No. 843,178. PATENTED FEB. 5, 1907.

W. A. ROBINSON.

LAPPET LOOM.

APPLICATION FILED MAY 9, 1904.

5 SHEETS—SHEET 1.

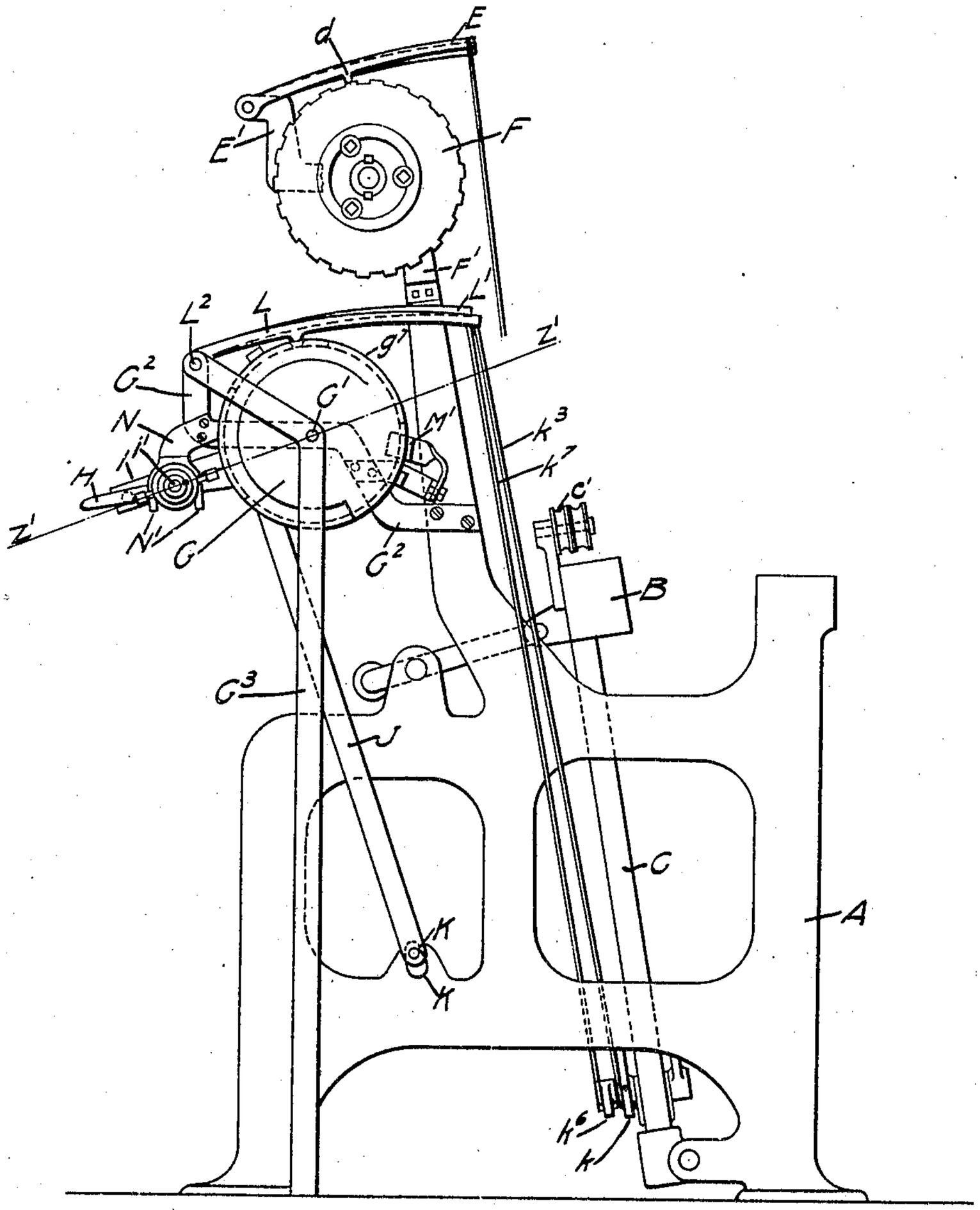

FIG. 1.

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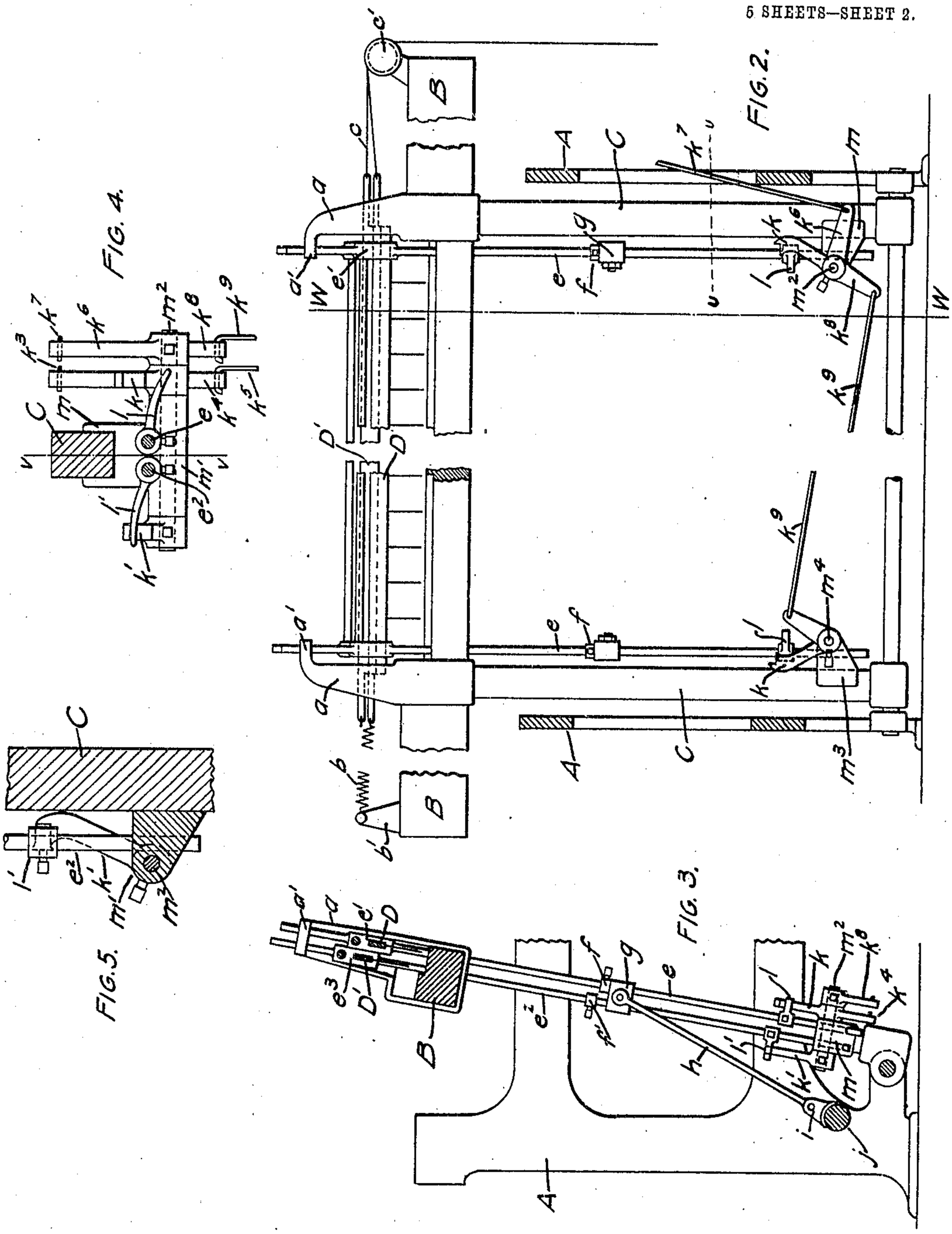

