No. 731,377. PATENTED JUNE 16, 1903.

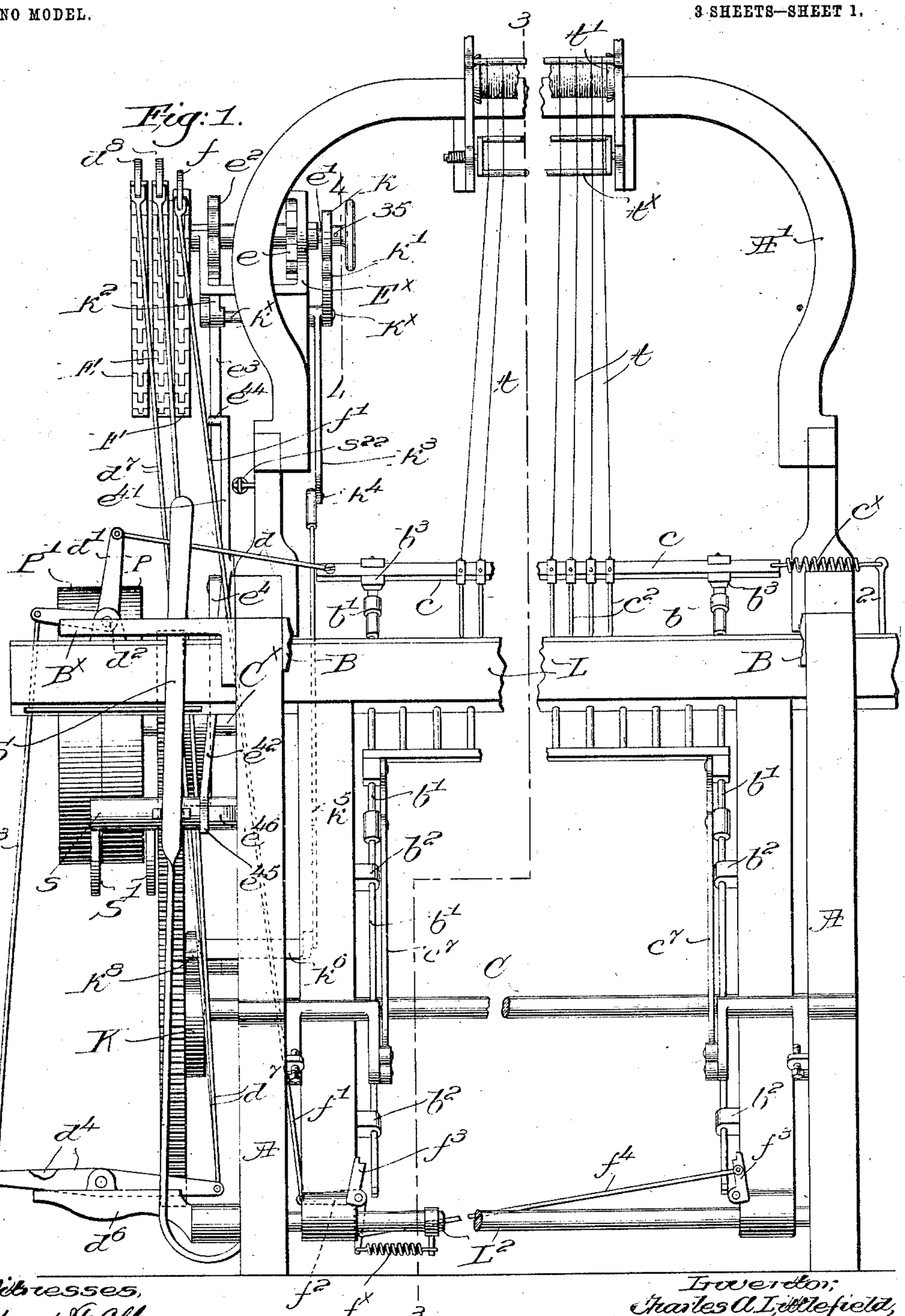
C. A. LITTLEFIELD.

LAPPET LOOM.

APPLICATION FILED MAR. 12, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

Fig: 1.



