the series. The distance to which they are moved to produce a change is always the same, and the pattern-pins are all of the same length. If more shuttle-boxes are used, the cross-head arms must be fitted with a series of steps or grades, so that by turning the wrists a greater or less distance they will be brought into the proper positions to act upon particular ones of these grades to raise or to depress the series in a corresponding manner, and in order to move the wrists to different positions pattern-pins of different lengths must be fitted to the pattern-wheel. The number of pins required to produce the change may, as in the example represented, be one less than the number of shuttle-boxes, as the face of the pattern-wheel, against which the shoe of the arm W bears, acts in place of one set of pins to regulate its position.

The apparatus for moving the heddles is situated at the lower part of the loom-frame and in front of the cam-shaft. It consists of a series of marches equal in number with the leaves of heddles, of a corresponding reciprocating series of levers by means of which the marches are worked, of a pattern-barrel for operating the reciprocating series of levers, and of arms and cams by means of which the proper rotary motion is imparted to the pattern-barrel and the proper reciprocating movement is imparted to the series of levers by the rotation of the cam-shaft. The leaves of heddles are suspended from a series of top levers, V, and are connected directly with the inner extremities of the marches X beneath. The outer extremities of the top levers are also connected with the outer extremities of the marches, so that the heddles are made to rise and fall as the inner extremities of the marches are raised and depressed. The marches X are pivoted side by side to a beam or rail which extends from one end of the loom-frame to the other. The inner extremities of the marches are forked, as shown in the drawings, and a heart-shaped aperture, *z*, is formed in that part of the march which is immediately within its forked extremity. The reciprocating series of levers A are pivoted side by side to the one branch of a crutch-formed arm, B, which projects upward from a sleeve, *a*, that, together with the arm, rocks upon a pivot secured to the lower part of the loom-frame, and the longer arms of the series of reciprocating levers lie within the forked extremities of the marches X. The other branch of the crutch-formed arm is fitted with a pin, *b*, which extends transversely through the heart-shaped apertures of the whole series of marches, and when the arm to which it is secured is at rest occupies the smaller extremities of these apertures, thus maintaining the whole series of marches in the same horizontal position. The crutch-formed arm is rocked toward and from the pivot on which the marches turn by means of a bent disk-cam, C, which is secured to the cam-shaft, and whose bent rim runs between two pins, *d d*, secured to the hinder face of the crutch-formed arm. When the crutch-formed arm is at rest, the shorter arms of the levers pivoted to it are within the range of a series of pins, *f f*, which project from the periphery of a barrel, D, that is pivoted to the loom-frame. This barrel is perforated with rows of holes to receive the pins, there being as many holes in each row as there are levers in the series A. The barrel is fitted with a star-wheel, E, the teeth of which correspond in number with the rows of pin-holes and are within the range of a pair of arms, *g g*, that project from the cam-shaft, so that as the latter revolve at each half-revolution the barrel is turned to cause such pins as may be in one of the rows of holes to depress the adjacent shorter arms of the corresponding levers in the reciprocating series. As the shorter arms of the levers struck by the pins are depressed, their opposite longer arms are raised within the forked extremities of the marches, while those levers which are not struck by pins maintain their positions. The series of levers is thus divided into two sets, the one of which point upward and the other downward in the forked extremities of the marches.

The arms *g g*, that turn the barrel, and the cam C, that imparts the reciprocating movement to the crutch-formed arm, are secured to the cam-shaft in such relative positions that as the levers are divided into the two sets the crutch-formed arm is rocked toward the pivot of the marches. In this movement the extremities of the levers are borne against the forked extremities of the marches, and at the same time the evening-pin *b* is moved from the narrow extremities of the heart-shaped apertures into the enlarged portions thereof. As the extremities of the levers strike the marches, those levers which point upward move the marches upon which they act also upward, while those levers which point downward depress their corresponding marches, and as the marches are connected directly with the leaves of heddles the latter are divided into two sets, of which the ascending raise the warp-threads to form the upper half of the shed, while the descending lower the remaining warp-threads to form the lower half of the shed. When the crutch-formed arm is rocked back by the cam to its first position, the levers release the marches, which are restored to their positions by the movement of the evening-pin *b* into the narrow extremities of the heart-shaped apertures. As the shed must be opened and closed at each vibration of the lay, and as the cam-shaft is driven by the cog-wheels *d d'* at but half of the speed of the crank-shaft above, the bent disk-cam C is so formed as to rock

the crutch-formed arm twice at each revolution, and two arms, *g g*, are provided to drive the pattern-barrel.