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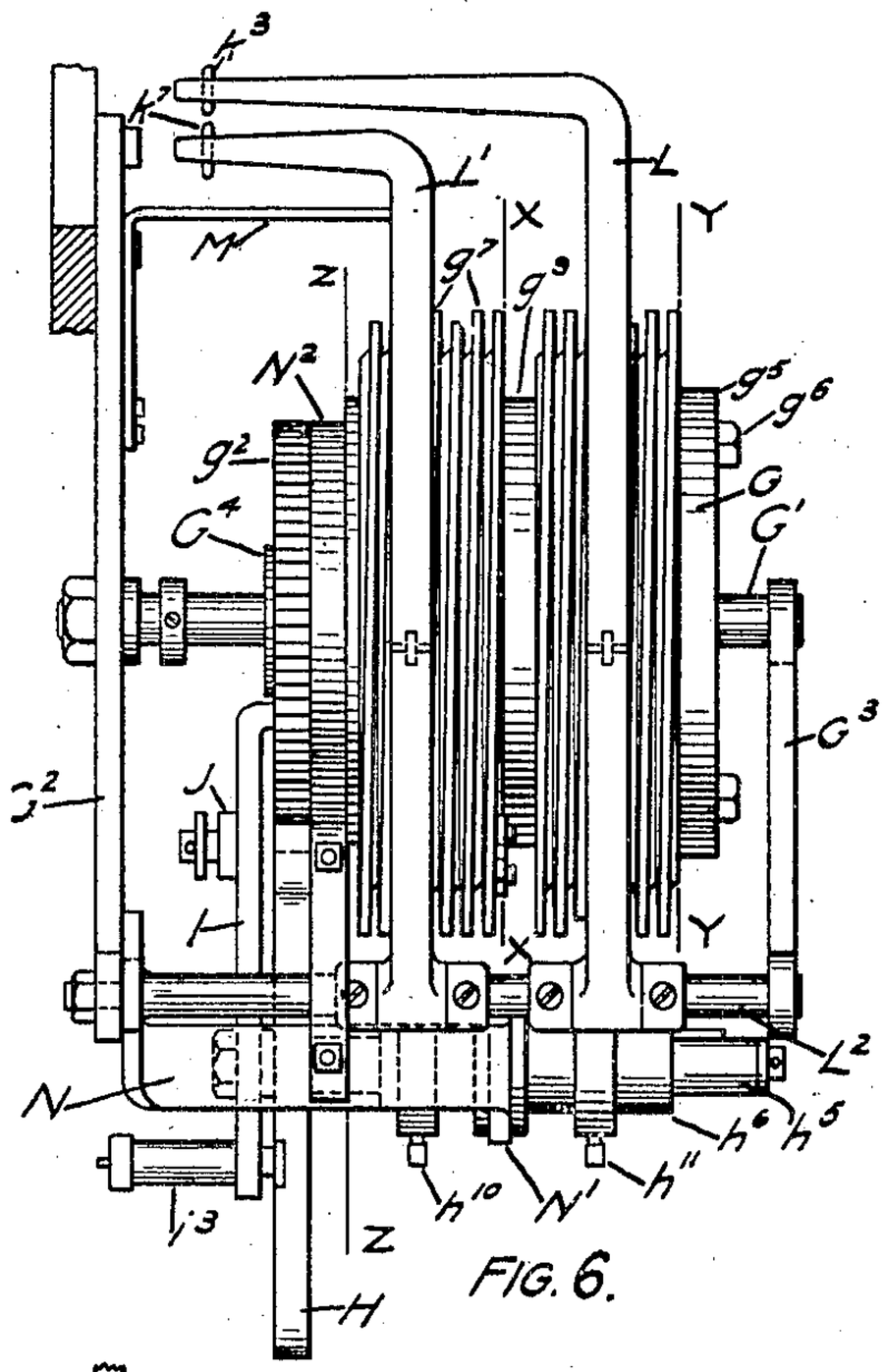

FIG. 6.

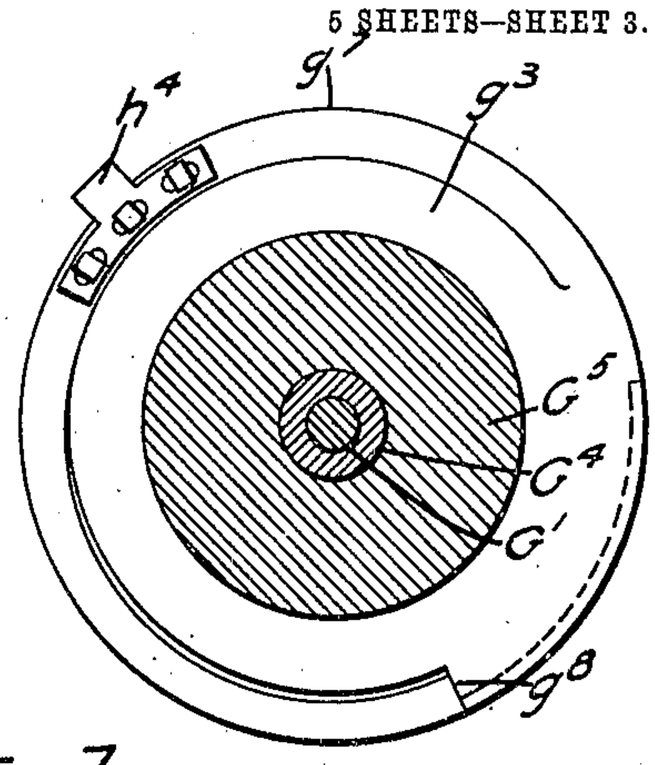

FIG. 7.

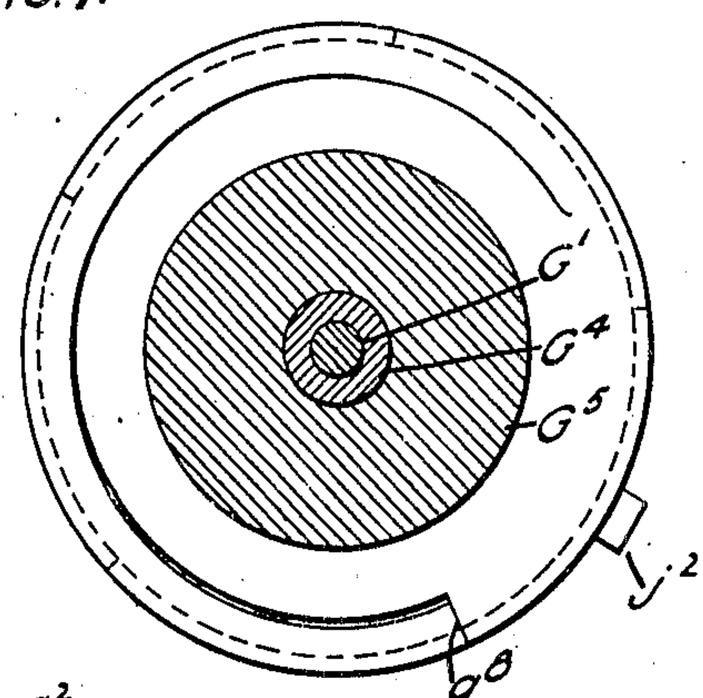

FIG. 8.

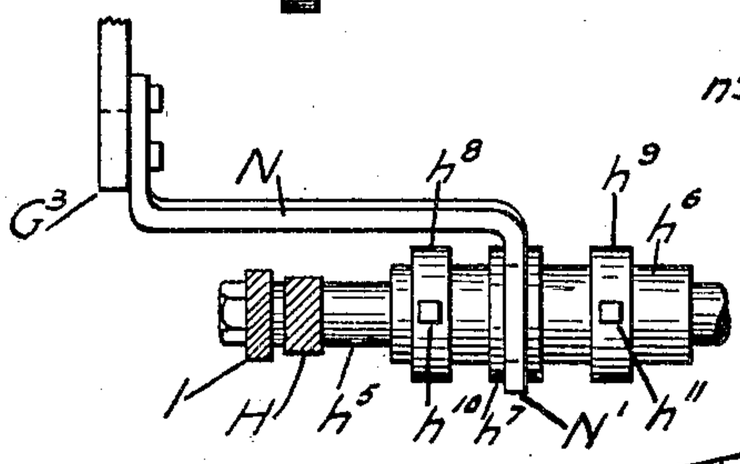

FIG. 13.