Witnesses,
Edward F. Allen.
J. Wm. Lutton.

Inventor;
Charles A. Littlefield,
By Crosby & Gregory.
Atty's

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NO MODEL. 3 SHEETS—SHEET 2.

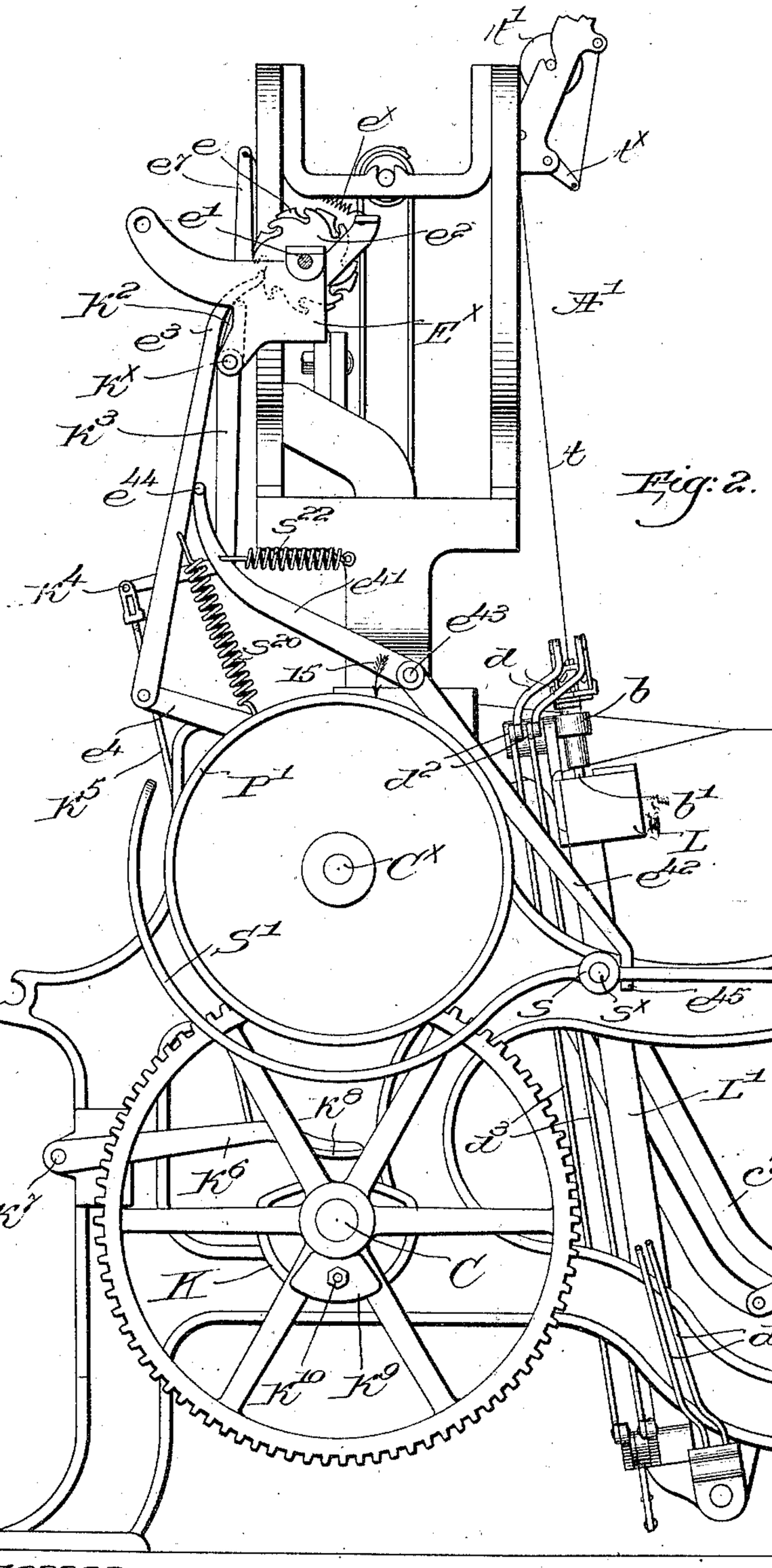

Fig: 2.

