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G. H. HODGES & T. LONERGAN.

LAPPET LOOM.

No. 400,915. Patented Apr. 9, 1889.

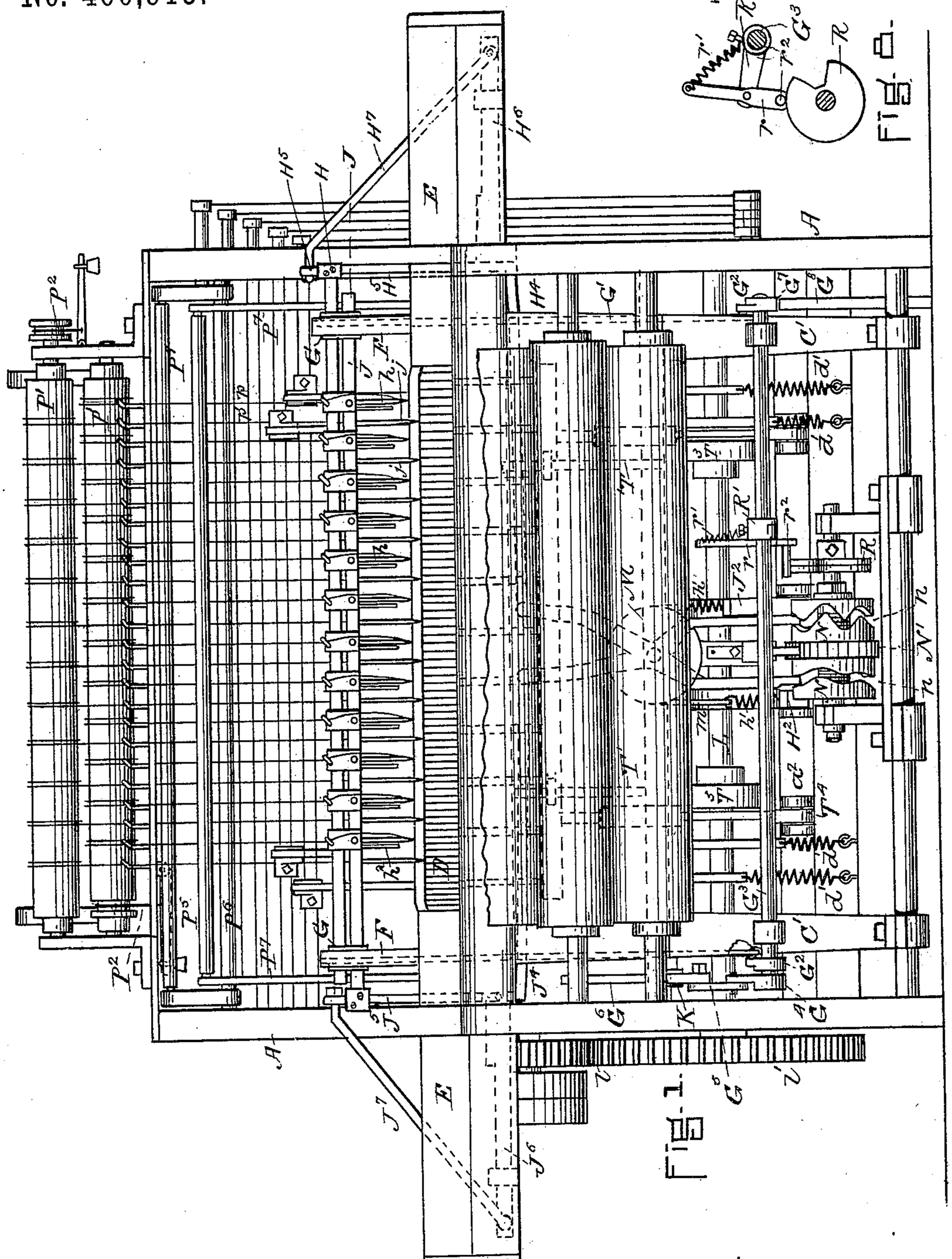

FIG. 1.

FIG. 6.