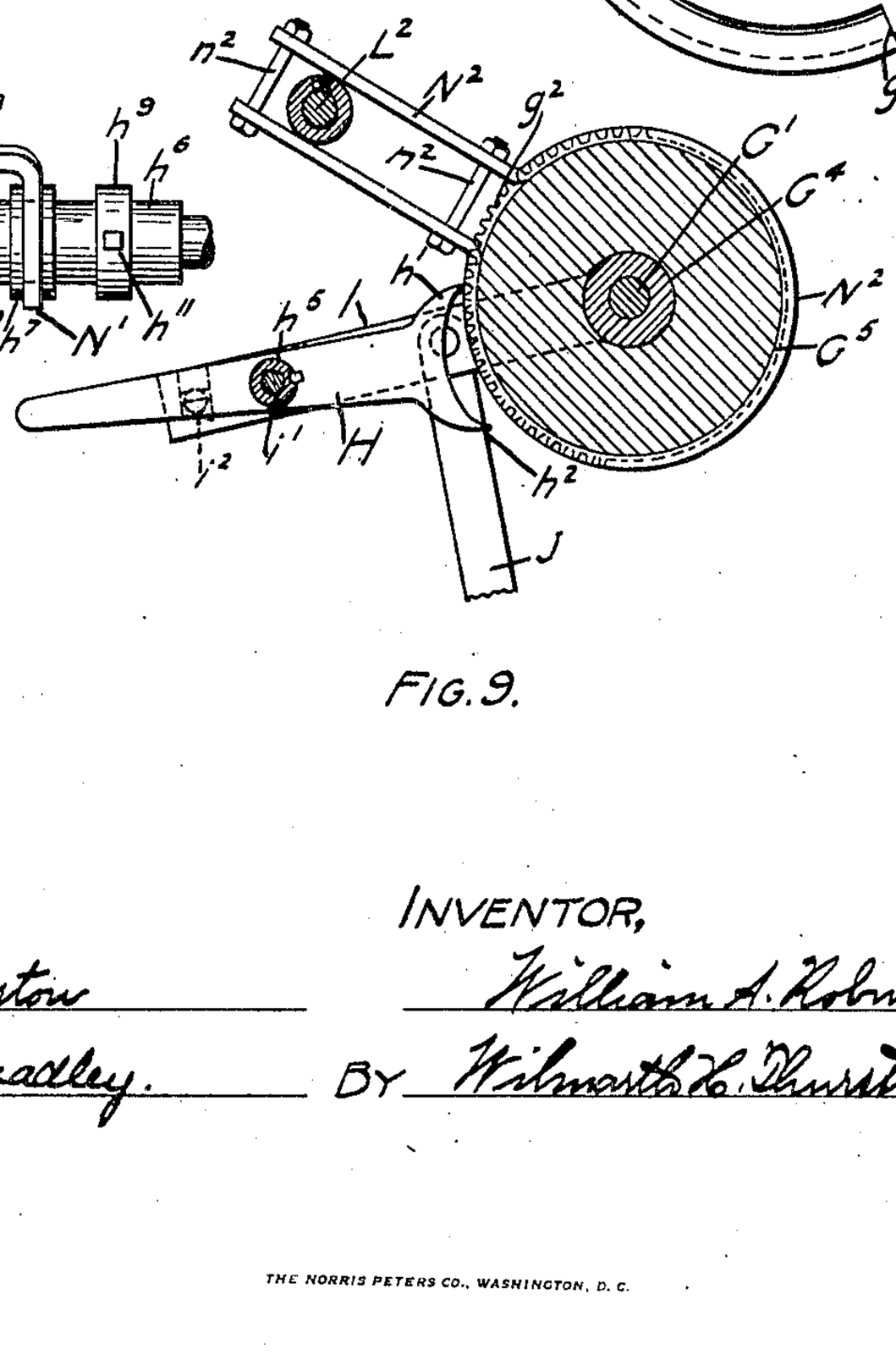

FIG. 9.

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5 SHEETS—SHEET 4.

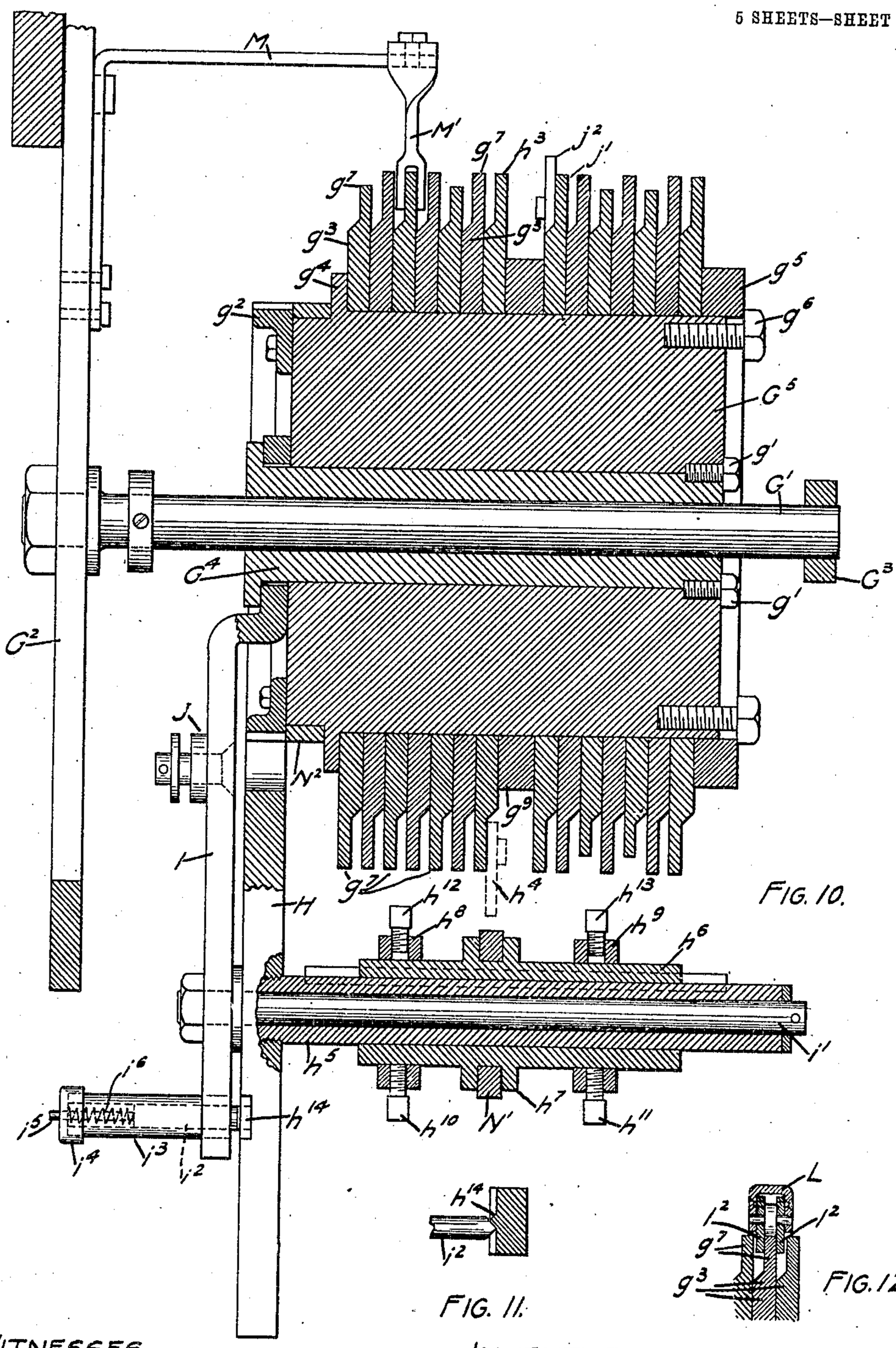

FIG. 10.

FIG. 11.

FIG. 12.

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5 SHEETS—SHEET 5.