From the above description it will be seen that whenever certain leaves of heddles are to be raised the holes in the pattern-barrel which correspond with their levers and marches must be fitted with pins, and that if the arrangement of the pins in each consecutive row be varied a corresponding change will be made in the movement of the leaves of heddles. In the present example there are eight rows of holes in the pattern-barrel, and consequently eight changes may be effected before the first arrangement of heddles is reproduced. In the process of weaving it frequently happens that a less number than eight changes are required. In order to adapt this heddle apparatus to such a contingency holes are made in the hinder face of the star-wheel E at the bases of the teeth and a shorter pair of arms, *h h*, is secured to the cam shaft at right angles with those, *g g*, that act upon the teeth of the star-wheel. When a less number than eight changes are to be made, one or more of these intermediate holes are fitted with pins *k*, which project within the range of the shorter arms. Hence as the cam-shaft is revolved the shorter arms will strike the supplementary pins and will turn the pattern-barrel one-eighth of a revolution between the periods at which the longer arms act. As this turning of the pattern-barrel is not accompanied by a corresponding movement of the crutch-formed arm, the row of pins which by it are made to act upon the reciprocating levers do not produce any effect upon the heddles, which are only operated when the crutch formed arm is rocked by its cam. Hence, whenever one of the shorter arms acts upon a supplementary pin on the star-wheel of the pattern-barrel, the row of pins corresponding to it is passed by without acting and the number of changes of heddles produced is diminished by one. If less changes are required, more supplementary pins are applied to the wheel, and the changes may thus be reduced from eight to seven, six, five, &c., as occasion may require.

The stop-motion, by whose operation the movement of the loom is stopped whenever a thread breaks, is secured to the lay and by its rocking is made to operate a belt-lever, by means of which the driving-belt is transferred from the fast pulley to the loose pulley on the crank-shaft. This shifting-lever G is pivoted to the side of the loom-frame. It is forked at its hinder extremity to embrace the driving-belt, and is connected at its front extremity with a spring-standard, H, whose head is formed into a handle and whose neck is passed through a slot formed in a bracket, *l*, secured to the loom-frame. The slot has a socket, *o*, at its inner extremity, in which the neck of the standard is engaged when the shifting-lever is guiding the belt upon the fast pulley, and the spring-standard H is arranged in such manner that when its neck is disengaged from the socket it will spring outward and move the belt from the fast to the loose pulley. In order to effect this movement when the shuttle is being thrown toward that side of the loom at which the shifting-lever is situated, a grid, *p*, composed of several bars, is secured to the lay just in front of the mouth of the shuttle-box. A corresponding fork, I, is provided, the prongs of which correspond with the spaces between the bars of the grid. The shank of this fork is constructed to slide in a box-socket formed upon the breast-beam, and is indented to receive a pin which projects downward from the one arm of a V-lever that is pivoted at the junction of its arms to the inner extremity of a horizontal lever, K, whose outer extremity bears against the neck of the spring-standard. The other arm of the V-lever projects toward the lay. The central prong of the fork is passed through a guide-eye, *r*, secured to the lay behind the grid, and is hooked at its extremity. This prong is of such length that as the lay completes its backward stroke the eye bearing upon the hook of the prong draws the fork with it and turns the V-lever to such a position that in the next succeeding forward movement of the lay the upper extremity of a plate, *s*, secured to it will strike the projecting extremity of the V-lever, and thus move the horizontal lever K to disengage the spring-standard from its socket. All the prongs of the forks are bent near their bases, and these bent portions are at such a distance from the pivot of the V-lever that when a thread is drawn by the shuttle between the grid and the bent prongs of the fork and the lay is completing its forward stroke this thread, by preventing the movement of the prongs through the grid, will force the fork to move forward with the lay and to turn the projecting arm of the V-lever out of the range of the plate *s* on the lay, while if the thread be broken the bent prongs of the fork will pass through the grid, the forward movement of the fork will not be affected, and the V-lever will be struck by the plate on the lay. The apparatus thus effects the stoppage of the loom whenever the thread does not intervene between the fork and grid. This is the case whenever the shuttle is thrown toward the side of the loom farther from the fork and grid, and consequently, if no further apparatus was added, the loom would be stopped at each alternate beat of the lay. In order to prevent this the plate *s* upon the lay is formed upon the upper extremity of an inclined lever, L, which is pivoted to the lay. The lower arm of this plate-lever is made so much heavier than its upper arm that in tending to assume a vertical position it swings the upper arm out of the range of the extremity of the V-lever. The lower extremity of this plate-lever is perforated to admit the horizontal arm of an elbow-lever, M, which is pivoted at the intersection of its arms to the back of the shuttle-box frame, and