WITNESSES

Frank H. Parker

Fred B. O'Neil,

INVENTORS

Geo. H. Hodges

Thos. Lonergan

by Geo. O. G. Coale

Atty.

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G. H. HODGES & T. LONERGAN.

LAPPET LOOM.

No. 400,915 Patented Apr. 9, 1889.

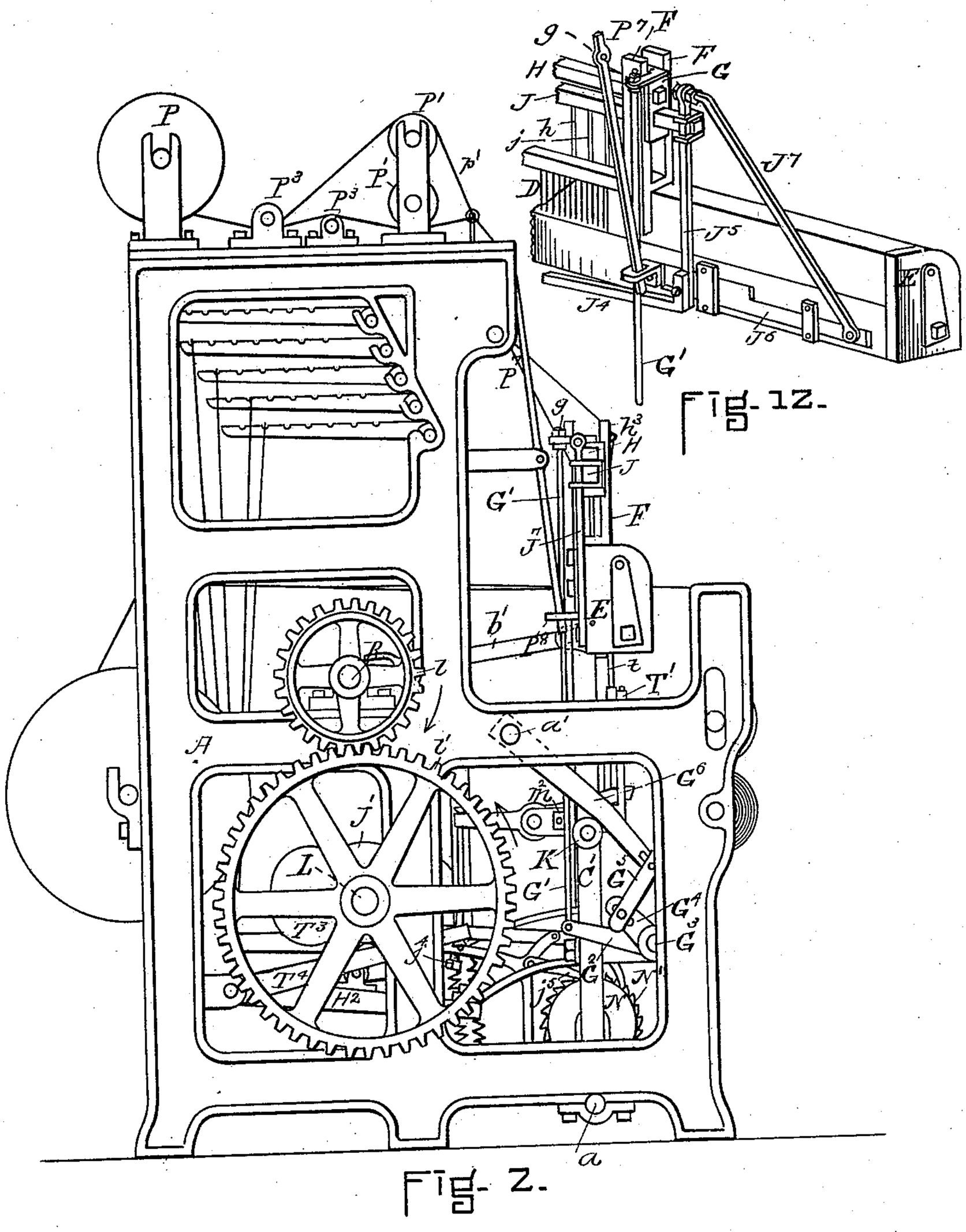

Fig. 12.