Witnesses,
Edward F. Allen.
J. Wm. Lutton.

Inventor;
Charles A. Littlefield,
by Crosby Gregory.
Attys.

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NO MODEL. 3 SHEETS—SHEET 3.

Fig: 4.

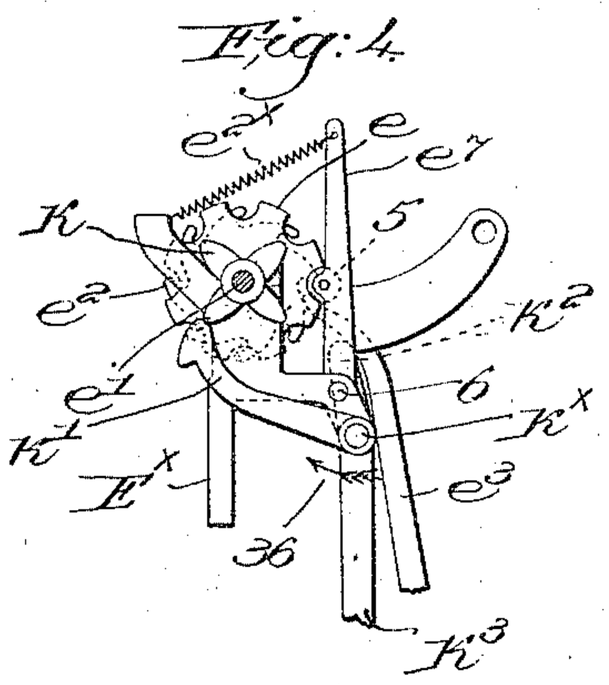

Fig: 3.

Witnesses,
Edward F. Allen.
H. Wm. Lutton.

Inventor:
Charles A. Littlefield,
by Munday Evarts Adcock & Clegg.
Attys.

No. 731,377. Patented June 16, 1903.

UNITED STATES PATENT OFFICE.

CHARLES A. LITTLEFIELD, OF NEW BEDFORD, MASSACHUSETTS, ASSIGNOR TO DRAPER COMPANY, OF HOPEDALE, MASSACHUSETTS, A CORPORATION OF MAINE.

LAPPET-LOOM.

SPECIFICATION forming part of Letters Patent No. 731,377, dated June 16, 1903.

Application filed March 12, 1903. Serial No. 147,406. (No model)

To all whom it may concern:

Be it known that I, CHARLES A. LITTLEFIELD, a citizen of the United States, and a resident of New Bedford, county of Bristol, State of Massachusetts, have invented an Improvement in Lappet-Looms, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to lappet-looms; and it has for its object the production of means for so controlling the lappet mechanism that the irregular weaving of lappet figures or patterns in the cloth will be obviated.

It not infrequently happens that when a loom has been set or adjusted to effect in a predetermined manner the uniform weaving of a certain lappet figure, design, or pattern, whichever term be employed, such figure or pattern governed by or through the lappet mechanism will very perceptibly vary or be irregularly produced throughout the cut or piece of cloth. After careful study and investigation I have discovered this non-uniformity or irregularity to be due to the following reasons: As is well known, a loom at its best is rather a loose-jointed apparatus, with considerable lost motion, and one that requires almost constant adjustment of its several parts to make it give the desired results in goods woven. This fact of itself is sufficient usually to disarrange or cause non-uniformity or irregularity in the repeat of the lappet pattern or figure as predetermined, as well as in the pattern or figure itself. The picking motion also contributes largely to the above-mentioned disarrangement of pattern or figure, inasmuch as it causes considerable "jar" or "slat" to the lay and the parts carried thereby. Especially is this the case in lappet-looms, wherein the lappet-needles and their supporting-bars are carried by the lay, such jarring or slatting causing a movement of the said bars and their needles which is beyond the control of either the pattern-surface proper or of the operator.