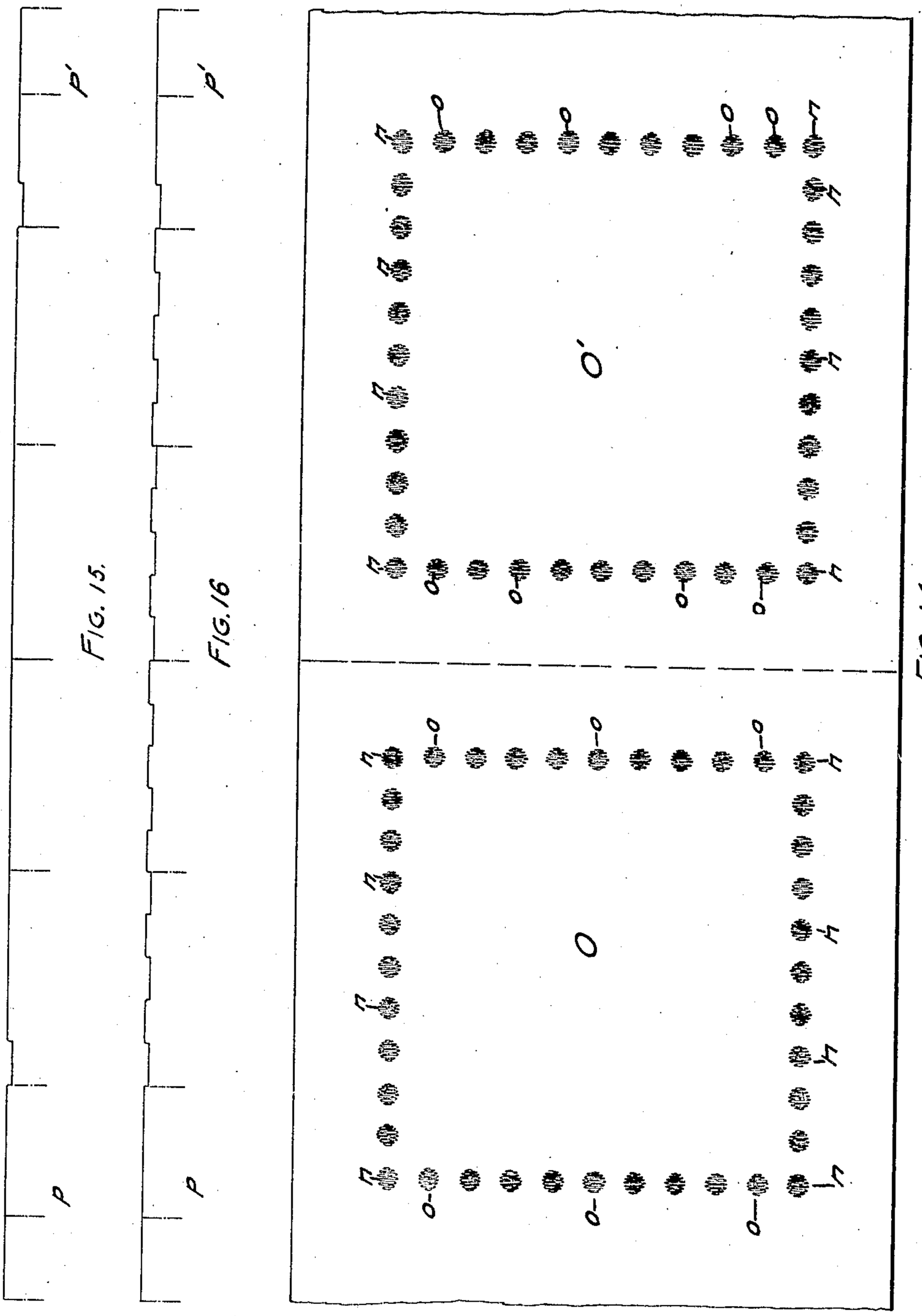

FIG. 14.

FIG. 15.

FIG. 16

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UNITED STATES PATENT OFFICE.

WILLIAM A. ROBINSON, OF WOONSOCKET, RHODE ISLAND, ASSIGNOR TO MANVILLE COMPANY, OF PROVIDENCE, RHODE ISLAND, A CORPORATION OF NEW JERSEY.

LAPPET-LOOM.

No. 843,178. Specification of Letters Patent. Patented Feb 5, 1907.

Application filed May 9, 1904. Serial No. 207,000.

To all whom it may concern:

Be it known that I, WILLIAM A. ROBINSON, of the city of Woonsocket, county of Providence, and State of Rhode Island, have invented certain new and useful Improvements in Lappet-Looms; and I do hereby declare the following specification, taken in connection with the accompanying drawings, forming a part of the same, to be a full, clear, and exact description thereof.

The object of the present invention is to produce a design composed of individual lappet patterns or figures, which design requires for its production the employment of a much longer repeat than has heretofore been possible or practicable. By the present invention such lappet design may be of such size or length that a single design may constitute a complete article—as, for instance, a doily or a handkerchief.

In practice I have employed the invention for the production of handkerchiefs provided with a lappet design, which handkerchiefs were fourteen inches in length and in which the lappet design or repeat is likewise fourteen inches long. In weaving these handkerchiefs successively in a continuous fabric the lappet design or repeat may be conveniently measured from the beginning of the lappet-weaving in one handkerchief to the beginning of the lappet-weaving of the same design in the next handkerchief, the distance between which points will likewise necessarily be fourteen inches. Assuming, therefore, that the fabric is to be woven—say, sixty-four picks to the inch—the lappet design or repeat for an article fourteen inches long would in such case require to be eight hundred and ninety-six picks in length. It would be obviously impossible to provide for a lappet design or repeat of such length by the ordinary pattern-wheel, and it would likewise be impracticable to provide for the same by a pattern-chain, which in such case would require to be composed of eight hundred and ninety-six links.

The object of the present invention is to provide a lappet-pattern or controlling mechanism adapted to provide for a lappet design or repeat of extreme length—as, for instance, a repeat composed of as many or even a greater number of picks than that above mentioned.

To that end the invention consists primarily in providing a spiral pattern-surface for controlling the vertical movements of the needle-bar, and thereby controlling the beginning and end of a lappet design of the character referred to.

If desired, the lappet design as a whole may be composed of separate designs matched together to compose the complete design. Thus, for example, in a handkerchief the lappet design as a whole may consist of a border extending parallel with the four sides of the handkerchief, and in such case the side portions of this border may constitute one lappet design to be controlled by one pattern-surface, and the cross portions of the border may constitute another lappet design to be controlled by another pattern-surface, the side portions and the cross portions referred to being matched to make the complete border, which border in this case constitutes the complete symmetrical design for the handkerchief. In this latter case the times for throwing the two needle-bars into and out of operation will vary in the case of the constituent designs, and consequently the two needle-bars required for the production of the two constituent designs must be controlled by separate and independent operating mechanism, because one of the needle-bars will require to be held out of operation at times when the other needle-bar is operating.

A further feature of the invention therefore consists in providing two pattern-surfaces, one to control one of the constituent lappet designs and the other to control the other constituent lappet design.

A further feature of invention consists in the employment of a pattern-surface for controlling the lateral movements of the needle-bar and an independently-operated pattern-surface for controlling the vertical movements of said needle-bar. By this arrangement the needle-bar may be continuously reciprocated laterally, and it therefore becomes unnecessary to devote any portion of the periphery of the pattern-wheel which controls the weaving of the lappet figure to hold the needle-bar in a fixed lateral position during the weaving of the space intermediate between two consecutive lappet-figures. As a result of this arrangement the entire periphery of the pattern-wheel which controls the weaving of the lappet figure may be devoted

to such figure, and thus the projections and depressions on the periphery of said wheel may be spaced farther apart than would be possible if a portion of said periphery had to be devoted to the space between two adjacent figures. Thus, for example, suppose that the lappet figure occupies forty-four picks and that this is followed by forty-four picks of plain weaving, if the pattern-wheel which controls the up-and-down movements of the needle-bars is operated independently of the pattern-wheel which controls the weaving of the lappet figure, the pattern-wheel for the lappet figure may complete one revolution in forty-four steps, at the end of which revolution the needle-bars may be locked out of operation, and the pattern-wheel which controls the weaving of the figure may then make another revolution, which will cause the continued lateral reciprocation of the needle-bars, which, however, will be inoperative to effect any lappet-weaving, because the needle-bars are during this second revolution of the pattern-wheel locked out of operation.

Referring to the drawings, Figure 1 is an end view of a lappet-loom embodying the invention. Fig. 2 is a rear view of the lay and its adjuncts, with the frame broken away. Fig. 3 is a section on the line *w w* of Fig. 2. Fig. 4 is a section through one of the swords of the lay on the line *u u* of Fig. 2. Fig. 5 is a section on the line *v v* of Fig. 4. Fig. 6 is a plan view on an enlarged scale of the spiral pattern-head. Fig. 7 is a section on the line *x x* of Fig. 6. Fig. 8 is a section on the line *y y* of Fig. 6. Fig. 9 is a section on the line *z z* of Fig. 6. Fig. 10 is a section on the line *z' z'* of Fig. 1 on an enlarged scale. Figs. 11, 12, and 13 are details. Fig. 14 represents two handkerchiefs as woven successively in a continuous fabric, each of said handkerchiefs embodying a lappet design in the form of a border composed of individual lappet figures in the form of spots. Figs. 15 and 16 are developments on a larger scale of the two spiral surfaces for controlling the two needle-bars employed in the production of one of the two lappet designs or repeats shown in Fig. 14, said Figs. 15 and 16 being twice the scale of Fig 14.

A represents the frame of the loom, B the lay, and C the swords of the lay. Mounted in the lay are two needle-bars D D', arranged to reciprocate laterally and also to have up-and-down movements imparted thereto. The means for giving the desired lateral movements to the two needle-bars are the same in each case, and a description of the the means for giving such lateral movements to one of the needle-bars will be sufficient. The needle-bar projects laterally through the brackets *a*, secured to the upper ends of the swords. To one end of the needle-bar is secured the spring *b*, the other end of said spring being attached to a standard *b'*, secured at or near one end of the lay. Attached to the opposite end of the needle-bar is a cord *c*, which passes around a pulley *c'*, mounted upon the opposite end of the lay. Said cord *c* passes down around a pulley near the floor, (not shown in the drawings,) and thence upward and is connected to the free end of the lever E, which lever is pivoted at its other end to a bracket E', secured to the frame of the loom. The lever E is provided with a projection or roll *d*, adapted to ride upon the surface of the pattern-wheel F, which is supported for rotation on the bracket F', secured to the frame. The periphery of the pattern-wheel is provided with a series of projections and depressions corresponding to the pattern of the lappet figure to be produced, and said pattern-wheel is to be rotated one step for each pick by any suitable mechanism not necessary to be described. When the roll *d* is upon one of the projections of the pattern-wheel F, the needle-bar will be pulled to the right in Fig. 2, and when the roll *d* is in one of the depressions on said pattern-wheel the needle-bar will be pulled to the left by the spring *b*.