Fig. 2.

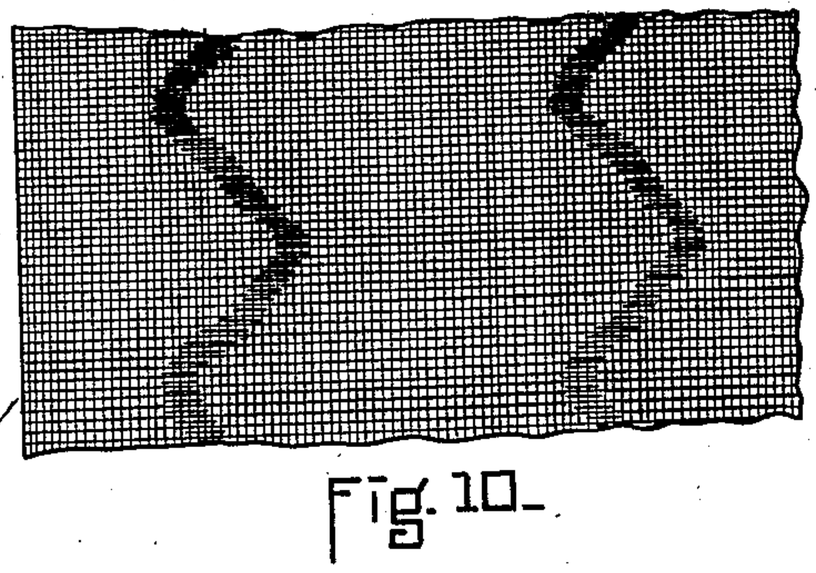

Fig. 10.

WITNESSES
Frank H. Parker
Fred B. O'Neil

INVENTORS
Geo. H. Hodges
Thos. Lonergan
by Geo. O. Goodell Atty

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G. H. HODGES & T. LONERGAN.

LAPPET LOOM.

No. 400,915. Patented Apr. 9, 1889.