It will be understood that the connections operating the needle bar or bars and between the latter and the pattern-surface must of necessity be more or less loosely arranged to compensate for the distance through which they act and because of the freedom of movement which must exist between such connections, the pattern-surface, and the needle-bar. Such lost motion of the several parts and the jar of the picking mechanism imparted to the lay tend to shift the lappet-needle bar or bars laterally in the supports therefor on the lay, causing the lappet-needles to either increase or diminish the tension of the lappet-warps led thereto and in the case of increase of tension drawing from the lappet-spools more lappet-yarn than is required. Such irregularity of tension is detrimental to the lappet pattern or figure, as must be evident, and results in irregularity therein in the cloth when finished. Also, as is well known, it is usual in weaving to give the rear harness or harnesses a greater travel to make the leaves of the shed even in plane and to insure an unobstructed path for the shuttle in its flight. This alone causes a difference in tension in the main or harness warps, the tension of the warps controlled by the rearmost harness of course being considerably greater. In this case a predetermined travel of the lappet-needle bars across the high-tension warps in laying the lappet-yarns will not permit the lappet-yarns to crowd the said main warps together to such a degree as would be the case when the low-tension or front-harness warps were in the upper plane of the shed and acted upon by the lappet-yarn, supposing that the lappet-yarns are subjected to substantially uniform tension.

From the foregoing it will be evident that regularity of figure or pattern cannot continue throughout the cut or piece of cloth when the needle bar or bars are moved across first one set of main warps and the next time across another set; so, too, with the slatting of the picking mechanism, which latter is liable to vary in power at the two sides of a loom, thereby jarring the needle-bars irregularly laterally and causing bad effects both upon the main or harness warps and the lappet-warps, each tending to injure the configuration of the pattern to be woven. These defects are more prominent when solid figures—

such as spots or diamonds, for instance—are to be woven, it being desired that each one shall preserve the same shape and size and contain the same number of stitches in its construction as the previous one throughout the cut, and the provision of means to effect this uniformity is the main object of this invention.

Let it be supposed in the present case it has been found by experiment that the best results are obtained from a needle bar or bars giving to the lappet-needles the necessary movement required by the pattern-surface just previous to the picking of the shuttle from the left-hand shuttle-box to the right-hand box. Then such relative movement of the parts mentioned must be preserved throughout the required length of cloth to be woven. In other words, the lappet-needles should not be given the requisite movement just prior to the opposite pick of the shuttle—viz., from right to left.

It is to be understood that the adjustment to effect the desired relative timing can be made with regard to either pick, as may be most appropriate to the work in hand, provided that relation obtains throughout the completion of a cut of the cloth.

The manner in which my invention is made effective will be clearly pointed out in the subjoined description and accompanying illustration of a practical embodiment thereof in a lappet-loom, the general structure of the lappet mechanism not forming any part of my present invention.

I have provided means for automatically rendering inoperative the pattern-controlling mechanism by or through the stoppage of the loom, thereby obviating the necessity of turning back the pattern-surface.

When the loom is at rest, the weaver can turn the loom over, as is frequently necessary in order to piece up warps or supply new filling, without any effect upon the feed of the pattern-surface, and by means to be described the feed of the pattern-surface will be resumed automatically in proper relation to the picking of the shuttle when the loom is again started up.

The various novel features of my invention will be fully described hereinafter and particularly pointed out in the following claims.

Figure 1 is a front elevation, centrally broken out, of a sufficient portion of a lappet-loom to be understood with one embodiment of my present invention applied thereto. Fig. 2 is a left-hand side elevation thereof, showing the shipping mechanism, the pattern-surface and some of its coöperating parts for controlling the positioning of the lappet-needles being omitted. Fig. 3 is a vertical sectional view on the line 3 3, Fig. 1, looking toward the left; and Fig. 4 is a detail of the means for controlling the pattern mechanism and preserving the timing of the same relative to the picking of the shuttle, the view being taken on the line 4 4, Fig. 1, looking toward the left.

In the drawings the shipper is in running position and the lay is just about to beat up. Only so much of the lappet mechanism is illustrated and will be described as will be sufficient to effect a proper understanding thereof in connection with the novel features of my invention, the particular lappet mechanism herein forming no part of my invention.