whose upright arm extends upward behind the shuttle-boxes, where it bears upon a bent spring-lever, *t*, that is forced outward whenever a shuttle enters the shuttle box, but regains its position in the shuttle-box whenever the shuttle is ejected therefrom. When, therefore, the shuttle is thrown out of the shuttle-box toward the opposite extremity of the lay, the plate-lever is allowed to swing by the weight of its lower extremity, or is pushed by a spring out of the way of the V-lever, and the loom is not stopped; but when the shuttle enters the shuttle-box the elbow-lever is moved by the shuttle-box lever to turn the plate-lever in a position to strike the V-lever whenever the thread breaks.

The stop-motion for stopping the loom whenever the shuttle does not enter the proper box before the lay beats up, and also whenever the shuttle does not leave its box before the lay completes its back-stroke, is also secured to the lay, and is constructed as follows: A rock-shaft, P, is pivoted to the hinder part of the lay and extends from one shuttle-box to the other. At each of its extremities an arm, N, is projected upward behind the shuttle-box levers *t t*. A horizontal arm, Q, is also projected forward from its middle and is borne downward by a spring, *w*, which thus tends to hold the upright arms N against the shuttle-box levers. The front extremity of the horizontal arm acts upon the hinder toe of a short rock-shaft, R, which is pivoted to the front of the lay and is fitted with a second toe, *x*, that projects toward the breast-beam B of the loom. This breast-beam has a horizontal lever, S, pivoted to its lower side. The inner extremity of this lever is within the range of the front toe, *x*, of the rock-shaft on the lay. Its outer extremity bears against the spring-standard H, so as to disengage the latter from its socket when the inner extremity of the breast-beam lever is moved forward or when its outer extremity is moved backward. A toe, *y*, is projected downward from the long rock-shaft P to act upon the upper arm of a lever, T, which is pivoted to the lay and whose lower arm is connected by a chain, U, with the outer extremity of the breast-beam lever. The length of this chain is such that when the lower arm of the chain-lever T is moved backward by the action of the toe of the rock-shaft upon its upper arm the chain in the backward stroke of the lay draws the outer extremity of the breast-beam lever along with it to disengage the spring-standard; but when the chain-lever is not moved by the toe of the rock-shaft the chain is not drawn sufficiently tight to move the breast-beam lever or the spring-standard upon which it acts.

From the above description it is evident that if a shuttle is not in one of the shuttle-boxes at the time the lay is completing its forward stroke neither shuttle-box lever *t t* will be moved to act upon the corresponding arms, N, of the rock-shaft P, and consequently the front end of the toe *x* will be borne against the inner extremity of the breast-beam lever, and by moving it will effect the disengagment of the spring-standard and the stopping of the loom. If, however, the shuttle is received in either shuttle-box before the lay completes its forward stroke, the lever of that shuttle-box will be forced outward by the entering shuttle, the corresponding upright arm, N, of the rock-shaft will be moved to turn its shaft, and the central horizontal arm, Q, of the rock-shaft will be moved to depress the toe *x* beneath the lower face of the breast-beam lever, so that it will pass the latter without moving it. Hence, if the shuttle be in either box when the lay is beating up, the loom will not stop. On the other hand, if a shuttle be in either box at the time the lay is completing its back-stroke, the rock-shaft P, being turned by the action of the corresponding shuttle-box levers *t t* upon the appropriate upright cam N, will move the chain-lever T to tighten the chain U, which, acting upon the breast-beam lever, detaches the spring-standard, and thus effects the stopping of the loom, while if the shuttle is at this time traveling in the proper manner from one shuttle-box to the other the rock-shaft will not be moved by the action of either shuttle-box lever upon its upright arms and the chain will not be tightened. Consequently the loom is not stopped. This stop-motion therefore effects the stopping of the loom whenever the shuttle is not in its proper box at the time the lay is beating up, and also whenever the shuttle is not thrown from its box at the time the lay is retrograding.