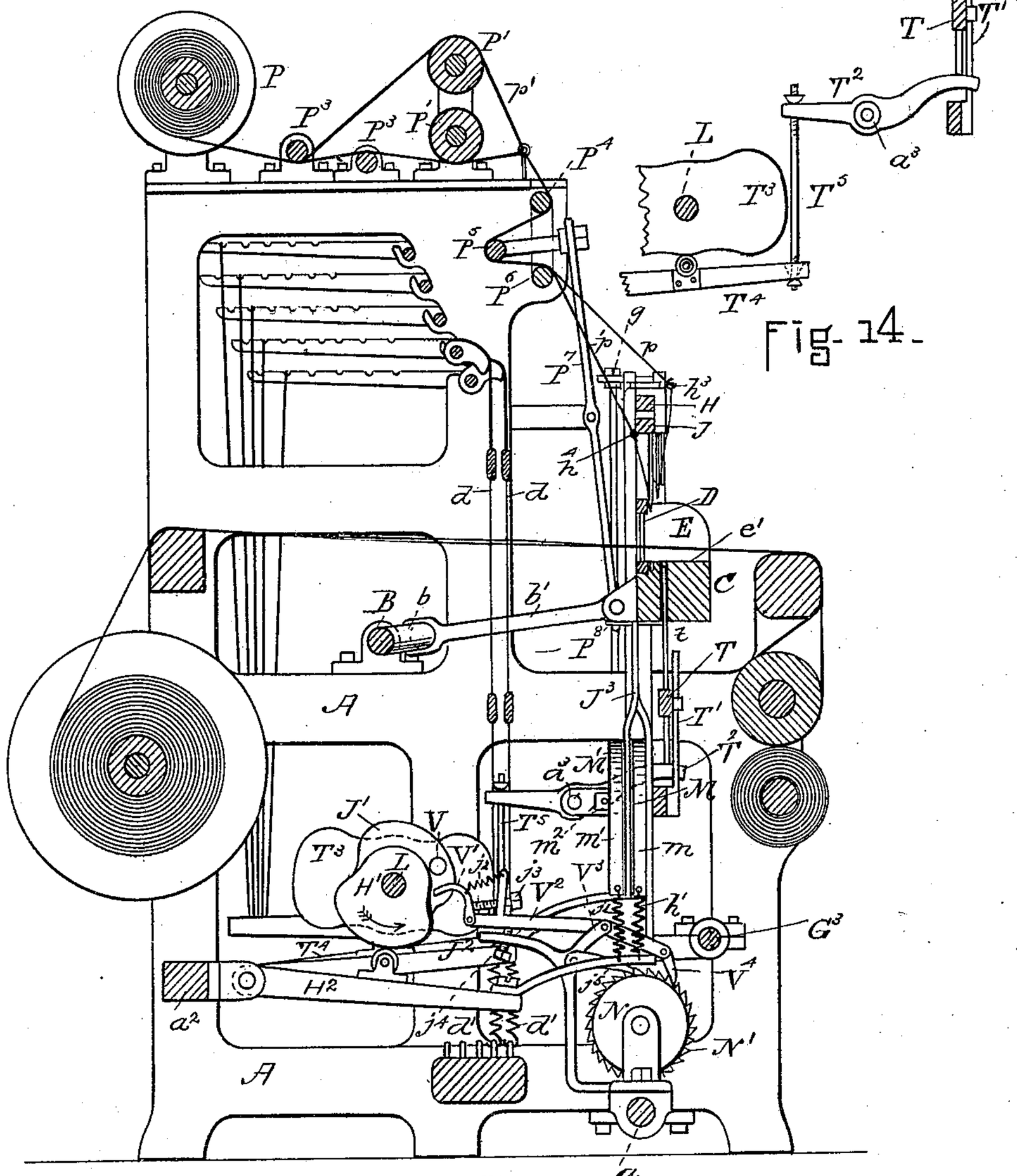

Fig. 14.

Fig. 13.

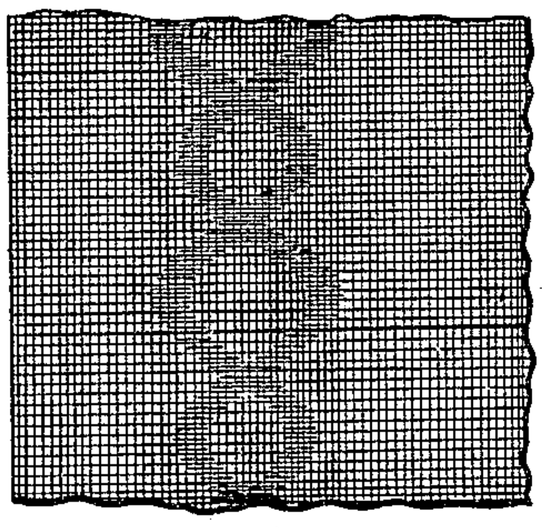

Fig. 11.

WITNESSES
Frank G. Parker
Fred B. O'Neil

INVENTORS
Geo. H. Hodges
Thos. Lonergan
by Chas. O. G. Grant Attys.

(No Model.) 4 Sheets—Sheet 4.

G. H. HODGES & T. LONERGAN.

LAPPET LOOM.

No. 400,915 Patented Apr. 9, 1889.