The loom sides A, overhanging arch A′, the breast-beam B, (omitted for the most part in Fig. 1,) the cam-shaft C, crank-shaft $C^{\times}$, provided with fast and loose pulleys P and P′, the shipper S, its notched holding-plate $B^{\times}$, and the belt-fork S′, mounted on a sleeve *s*, slidable on a stud $s^{\times}$, projecting from the loom side, may be and are all of usual or well-known construction. The lay L, its reed R, and the lay-swords L′ are also of usual construction, and I have shown the depending eye-pointed lappet-needles c^2 as secured to two needle bars or carriers *c c*, mounted upon and longitudinally movable in heads b^3, surmounting the lifter-rods *b*′, the latter sliding in guides *b* and b^2 on the lay and lay-swords, respectively. Each needle-bar is attached at one end to a spring $c^{\times}$, fixed at its outer end to a stud 2 on the lay to move the bar to the right, Fig. 1, opposite movement being effected by the pattern-surface through connections to be described. Each lifter-rod *b*′ is pivotally connected at c^6, Fig. 3, with the upper end of a link c^7, the lower end of the latter being fulcrumed at c^8 on a rocker-arm c^9, pivoted at c^{10} on the loom side, the forward movement of the lay acting through the links c^7 to raise the lifter-rods, and thereby lift the lappet-needles c^2 above the main or harness warps as the filling is beaten in. When the needles are in raised position, they will when necessary be moved longitudinally of the lay by or through the operation of the pattern-surface, the lappet-warps *t* being led to the needles from a warp-beam *t*′ on the arch A′ and controlled by a suitable tension device, as $t^{\times}$. When the needles are to be maintained in raised position, stop-arms f^3, Fig. 1, fulcrumed on the lay rocker-shaft L^2, are swung beneath the lower ends of the lifter-rods, a spring $f^{\times}$ holding the arms inoperative, they being connected by a link f^4 to rock in unison. One stop-arm has an attached outwardly-extended arm f^2, which is connected with a rod *f*′, the upper end of the rod being pivotally attached to a follower-arm *f*, governed as to its rise and fall by the pattern-surface F, shown herein as a chain, Fig. 3. A pattern-surface E, also shown as a chain, is shown in Fig. 1 to control a needle-bar, and as I have shown two needle-bars two pattern-surfaces E are provided, each coöperating with a follower-arm d^8, pivotally attached to a depending rod d^7. The lower ends of the rods are pivoted to rockers d^9, pivoted on an exten-

sion d^6 on the rocker-shaft L^2, the opposite ends of the rockers being connected by rods d^3 with bell-cranks d', fulcrumed at d^2 on the lay and connected by short links d with the nearer ends of the needle-bars c.

The pattern-chains E E and F are hung upon and are moved step by step by sprocket-wheels of usual construction fast on a pattern-shaft e', mounted in suitable bearings on a stand or frame $E^\times$, secured to the back of the arch A', said shaft having fast upon it a feed-ratchet e^2 and a disk or ratchet e, having concave spaces between its teeth to receive a roll 5 on a detent-pawl e^7, fulcrumed on the stand at 6 and held in coöperation with the disk by a spring $e^{2\times}$, Fig. 4.

The feed and detent ratchets e^2 and e have the same number of teeth, eight being herein shown, a feed-pawl e^3 coöperating with the former when the loom is running under normal conditions, said pawl being jointed to a pawl-carrier e^4, fulcrumed on the loom side at e^5 and having a suitable roll 8 to engage a cam e^6 on the crank-shaft $C^\times$. (See Fig. 3.) Each rotation of said shaft will operate through the feed-pawl and its coöperating ratchet to advance the pattern-shaft e' one step for each pick when the loom is running, a spring s^{10} tending to keep the pawl in engagement with the ratchet.