The mechanism for giving the required up-and-down-movements to the needle-bars is as follows: Each needle-bar is mounted in two lifting-rods *e e*, one located near each end of the needle-bar, said lifting-rods being provided with an enlarged portion *e'* near its upper end, which is mortised to receive the needle-bar. Each of these lifting-rods *e e* passes through the lay and is guided at its upper end in a bracket *a'* and is guided at its lower end in a bracket projecting from the sword C. The needle-bar, with its connected lifting-rods *e e*, will fall by gravity to its lowest position when permitted to do so, and it is only necessary to provide means for lifting said needle-bar at the desired times. The downward movement of the needle-bar is for the purpose of carrying the lappet-threads into and to the bottom of the shed and so that the shuttle will pass above said lappet-threads and so that they will be woven into the fabric, while the upward movement of the needle-bar is for the purpose of lifting the lappet-threads above the shed and so that they will not be woven into the fabric and also so that the needle-bar may be moved laterally to change the position of the needles. As the movement of the lay is timed with the opening of the shed, the lay swinging backward as the shed is opened, it is convenient to control the vertical movements of the needle-bar from the lay. Adjustably secured to the lifting-rod *e* is a collar *f*. Arranged to slide on said rod *e* is another collar *g*. To this collar *g* is pivotally secured one end of a connecting-rod *h*, the other end of which is pivotally connected to a bracket *i*, secured to the cross-rod *j* of the

loom. With this construction when the lay is in its rearward position, as shown in Fig. 3, the lifting-rod *e* and the needle-bar D carried thereby will be in their lower position. When now the lay swings forward, the collar *g* will be caused by the action of the connecting-rod *h* to move upward, and by engagement with the collar *f*, secured to the lifting-rod *e*, will serve to lift said rod, and thereby lift the needle-bar D. It will be understood that there is a similar construction at each end of the loom.

The construction of the mechanism for giving the up-and-down movements to the needle-bars where two such needle-bars are employed will next be described. Referring to Fig. 3, it will be seen that there is a second lifting-rod e^2, arranged just in front of the lifting-rod *e*, said lifting-rod e^2 being likewise provided with an enlargement e^3, which is mortised to receive the second needle-bar D′. Adjustably secured to the lifting-rod e^2 is a collar *f*′. In this case the sliding collar *g* is what may be termed a "double" collar or yoke, being a block having two holes extending therethrough and through one of which the lifting-rod *e* passes and through the other of which the lifting-rod e^2 passes. With this construction, if nothing further were provided, the two needle-bars D D′ would move upward and downward together and would so move at each beat of the lay. It it necessary, however, when the lappet-threads are not to be woven into the fabric that the needle-bars should be held in their upper position, and as it may happen that the lappet-threads controlled by one of the needle-bars are to be woven into the fabric at a time when the lappet-threads controlled by the other needle-bar are not to be woven in it is desirable to provide means whereby each needle-bar may be held in its upper or inoperative position independent of the other.

In the construction shown in the drawings this is accomplished by means of latches *k k*. Each of the lifting-rods *e e* of the needle-bar D is provided with a projection *l*, and each of the lifting-rods e^2 of the needle-bar D′ is provided with a corresponding projection *l*′. There are two latches *k k*, one near each end of the loom, one of said latches being adapted to be moved into and out of the path of the projection *l* on one of the lifting-rods *e* as said lifting-rod is raised or lowered and the other latch *k* being likewise adapted to be moved into or out of the path of the corresponding projection *l* on the companion lifting-rod *e*. Two other similar latches *k*′ *k*′, one located near each end of the loom, are likewise adapted to be moved into or out of the path of the projection's *l*′ *l*′ on the other pair of lifting-rods e^2 e^2, which control the vertical position of the other needle-bar D′.

Referring first to the construction at the right in Fig. 2 and likewise shown in Figs. 3 and 4, *m* is a bracket secured to the sword C. This bracket is provided with a bearing *m*′, in which is mounted a rock-shaft m^2. The latch *k* constitutes one arm of a three-armed lever provided with a hub, which hub is loosely mounted on the rock-shaft m^2. To a second arm k^2 of this three-armed lever a connecting cord or wire k^3 is attached, which leads to a lever controlled by the pattern-surface hereinafter described. The third arm k^4 of said three-armed lever projects downward and has a connecting-wire k^5 attached thereto. Secured to the rock-shaft m^2 is a two-armed lever, to one arm k^6 of which a connecting-wire k^7 is attached, the other end of which wire is connected to a pattern-lever controlled by another pattern-surface to be hereinafter described, and to the other arm k^8 of which a connecting-cord k^9 is attached. Secured to the opposite end of the rock-shaft m^2 is a latch *k*′, which engages the projection *l*′ upon the lifting-rod e^2.

Secured to the sword C, at the opposite end of the loom, is a similar bracket m^3, in which is mounted a rock-shaft m^4, upon which the latches *k k*′ at that end of the loom are similarly mounted. Each of the latches *k k*′ at this latter end of the loom constitutes one arm of a two-armed lever. The opposite arm of the lever *k* has the connecting cord or wire k^5 attached thereto, while the other arm of the lever *k*′ has the connecting cord or wire k^9 connected thereto. The construction is such that the two latches *k*′ *k* will be caused to simultaneously move toward or from each other, and the two latches *k*′ *k*′ will likewise be caused to move simultaneously toward or from each other. As the latches *k k* are controlled by one pattern-surface, while the latches *k*′ *k*′ are controlled by another and independent pattern-surface, it is evident that the latches *k k* will be caused to move toward or from each other without moving or disturbing the position of the latches *k*′ *k*′.

It is obvious that the sliding collar *g*, which surrounds both of the lifting-rods *e* e^2, is and must be moved up and down continuously at each to-and-fro movement of the lay by reason of the connecting-rod *h*, which is connected at one end to the frame of the loom. It is also obvious that as long as the latches *k k* are held out of the path of the projections *l l* and the latches *k*′ *k*′ are likewise held out of the path of the projections *l l*, both of the needle-bars D D′ will be continuously raised and lowered by the engagement of the sliding collar *g* with the fixed collars *f f*′, secured to the lifting-rods *e* e^2, respectively. If now it be desired to hold the needle-bar D, for instance, in its upper or inoperative position and at the same time to have the needle-bar D′ continue its up-and-down movements, all that is necessary to secure this result is to pull the cord k^3, which

will serve to rock both of the latches *k k* and move the free ends of said latches into the paths of the projections *l l*, this movement of the latches being effected at a time when the needle-bar is at or near its upper position and so that the free ends of said latches may thus be moved into the path of the projections *l l* and below the same—that is, at a time when the lay is at or near its forward position. When now the lay swings backward and the sliding collar *g* is thereby moved downward, the lifting-rods *e e* will be prevented from moving downward by the impingement of the projections *l l* against the latches *k k*, which latches will thereby serve to prevent the downward movement of the needle-bar D and will hold said needle-bar in its upper or inoperative position. As, however, there is nothing to prevent the downward movement of the needle-bar D′, said needle-bar will descend with the backward movement of the lay, being lowered or allowed to fall by the downward movement of the sliding collar *g*. It will be obvious that the needle-bar D will continue to be held in its upper or inoperative position as long as the latches *k k* remain in position below the projections *l l* and until they are withdrawn from the path of said projections. It is preferred to have the latches hold the needle-bar in a position somewhat below its extreme upper position, as thereby the latches can be readily moved into the path of the projections *l l* when the lay is forward and the needle-bar in its upper position, the projections *l l* at this time being sufficiently above the upper ends of said latches, so as not to interfere with the movement of said latches or to require any special force to move said latches into a position below said projections. With this construction also the projections will be lifted slightly above the upper ends of the latches at the time when the latches are to be withdrawn, and consequently no special force will be required to withdraw the latches. If now it be desired to hold the needle-bar D′ in its upper or inoperative position and to allow the needle-bar D to continue its up-and-down movements, this may be done by withdrawing the latches *k k* out of the path of the projections *l l* and moving the latches *k′ k′* into the path of the projections *l′ l′* of the lifting-rods e^2 e^2 of the needle-bar D′. When this has been done, the needle-bar D′ will be prevented from falling as the sliding collar *g* moves downward, while the needle-bar D will be permitted to follow down as the sliding collar *g* moves downward under the backward movement of the lay.

With the above construction it will be seen that both of the needle-bars D D′ may be permitted to operate to insert the lappet-threads in the fabric, or both of said needle-bars may be held in their upper or inoperative position, or either one or the other of said needle-bars may be held in its upper or inoperative position while the remaining needle-bar is permitted to continue its operative up-and-down movements. In other words, either one of said needle-bars may be locked out at will. So far as known, this is a result which has never heretofore been accomplished. As will be seen, this is a matter of great advantage, as it enables either one of two needle-bars to be employed for the production of lappet figures with spaces between said figures and greatly increases the variety of figures which can thus be produced with the employment of two needle-bars. The connecting-wires k^3 k^7, which serve to operate the latches *k k* and *k′ k′*, respectively, may be controlled by any suitable pattern mechanism constructed to produce a pull upon said wires when the latches are to be moved into the path of the projections on the lifting-rods, and which will release said latches at the proper times.