The self-adjusting pace is applied to the yarn-roll. It consists of one or more friction-bands, V, which are passed around the peripheries of the heads *z z* of the yarn-roll G and are pressed upon it by weighted levers W, whose weights X are shifted automatically to diminish the pressure as the yarn is given off from the roll. The weights X are fitted to slide freely upon the levers W and are connected by cords *a' a'* with a drum, Y, that is secured to the extremity of a short shaft, *b'*. This shaft is also fitted with a pinion, *c'*, whose teeth engage with those of an upright rack, Z. The latter is arranged to slide in a guide-box, *f'*, toward and from the barrel of the yarn-roll, and its upper extremity is fitted with a boss or rubber to bear against the cylindrical surface of the yarn upon the roll. The levers W are slightly inclined downward from their extremities, so that the jar of the loom causes the weights to slide toward their pivots or fulcra and to draw their cords from the cord-drum, which, being turned by the pull of the cords, acts by means of its pinion upon the rack, which is thus forced upward against the periphery of the roll of yarn.

When the yarn-roll is filled with yarn, the weights are retained at the outer extremities of their levers, for the tendency of the cords to turn the drum Y is counteracted by the

pressure of the yarn upon the upper extremity of the rack. As the yarn is gradually worked off, the diameter of the roll diminishes, the rack is permitted to move upward, and is moved upward and retained in contact with the periphery of the yarn on the roll, for the jar of the loom, by imparting to the weights a constant tendency to descend upon their inclined levers, causes them to unwind their cords from the drum and turn the latter to raise the rack as fast as the diminishing diameter of the yarn on the roll will permit the rack to rise. As, therefore, the yarn is worked off from the roll, the weights move nearer the fulcra of their levers, thus diminishing the strain upon the friction-bands in proportion to the diminished diameter of the roll of yarn. As the yarn-roll diminishes in diameter, the friction-bands act upon it at a greater mechanical advantage by reason of the difference between the invariable diameter of the heads on which the bands act and the diminished diameter of the roll of yarn; but as this increase in effective force is counteracted by the lessening of the strain upon the friction-bands, due to the change in the positions of the weights upon their levers, the tension of the warp-threads remains the same and is not varied by the change in the diameter of the warp-roll as the warp-thread is worked off to form the web.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The method of moving both picker-sticks of a loom simultaneously and at each beat of the lay by the mechanism herein described, or the equivalent thereof, whereby a shuttle may be thrown from either side of the web at each beat of the lay and the momentum of the picker-motion at one side of the loom is counterbalanced by that of the other picker-motion at the opposite side of the loom, the mechanism operating in such manner that both the pickers are free to retreat to the outer ends of the shuttle-boxes the instant the shuttle is thrown, substantially as specified.

2. The combination of the pattern-wheel U, arm W, double-armed lever R, cross-head M, and stop L, operating, substantially as herein set forth, to effect the shifting of the shuttle-boxes, as herein set forth.

3. The combination of the forked marches, reciprocating levers, pattern-drum, and evening-pin, substantially as herein set forth, to effect the working of the heddles to form the shed, as herein set forth.

4. The combination of the supplementary arms on the cam shaft and pins upon the star-wheel, or the equivalents thereof, operating, substantially as herein set forth, to vary the number of changes of which the heddle mechanism is susceptible.

5. The combination of a fork and grid-motion for effecting the stopping of the loom when the weft-thread breaks as the shuttle is moving toward one side of the loom with the shifting-plate lever, operating substantially as described, for preventing the loom from being stopped by the fork and grid-motion when the shuttle is thrown toward the side of the loom farther therefrom.

6. The combination of the long rock-shaft on the lay with its arms, toes, and levers, and of the chain-lever and chain with the breast-beam lever, or the equivalents thereof, operating, substantially as described, to effect the stopping of the loom when the shuttle is not in its proper shuttle-box at the time the lay is beating up, and also whenever the shuttle has not been ejected from its box at the time the lay is completing its back-stroke, as herein set forth.

In testimony whereof we have hereunto subscribed our names.

BARTON H. JENKS.
ROBERT BURNS GOODYER.

Witnesses:
JNO. P. OFFERMAN,
S. H. PETERSON.