A lever e^{41} e^{42}, Fig. 2, is fulcrumed at e^{43} on the loom side adjacent the shipper mechanism, the upturned and rearwardly-extended arm e^{41} having a lateral lug e^{44} just in front of the feed-pawl e^3, while the arm e^{42} is downturned, its extremity e^{45} projecting in front of a cam-shelf e^{46} on the sleeve s (see Fig. 1) and being held against it by a spring s^{22}. The cam-shelf rises from its outer end toward the center of the loom, so that when the shipper S is released the outward movement of the sleeve s causes the cam-shelf to act on the part e^{45} of the lever e^{41} e^{42}, turning the latter in the direction of arrow 15, Fig. 2, and through the lug e^{44} the feed-pawl e^3 is disengaged from its ratchet e^2. Consequently the stoppage of the loom automatically throws the pattern mechanism out of operation, and any turning over of the loom by hand in either direction has no effect on the pattern mechanism.

The means by which the proper operation of the pattern mechanism is insured relative to the picking action will now be described, it being remembered that it is desired to maintain a given relation throughout the cut of cloth.

A four-point star wheel or cam k is secured to the pattern-shaft e' by a suitable set-screw 35, Fig. 1, and coöperating with the star-wheel is an upturned follower k', shown as an upturned arm fast on a rock-shaft $k^\times$, mounted in suitable bearings on the stand $E^\times$. Said rock-shaft is just in front of the feed-pawl e^3, which, it will be remembered, operates on each pick to advance the ratchet e^2 one tooth when the loom is running. A short upturned knock-off arm k^2, fast on the rock-shaft, is located immediately in front of the feed-pawl, Fig. 1, so that when the rock-shaft is turned in the direction of arrow 36, Fig. 4, the knock-off arm will throw the pawl e^3 out of engagement with its ratchet e^2. Referring to Fig. 4, it will be evident that whenever the follower k' rests against a point of the star wheel or cam, as shown, the knock-off arm k^2 will be maintained retracted or in inoperative position as regards the feed-pawl, this occuring at every other pick. On the intervening picks, however, when the follower is between two points of the star-wheel the rock-shaft $k^\times$ may be turned to render the knock-off arm k^2 operative. A depending rearwardly-bent arm k^3 is rigidly secured to the rock-shaft $k^\times$ and is pivotally connected at k^4 with the upper end of a link k^5, in turn pivoted to a follower-arm k^6, fulcrumed on the loom side at k^7. The follower at its free front end is provided with a shoe k^8, adapted to coöperate with a cam K, mounted on the cam-shaft C of the loom and held in adjusted position by a clamp-plate k^9 and bolt k^{10}, Fig. 2. The weight of the follower and the devices connecting it with the rock-shaft $k^\times$ tend to turn the latter in the direction of the arrow 36 and to move the follower k' inward toward the center of the star-wheel.

As shown in Figs. 2 and 3, the cam K has only high and low portions, the high portion acting for one pick to elevate the follower k^6 and for the next pick the low part permits it to descend, it being understood that the cam-shaft C rotates once for every two picks.

The cam K is so set with relation to the star wheel or cam (see Fig. 1) that when the follower k' is in engagement with a point of the star-wheel or when the follower k^6 is raised by the cam K the pattern mechanism will be operated by or through its feed-pawl e^3 and coöperating ratchet. In other words, in either of the cases above mentioned the rock-shaft $k^\times$ cannot turn to render the knock-off arm k^2 operative to throw off the feed-pawl, and the star-cam thus operates on one pick to control the rock-shaft, while on the next pick the latter is controlled by the cam K, and so on while the loom continues to run.

Supposing that the star-cam and cam K are set, as shown, so that the lappet-needles will be changed only prior to the picks of shuttle from left to right, (which may be termed the "odd" picks,) it following that then the lappet-warps will always be carried over the same division of the main or harness warps, then the mechanism just described will maintain such relative operation even though the loom be turned backward or forward by hand when stopped—that is, should the low portions of both the star-cam k and the cam K be opposite their respective followers the rock-shaft $k^\times$ will be turned so that the knock-off arm

k^2 will render the feed or pick pawl e^3 inoperative and the pattern mechanism will not operate while such condition holds.