In the construction shown in the drawings, each of the connecting-wires k^3 k^7 is operated or controlled by a convolute or spiral pattern-surface, which constitutes another feature of the present invention and which will now be described.

G represents the pattern-head for controlling the up-and-down movements of the needle-bars G G′. Said pattern-head is mounted on an arbor G′, secured at one end to the bracket G^2, projecting from the frame of the loom and preferably supported at its opposite end by a standard G^3, secured to the floor at a short distance from one end of the loom. Mounted loosely on the arbor G′ is a flanged sleeve G^4, upon which is mounted a drum G^5, which said drum is secured to the sleeve G^4 by bolts *g′* and so that said drum and sleeve will rotate together. The drum G^5 is provided at one end with a ratchet-wheel g^2 for intermittently rotating the same, which ratchet-wheel may be formed integral with said drum or may be formed separately and secured to the drum, as shown in the drawings. Mounted upon the drum G^5 are a series of disks g^3, which are clamped in position between an annular flange g^4 at or near one end of the drum and a clamping-ring g^5, which is held in position by the clamp-screws g^6, which take into the opposite end of the drum. Each of the disks g^3 is provided with a body portion and with a projecting portion g^7, which is in the form of a spiral. Preferably the projecting portion g^7 of each disk consists of a complete convolution, as shown in Fig. 8, which convolution begins and ends with an abrupt shoulder, as indicated at g^8. With this construction when a series of these disks are mounted upon a common axis and clamped together the projecting portions g^7 will interlock with each other, the abrupt shoulder g^8 of one disk abutting

against the corresponding shoulder of the next disk and so that the convolution on one disk will be a continuation of the convolution on the adjoining disk.

The periphery of each disk, or the projecting portion g^7 thereof, is provided with projections and depressions to constitute the pattern-surface, and by reason of the spiral or convolute construction referred to the pattern-surface will extend from one disk to the next and may be increased in extent by simply increasing the number of disks employed. Each disk will provide a pattern-surface for as many picks as there are teeth in the ratchet g^2. Assuming said ratchet to be provided with eighty teeth, for instance, a series of six disks will provide a pattern-surface for four hundred and eighty picks, if the ratchet be advanced one tooth at each pick of the loom, as it may be by operating the pawl which actuates said ratchet at each pick of the loom. In the arrangement shown, however, the pawl H, which serves to operate the ratchet g^2, is actuated by a connection with the cam-shaft which rotates once at every two picks, and with this construction a pattern-surface formed by a series of six disks, as shown, will with an eighty-tooth ratchet serve to control the operation of the needle-bars for nine hundred and sixty picks, and will thus provide for a design or repeat of that length. In the construction shown, in which two needle-bars are employed, there are two of these spiral pattern-surfaces, one for each needle-bar, each composed of a series of six disks, as shown in Figs. 6 and 10, both of which series of disks are mounted upon the same drum G^5. If desired, an intermediate spacing-collar g^9 may be employed, as shown in Fig. 10.

Pivoted to swing about the axis of the pattern-head G is a lever I, which carries the pawl H, which engages the ratchet g^2 to intermittently rotate the pattern-head. A connecting-rod J connects the lever I with a crank K on the cam-shaft K'. With this construction, as is obvious, the pawl H will be caused at each revolution of the cam-shaft K' to advance the pattern-head G one tooth of the ratchet g^2.

Pivoted upon a cross-bar L^2 are two pattern-levers L L', one of which overlies one of the two spiral pattern-surfaces shown in Fig. 10 and the other of which overlies the other spiral pattern-surface there shown. To the free end of the lever L the connecting-wire k^3 is attached, while to the free end of the lever L' the end of the connecting-cord k^7 is attached. Each of these levers is preferably provided with a dolly-roll to ride on the pattern-surface.

In order to enable the dolly-roll of the pattern-lever to follow the spiral pattern-surface, it is necessary that either the pattern-head shall be moved longitudinally beneath the pattern-lever or that the pattern-lever shall be moved longitudinally along the pattern-head. It has been found more convenient to give this longitudinal movement to the pattern-head rather than to the pattern-lever, and this is the construction shown in the drawings. Secured to the bracket G^2 is an overhanging bracket M, to which is secured a depending fork M', the forked end of which straddles the projecting portion g^7 of the pattern-disk. The pattern-head G as a whole is adapted to move longitudinally on its supporting-stud G'. Consequently as the forked projection M' is stationary and rigid the revolution of the pattern-head will by reason of the spiral formation of the projecting portions g^7 of the disks g^3 cause said pattern-head to be gradually moved lengthwise along the supporting-stud G' and so that as said pattern-head revolves the dolly-roll on the pattern-lever will be caused to travel from one disk to the next, and thus to follow the spiral pattern-surface. It will be obvious that as the pattern-head is intermittently rotated by its pawl and ratchet the pattern-levers L L' will under the action of their respective spiral pattern-surfaces be caused to operate the connecting-wires k^3 k^7, so as to throw the needle-bars D D', one or both, into and out of operation at the desired times, depending upon the form of the respective spiral pattern-surfaces.

In employing a spiral pattern-surface such as above described it is necessary when the roll of the pattern-lever has reached the end of the pattern-surface, either by the longitudinal movement of the pattern-head described or by a corresponding longitudinal movement of the pattern-lever with relation to the pattern-head, that the parts shall be returned to their original position in order that the lever may be again caused to travel over the pattern-surface. In other words, as the pattern-surface in this case is not endless means must be provided for returning the parts to their original position. While this may be accomplished in various ways, it is preferred to thus return the parts to their original position by a reverse rotation of the pattern-head, and thus to utilize the return movement for the production of a duplication of the design or repeat. In other words, the travel of the pattern-lever from one end of the spiral pattern-surface to the other while the pattern-head is revolving in one direction may be used to produce a given design, and the travel of the pattern-lever along the pattern-surface in the reverse direction by the revolution of the pattern-head in the opposite direction may serve to produce the next repetition of the design in the continued length of the fabric. Thus a spiral pattern-surface composed of six disks, as shown, which will control the operation of the needle-bars for

nine hundred and sixty picks, as above stated, may by a mere reversal of the direction of revolution of the pattern-head be caused to control the operation of said needle-bars for one thousand nine hundred and twenty picks. If desired, instead of having the revolution of the spiral pattern-surface in one direction control the needle-bars for the production of a complete design it may serve to control said needle-bars for the production of one-half of the proposed design measured lengthwise of the fabric, and the completion of said design may be controlled by the revolution of the pattern-head in the reverse direction. By this arrangement a spiral pattern-surface composed of six disks, as shown, may with an eighty-tooth ratchet serve to control a lappet design or repeat one thousand nine hundred and twenty picks in length.

The means employed for producing the reverse rotation of the pattern-head G in the construction shown is as follows: The pawl H instead of being a single pawl and rigidly secured to the lever I is a double pawl provided with two engaging fingers h' h^2 and is pivoted to said lever I at i'. When the pattern-head is to be rotated in one direction, the finger h' is thrown into engagement with the ratchet g^2, as shown in Fig. 9. When the pattern-lever has reached the end of the spiral pattern-surface and the direction of rotation of the pattern-head is to be changed, the pawl H is turned upon its pivot so as to throw the finger h' out of engagement with the ratchet g^2 and the finger h^2 into engagement with said ratchet. This is accomplished by the following means: Mounted upon the drum G^5 adjacent to the last disk g^3 of the pattern-surface is another disk h^3, to which is secured a projection h^4. Preferably this disk h^3 is constructed the same as the disks g^3, with a projection in the form of a spiral terminating in abrupt shoulders and so that said disk h^3 may be interlocked with the last disk g^3 and fitted closely thereto. This construction, however, is not necessary, and said disk h^3 may be a plain disk. When the disk h^3 is formed in the manner shown, it may, if desired, be utilized as a continuation of the pattern-surface for the greater portion of its periphery and would thus serve to extend the pattern-surface that much.

Secured to the pawl H is a sleeve h^5, projecting at right angles from the pawl, which sleeve surrounds the stud i', secured to or projecting from the lever I, which said stud i' constitutes the pivot for said pawl. Surrounding the sleeve h^5 is another sleeve h^6, keyed to the sleeve h^5, so that rotary movement imparted to said sleeve h^6 will be transmitted to the sleeve h^5 and consequently to the pawl H, while at the same time the sleeve h^5 may move longitudinally through said sleeve h^6. Secured to the bracket G^2 is a bracket N, the free end of which is bent downward and provided with a forked end N', which forked end N' is adapted to enter an annular groove formed in a projecting hub h^7, formed on the sleeve h^6, as shown in Figs. 10 and 13. By this construction said sleeve h^6 will be held against lengthwise movement, while the sleeve h^5 and the pawl H will be permitted to travel lengthwise with the pattern-head G. Adjustably secured to the sleeve h^6 are two collars h^8 h^9, which are held in their adjusted position on said sleeve by means of set-screws h^{10} h^{11}. By loosening the set-screws h^{10} h^{11} the collars h^8 h^9 may be adjusted lengthwise on the sleeve h^6 and may also be adjusted axially thereon. The collar h^8 is provided with a projection h^{12}, and the collar h^9 is provided with a projection h^{13}. As shown, these projections h^{12} h^{13} are in the form of screws or bolts and may thus be adjusted toward or from the pattern-head.