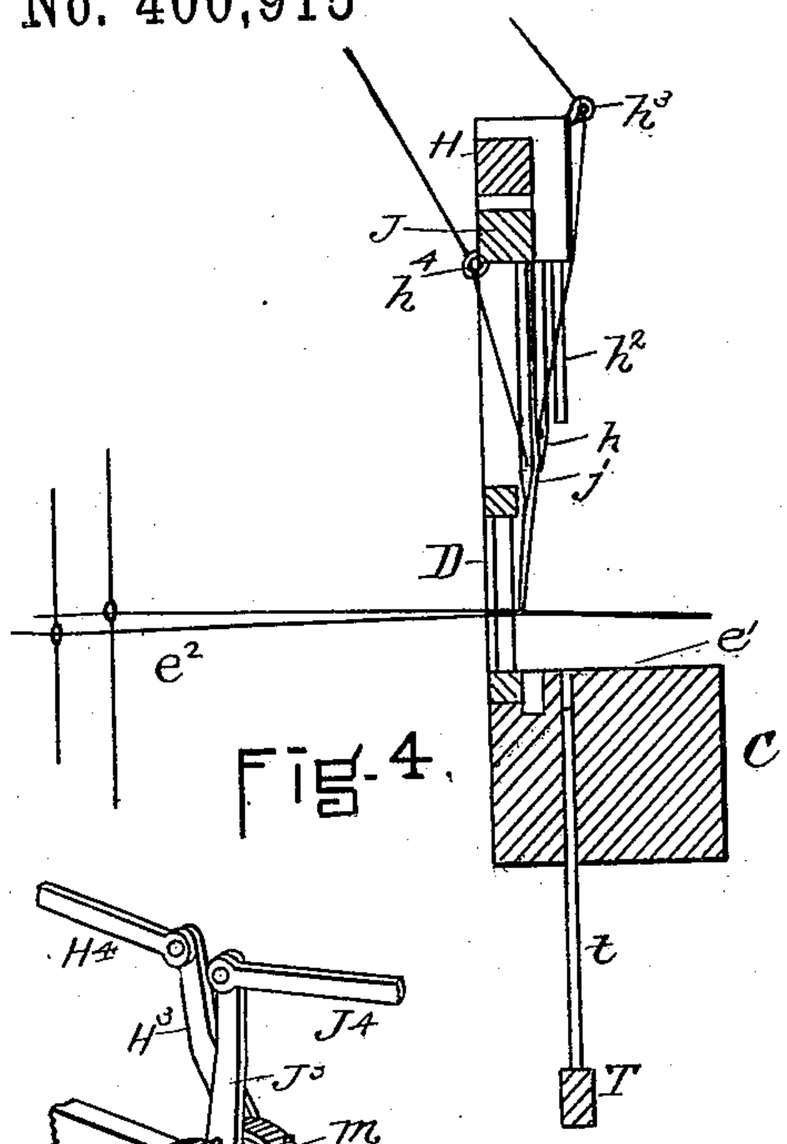

Fig. 4.