When the loom stops, the feed-pawl is rendered inoperative automatically by or through the stopping means, as has been described, and then the weaver can turn the loom forward or back one or more picks to piece up warp, supply new filling to the shuttle, &c., and there will be no movement of the pattern-shaft $e^{\times}$.

Now, viewing Fig. 3, if the loom should stop with the star-cam k and cam K in the position therein shown the weaver might turn the cam-shaft C through one-half of a revolution, equivalent to one pick, or far enough to equal three picks or any odd number of picks, thereby bringing the high part of cam K into engagement with its follower. Such movement for an odd number of picks would when starting up the loom throw out the relative adjustment between the lappet-needles and the picking action unless provided for by the means described—that is, if the high part of cam K is in engagement with its follower then on starting up the loom the first half-turn of the crank-shaft beats in the filling and the feed-pawl e^3 will be moved ahead, advancing the pattern-shaft one tooth of the ratchet e^2, thus bringing the follower k' opposite a low point of the star-cam k, the follower k^6 still remaining in engagement with its cam K. As the crank-shaft completes the first revolution the lay swings back, the shed is changed, and the back-harness warps will be in the upper plane of the shed, the feed-pawl e^3 again resuming the position shown in Fig. 3; but the cam K will then have reached its position shown in said figure and both followers will be opposite low parts of their controlling-cams. Immediately the combined weight of follower k^6, link k^5, and arm k^3 acts to rock the shaft $k^{\times}$ in the direction of arrow 36, Fig. 4, and the knock-off arm k^2 engages the feed-pawl e^3 and disengages it from its ratchet, so that on the first part of the second revolution of the crank-shaft there will be no advance of the pattern-shaft as the lay beats up. As the second revolution of the crank-shaft is completed the shed is changed and the front-harness warps are moved into the upper plane of the shed, while the pawl e^3 is lowered into setting position; but it will not be permitted to swing into engagement with the ratchet e^2 until the follower k^6 has been lifted by engagement with the high part of cam K. Such engagement occurs just before or as the crank-shaft completes its second revolution referred to, and then it will be manifest that the cams and their followers are again in proper relation to each other—viz., the high part of one cam is in engagement with its follower, while the other follower, as k', is opposite its low part. This allows the return of the knock-off arm to inoperative position, and the feed-pawl e^3 as a consequence resumes coöperation with its ratchet, so that on the first half of the third revolution of the crank-shaft the pattern-shaft is advanced one step. Thereafter the regular operation of the loom and pattern mechanism continues until another stoppage of the loom, accompanied by turning over of the loom by hand for one pick or an odd number of picks, when the operation described in detail again occurs.

Manifestly if the adjustment has been such that an advance of the pattern mechanism is to occur only when the front-harness warps are up the means hereinbefore described will prevent such an advance when the back-harness warps are up, even should the weaver have so turned the loom over by hand that such result would ordinarily follow.

Of course the adjustment could be made relative to those picks on which the back-harness warps are up, and in that case the mechanism herein described would prevent the operation of the pattern mechanism when the front-harness warps were up.

To a certain extent the controlling means for the lappet pattern mechanism is a pick-finding device, as it prevents a certain operation of the pattern mechanism on other than prearranged picks following a certain sequence.

My invention comes into play in weaving another lappet design not heretofore referred to specifically—viz., the weaving of spots or polka-dot effects, the spots being made by the same needle-bar and staggered. In weaving such a design it is a well-known fact that sometimes one series of spots will be large, for instance, the next series smaller, the next larger, and so on; but the true explanation of this peculiarity is difficult to determine, unless it be due to some of the various irregularities in a lappet-loom hereinbefore referred to. Without the employment of my present invention it is possible to weave such a pattern correctly for a length of the cloth in which occurs no breakage of the warp or filling or while the yarn holds out on the shuttle-bobbin. Thereafter, however, when the weaver supplies fresh filling or when a warp-thread is pieced up he will almost invariably turn the loom over in one direction or the other or the pattern-surface may be moved forward or back. In such case the pattern-surface may not—in all probability will not—maintain the previous relation of movement to the other parts of the loom in starting up. Hence there is the liability that the large spots, for instance, may be woven in the places the smaller spots should occupy, and vice versa, and in actual practice this frequently happens, so that the cut of cloth would show a great irregularity in its design.