The tail of the pawl H is provided with a V-shaped projection h^{14}, adapted to be engaged by a V-shaped spring-pressed plunger i^2, slidably mounted at or near the lever I. The V-shaped plunger is mounted in a casing i^3, secured to the lever I, provided with a screw-cap i^4, through which the reduced end i^5 of the plunger projects. The spiral spring i^6 abuts at one end against a shoulder formed on the plunger and at the other end against the screw-cap i^4. Each of the pattern-levers L L' is preferably provided with projections l^2 l^2, arranged to straddle the projecting portion g^7 of the disk g^3, as shown in Fig. 12. These projections l^2 l^2 serve to prevent any accidental displacement of the pattern-lever and to retain it in proper position with relation to the spiral pattern-surface as it travels along the same.

The operation of the mechanism above described for effecting the reversal of the pattern-head is as follows: Assuming the pattern-lever L, for instance, to be in position on the first disk to the left in Fig. 10, the pattern-head G will be rotated step by step by the action of the pawl H as said pawl is oscillated by the rotation of the cam-shaft K'. As the pattern-head is thus rotated it will be caused to travel lengthwise on its supporting-stud g', as above explained. This longitudinal movement of the pattern-head will be accompanied by a corresponding longitudinal movement of the lever I, the pawl H, and the sleeve h^6. The said longitudinal movement of the pattern-head will likewise serve to bring the projection h^4 on the disk h^3 in line with the projection h^{13} on the sleeve h^6 and so that upon the next revolution of the pattern-head said projection h^4 will come against the projection h^{13}, and thereby impart a rocking movement to the sleeve h^6, and consequently to the sleeve h^5 and the pawl H. This rocking movement of the pawl H will serve to turn said pawl upon its pivot i', and thus throw the finger h' of said pawl out of

engagement with the ratchet g^2 and to throw the finger h^2 into engagement with said ratchet. As the pawl H is rocked it will serve to depress the spring-pressed plunger i^2, the V-shaped end of which, acting in co-operation with the V-shaped projection h^{14} on the pawl, will serve to quickly throw the pawl into its opposite position. With the finger h^2 of the pawl in engagement with the ratchet said ratchet and the pattern-head secured thereto will of course be rotated step by step in the reverse direction.

When the pattern-head has been moved lengthwise back to its original position and so as to bring the pattern-lever into its original position with relation to the pattern-surface, it is necessary, of course, that the pawl H shall be again rocked and the pattern-head again rotated in its original direction. This is effected by means of a projection j^2 on a disk j', which projection j^2 when the pattern-head has been returned to its original position longitudinally will be brought in line with the projection h^{12} on the sleeve h^6, and the rotation of the pattern-head will then cause said sleeve h^6, together with the sleeve h^5 and the pawl H, to be rocked in the opposite direction.

In order to hold the pattern-head G in the position to which it is moved by the pawl H, a friction-brake N^2 is employed, as shown in Figs. 6 and 9, said brake being in the form of a friction-strap, which is conveniently supported in place by having the two ends of the strap composing said friction-brake arranged to straddle the rod L^2, on which the levers L L′ are pivoted, the ends of said friction-strap being connected together by cross-bolts n^2 n^2, and by means of which the tension of said friction-brake may be adjusted.

Referring to Fig. 14, which shows two handkerchiefs as successively formed in a continuous fabric, each of said handkerchiefs is shown as provided with a lappet design in the form of a border composed of individual lappet figures in the form of spots. In the formation of the border or design there shown the side portions of the border, composed of the eleven lappet figures or spots n, are produced under the control of one of the needle-bars—as, for instance, the needle-bar D—while the cross portions of said border, composed of the nine lappet figures or spots o are formed under the control of the other needle-bar—as, for instance, D′. The operation of the needle-bars in the formation of the lappet design shown is as follows: Assuming that the complete design or lappet begins at a point midway between two adjacent handkerchiefs and terminates at a point midway between the next two adjacent handkerchiefs, both needle-bars D D′ will of course at the beginning of the design or repeat be out of operation, and the pattern-surfaces will be constructed to hold the needle-bars in their upper or inoperative position, as shown in Figs. 15 and 16. After the required length of the plain weaving has been completed both needle-bars D D′ will be unlocked and thrown into operation and will be continued in operation while the lappet figures o, composing the cross portion of the border, and the first two lappet figures n of the side portions of the border are being formed, said lappet figures o, as above stated, being formed under the control of the needle-bar D′ and said figures n being formed under the control of the needle-bar D. When now the cross portion of the border has been completed, both needle-bars will be locked out of operation, as indicated in the developments of the pattern-surface shown in Figs. 15 and 16. The needle-bar D′ will continue to be held out of operation until the time arrives to produce the lappet figures o in the other cross portion of the border; but the needle-bar D will be intermittently thrown into and out of operation to produce the successive lappet-figures n, composing the side portions of the border, until the point is reached where the other cross portion of the border is to be formed, when both needle-bars will be thrown into operation to produce the end figures or spots n of the side portions of the border and the figures or spots o, composing the remaining cross portion of the border. When these lappet figures have been completed, both needle-bars will be thrown out of operation and will be held out of operation during the remainder of the design or repeat, which will be the dividing-line between the handkerchief O and the adjacent handkerchief O′, at which point the direction of rotation of the pattern-surface is to be reversed, as above explained, and so that the adjacent handkerchief O′ will be woven in the same manner during the revolution of the pattern-surface in the reverse direction.

As will be seen, the mechanism above described not only enables either one of the two needle-bars to be locked or held out of operation at will, but it enables a complete article to be woven or produced embodying a lappet design or repeat equal in extent to the extent of the article itself, the production of said lappet design or repeat and of the entire article being thus controlled by one or more pattern-surfaces each of which controls the production of the complete article from beginning to end. It will be further seen that when two needle-bars and two pattern-surfaces are employed the two designs controlled by said pattern-surfaces, respectively, may be matched together to constitute a unitary symmetrical design composed in part of the design controlled by one of the pattern-surfaces and in part by the design controlled by the other pattern-surface.

The developments of the pattern-surfaces shown in Figs. 15 and 16 show the projections

and depressions on the pattern-surfaces and show how the periphery of each of the six disks composing each of the two spiral pattern-surfaces is to be formed. As above stated, with six disks employed to constitute the pattern-surface provision is made with an eighty-tooth ratchet and with the pawl operated from the cam-shaft for nine hundred and sixty picks, whereas the particular pattern shown is intended to occupy only eight hundred and ninety-six picks. As this would not involve the full capacity of the six disks shown, the design or repeat does not begin at the beginning of the first disk, but instead begins at the point *p* in Figs. 15 and 16 and extends only to the point *p'* in said figures.

The construction and arrangement of the parts may be widely varied in embodying the features of invention and the novel combinations in different forms of looms, and I do not intend to limit my invention to the particular construction and arrangement of devices shown and described.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a lappet-loom, the combination, with a needle-bar, of a spiral pattern-surface for controlling the vertical movements of said needle-bar, substantially as described.

2. In a lappet-loom, the combination, with a needle-bar, of a spiral pattern-surface for controlling the vertical movements of said needle-bar in the production of an article provided with a lappet design, substantially as described.

3. In a lappet-loom, the combination, with a needle-bar, of a spiral pattern-surface for controlling the vertical movements of said needle-bar from the beginning to the end of a complete article provided with a lappet design, substantially as described.

4. In a lappet-loom, the combination, with a needle-bar, of a spiral pattern-surface for controlling the vertical movements of said needle-bar, a member coöperating with said pattern-surface, and means for rotating said pattern-surface, substantially as described.

5. In a lappet-loom, the combination, with a needle-bar, of a spiral pattern-surface for controlling the vertical movements of said needle-bar, a member coöperating with said pattern-surface, means for rotating said pattern-surface, and means for causing said coöperating member to traverse said spiral pattern-surface, substantially as described.

6. In a lappet-loom, the combination, with a needle-bar, of a spiral pattern-surface for controlling the vertical movements of said needle-bar, a member coöperating with said pattern-surface, means for rotating said pattern-surface, and means for moving said pattern-surface with relation to said coöperating member to cause said coöperating member to traverse said spiral pattern-surface, substantially as described.

7. In a lappet-loom, the combination, with a needle-bar, of a spiral pattern-surface for controlling the vertical movements of said needle-bar, a member coöperating with said pattern-surface, means for rotating said pattern-surface, and means for reversing the direction of rotation of said pattern-surface, substantially as described.