It will be manifest that even should it be desired to make all the spots the same size and some lines across the cloth show large spots and other lines small spots there will be no objection to this variation if the same variation is present throughout the cut; but

if the design shows large and small spots following each other regularly for a part of the length of the cut then it changes and two rows of large or small spots follow each other before the alternation begins, and so on throughout the cut the latter would not be first-grade marketable goods. By means of my invention this changing of the design is prevented and the same sequence or order of the design is preserved throughout the cut and first-grade goods will be produced.

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

1. In a lappet-loom, a shipper, lappet-needles, a carrier or needle-bar therefor, a pattern-surface to control the operation thereof, an actuating pawl and ratchet to advance the pattern-surface step by step, and means actuated by movement of the shipper to stopping position to effect disengagement of the pawl and ratchet.

2. In a lappet-loom, a shipper, lappet-needles, a carrier or needle-bar therefor, a pattern-surface to control the operation thereof, a coöperating pawl and ratchet operating on each pick to advance the pattern-surface, a lever to engage and render the pawl inoperative, and means actuated by movement of the shipper to stopping-position to effect such engagement of the said lever and pawl.

3. In a lappet-loom, lappet-needles, a pattern-surface to control the operation thereof, a device to actuate the pattern-surface, means operated automatically upon stoppage of the loom to throw said device out of action, and means to permit pattern-controlled operation of the lappet-needles relative to only a predetermined sequence of picks.

4. In a lappet-loom, a lappet-needle bar, a pattern-surface to control the operation thereof, means operative automatically upon stoppage of the loom to isolate said pattern-surface from the main body of the loom, whereby the latter may be turned over manually without affecting the pattern-surface, and means to maintain a predetermined relation between the pattern-controlled operation of the needle-bar and the picking of the loom irrespective of any manual turning over thereof when stopped.

5. In a lappet-loom, lappet-needles, a pattern-surface to control the operation thereof, a device to actuate the pattern-surface, means operated automatically upon stoppage of the loom to throw said device out of action, and means operative upon starting of the loom to control the pattern-surface and maintain a predetermined relation between the pattern-controlled operation of the lappet-needles and the picking of the loom.

6. In a lappet-loom, lappet-needles, a pattern-surface to control the operation thereof, an actuating-pawl for the pattern-surface, means to render automatically said pawl inoperative upon stoppage of the loom, and means to maintain pattern-controlled operation of the lappet-needles relative to a predetermined sequence of picks, said means including a cam movable with the pattern-surface and a cam movable with a rotatable member of the loom.

7. In a lappet-loom, lappet-needles, a pattern-surface to control the operation thereof, actuating means for said pattern-surface, including a pattern-shaft having an attached ratchet, and a feed-pawl coöperating therewith, means to disengage the pawl and ratchet by or through stoppage of the loom, and means to maintain a predetermined relation between the pattern-controlled operation of the lappet-needles and the picking of the loom, said means including a cam on the pattern-shaft and a cam on a rotatable member of the loom, and a knock-off arm to act upon and render the feed-pawl inoperative unless the cams bear a predetermined relation to each other.

8. In a lappet-loom, lappet-needles, a pattern-surface to control the operation thereof, actuating means for said pattern-surface, including a pattern-shaft having an attached ratchet, and a feed-pawl coöperating therewith, means to disengage the pawl and ratchet by or through stoppage of the loom, and means to maintain a predetermined relation between the pattern-controlled operation of the lappet-needles and the picking of the loom, said means including a star-cam on the pattern-shaft and a cam having high and low points, on a rotatable member of the loom, followers to coöperate with said cams, a knock-off arm, and connections between it and the followers, said knock-off arm being moved into engagement with and rendering the feed-pawl inoperative when manual movement of the loom brings a high or a low point of both cams opposite their respective followers.

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

CHARLES A. LITTLEFIELD.

Witnesses:
GEO. H. POTTER,
CHARLES G. LEWIS.