8. In a lappet-loom, the combination, with a needle-bar, of a spiral pattern-surface for controlling the vertical movements of said needle-bar, a member coöperating with said pattern-surface, means for rotating said pattern-surface, means for causing said coöperating member to traverse said spiral pattern-surface, means for reversing the rotation of said pattern-surface, and means for reversing the direction of traverse of said coöperating member, substantially as described.

9. In a lappet-loom, the combination, with a needle-bar, of a pattern-head provided with a spiral pattern-surface for controlling the vertical movements of said needle-bar, a member coöperating with said pattern-surface, means for rotating said pattern-head, and means controlled by said pattern-head for causing said coöperating member to traverse said spiral pattern-surface, substantially as described.

10. In a lappet-loom, the combination, with a needle-bar, of a pattern-head provided with a spiral pattern-surface for controlling the vertical movements of said needle-bar, a pattern-lever coöperating with said pattern-surface, means for rotating said pattern-head, and means for moving said pattern-head with relation to said pattern-lever to cause said pattern-lever to traverse said spiral pattern-surface, substantially as described.

11. The combination of a spiral pattern-head loosely mounted on a supporting-arbor, means for rotating said spiral head, and a stationary member engaging said spiral head, whereby the revolution of said spiral head will cause it to be moved lengthwise on its supporting-arbor, substantially as described.

12. A spiral pattern-head composed of two or more disks, each disk being provided with a pattern-surface in spiral form, whereby when said disks are assembled to form the pattern-head a spiral pattern-surface will be formed extending from one disk to the next adjacent disk, substantially as described.

13. A spiral pattern-head composed of two or more disks, each disk being provided with a projecting portion on which a pattern-surface is formed, the projecting portion of one disk being adapted to interlock with the projecting portion of the next adjacent disk to form a continuing pattern-surface, substantially as described.

14. In a lappet-loom, the combination,

with two needle-bars, of two pattern-surfaces, one for controlling the vertical movements of each needle-bar, substantially as described.

15. In a lappet-loom, the combination, with two needle-bars, of two spiral pattern-surfaces for controlling the vertical movements of said needle-bars in the production of an article provided with a lappet design, one of said pattern-surfaces serving to control the production of a portion of said lappet design, and the other pattern-surface serving to control the production of the remainder of said lappet design, substantially as described.

16. In a lappet-loom, the combination, with two needle-bars, of two spiral pattern-surfaces for controlling the movements of said needle-bars from the beginning to the end of a complete article provided with a lappet design, one of said pattern-surfaces controlling one of said needle-bars for the production of a portion of said lappet design, and the other pattern-surface controlling the other needle-bar for the production of the remainder of said lappet design, substantially as described.

17. In a lappet-loom, the combination, with two needle-bars, of two spiral pattern-surfaces, one for controlling the vertical movement of each of said needle-bars, a member coöperating with each of said pattern-surfaces, and means for rotating said pattern-surfaces, substantially as described.

18. In a lappet-loom, the combination, with two needle-bars, of two spiral pattern-surfaces, one for controlling the movement of each needle-bar, a member coöperating with each of said pattern-surfaces, means for rotating said pattern-surfaces, and means for causing each of said coöperating members to traverse its spiral pattern-surface, substantially as described.

19. In a lappet-loom, the combination, with two needle-bars, of two spiral pattern-surfaces for controlling the movements of said needle-bars, a member coöperating with each of said pattern-surfaces, means for rotating said pattern-surfaces, and means for simultaneously moving said pattern-surfaces with relation to said coöperating members to cause said coöperating members to traverse said spiral pattern-surfaces, substantially as described.

20. In a lappet-loom, the combination, with two needle-bars, of two spiral pattern-surfaces for controlling the movements of said needle-bars, a member coöperating with each of said pattern-surfaces, means for rotating said pattern-surfaces, and means for reversing the direction of rotation of said pattern-surfaces, substantially as described.

21. In a lappet-loom, the combination, with two needle-bars, of two spiral pattern-surfaces for controlling the movements of said needle-bars, a member coöperating with each of said needle-bars, means for causing said coöperating members to traverse said spiral pattern-surfaces, means for rotating said pattern-surfaces, means for reversing the rotation of said pattern-surfaces, and means for reversing the direction of traverse of said coöperating members, substantially as described.

22. In a lappet-loom, the combination, with two needle-bars, of a pattern-head provided with two spiral pattern-surfaces for controlling the movements of said needle-bars, a member coöperating with each of said pattern-surfaces, means for rotating said pattern-head, and means controlled by said pattern-head for causing said coöperating members to traverse said spiral pattern-surfaces, substantially as described.

23. In a lappet-loom, the combination, with two needle-bars, of a pattern-head provided with two spiral pattern-surfaces, a pattern-lever coöperating with each of said pattern-surfaces, means for rotating said pattern-head, and means for moving said pattern-head to cause each of said pattern-levers to traverse its respective spiral pattern-surfaces, substantially as described.

24. The combination of a pattern-head loosely mounted on a supporting-arbor, said pattern-head being provided with two sets of spiral projections constituting two spiral pattern-surfaces, means for rotating said pattern-head, and a stationary member engaging one set of said spiral projections, whereby the revolution of said pattern-head will cause it to be moved lengthwise on its supporting-arbor, thereby effecting a corresponding movement of said spiral pattern-surface, substantially as described.

25. The combination of a pattern-head loosely mounted on a supporting-arbor, means for rotating said pattern-head in opposite directions, means for moving said pattern-head longitudinally on its supporting-arbor, and means controlled by the longitudinal movement of said head for reversing the direction of rotation thereof, substantially as described.

26. The combination of a pattern-head loosely mounted on its supporting-arbor, a ratchet and double-acting pawl for rotating said pattern-head, means for moving said pattern-head longitudinally on its supporting-arbor, and means controlled by the longitudinal movement of said pattern-head for shifting said pawl to change the direction of rotation of said head, substantially as described.

27. In a lappet-loom, the combination, with a needle-bar, of a pattern-surface for controlling the lateral movements of said needle-bar, and an independently-operated pattern-surface for controlling the vertical movements of said needle-bar, substantially as described.

28. In a lappet-loom, the combination,

with a needle-bar, of a pattern-surface for controlling the lateral movements of said needle-bar constructed to reciprocate said needle-bar both in its operative and in its inoperative positions, and an independently-operated pattern-surface for controlling the vertical movements of said needle-bar and the weaving of the lappet-threads, substantially as described.

29. In a lappet-loom, the combination, with a needle-bar, of a pattern-surface for controlling the lateral movements of said needle-bar, and an independently-operated spiral pattern-surface for controlling the vertical movements of said needle-bar, substantially as described.

30. In a lappet-loom, the combination, with a needle-bar, of a pattern-surface for controlling the lateral movements of said needle-bar, and an independently-operated pattern-surface for controlling the vertical movements of said needle-bar, said last-mentioned pattern-surface being caused to advance at a slower speed than the pattern-surface which controls the lateral movements of the needle-bar, substantially as described.

31. In a lappet-loom, the combination of two needle-bars and two pattern-surfaces, one for controlling the vertical movements of each of said needle-bars, one of said pattern-surfaces serving to control the action of one of the needle-bars to form one portion of a unitary lappet design and the other pattern-surface serving to control the action of the other needle-bar to form another portion of such unitary lappet design, substantially as described.

32. In a lappet-loom, the combination, with two needle-bars, of mechanism for holding either of said needle-bars against vertical movement without affecting the vertical movements of the other needle-bar, substantially as described.

33. In a lappet-loom, the combination, with two needle-bars, of two pattern-surfaces, one for controlling the vertical movements of each needle-bar, and mechanism whereby either needle-bar may be held against vertical movement without affecting the vertical movements of the other needle-bar, substantially as described.

34. In a lappet-loom, the combination, with two needle-bars, of mechanism for giving vertical movements to said needle-bars, two pattern-surfaces, mechanism controlled by one of said pattern-surfaces for holding one of said needle-bars against vertical movement, and mechanism controlled by the other pattern-surface for holding the other needle-bar against vertical movement, substantially as described.

35. In a lappet-loom, the combination, with two needle-bars, of mechanism adapted to impart vertical movement to both of said needle-bars or to either one of said needle-bars independent of the other, substantially as described.

36. In a lappet-loom, the combination, with two needle-bars, of mechanism adapted to impart vertical movement to both of said needle-bars or to either one of said needle-bars independent of the other, and mechanism for determining whether vertical movement shall be given to both of said needle-bars or to either of said needle-bars separately, substantially as described.

37. In a lappet-loom, the combination, with two needle-bars, of mechanism adapted to impart vertical movement to both of said needle-bars or to either one of said needle-bars independent of the other, two pattern-surfaces, and mechanism controlled by said pattern-surfaces for causing vertical movements to be given to both of said needles or to either one of said needle-bars independent of the other, substantially as described.

WILLIAM A. ROBINSON.

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