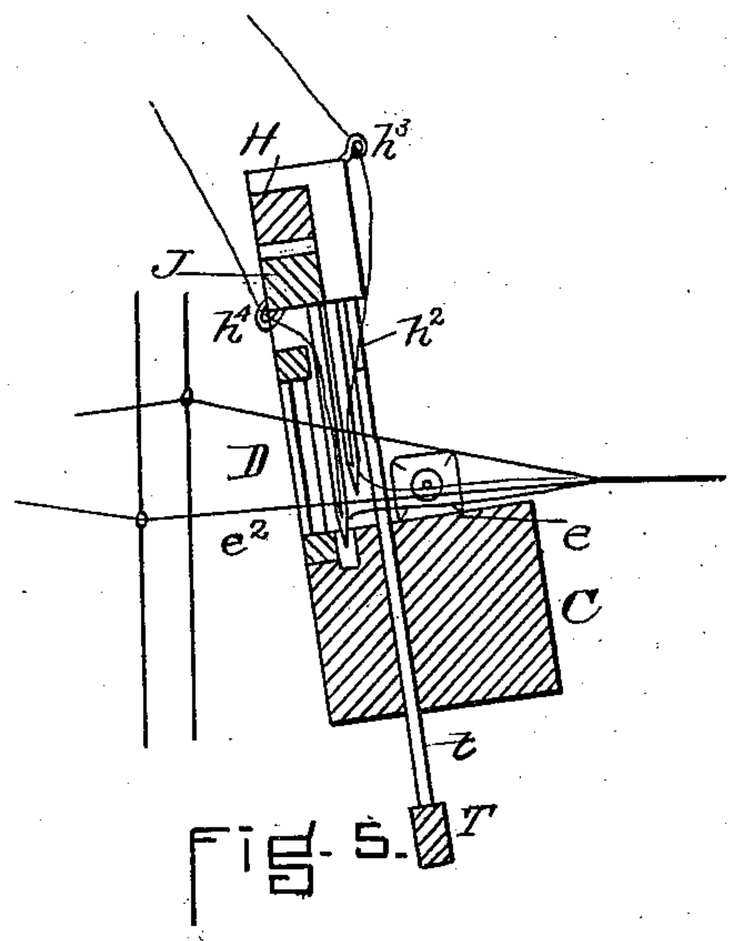

Fig. 5.

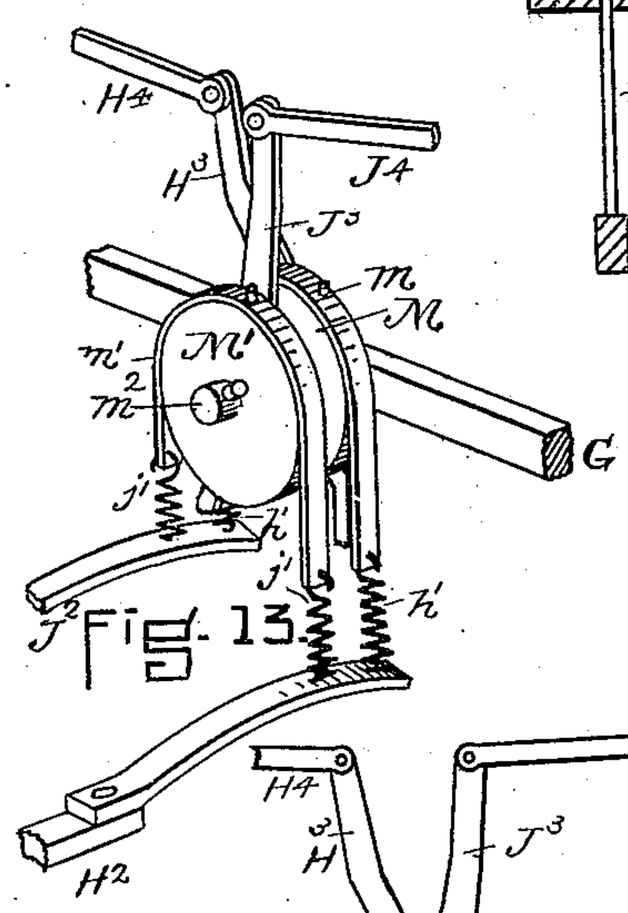

Fig. 13.

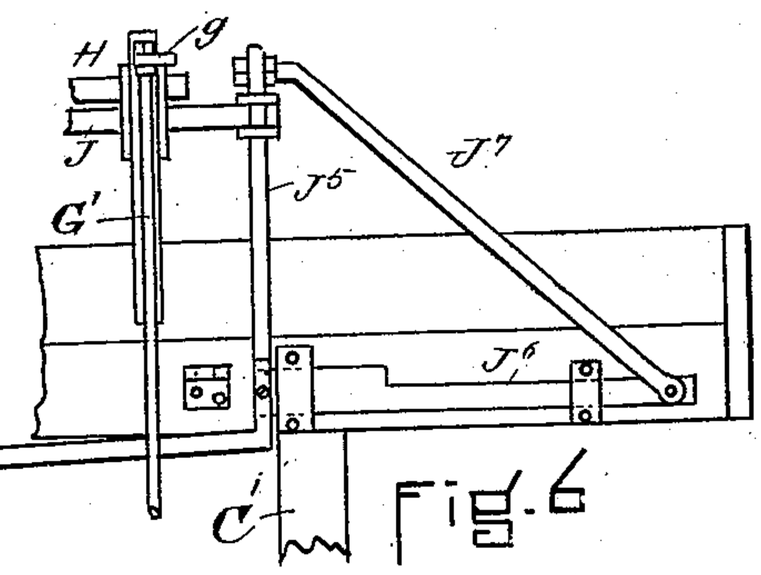

Fig. 6

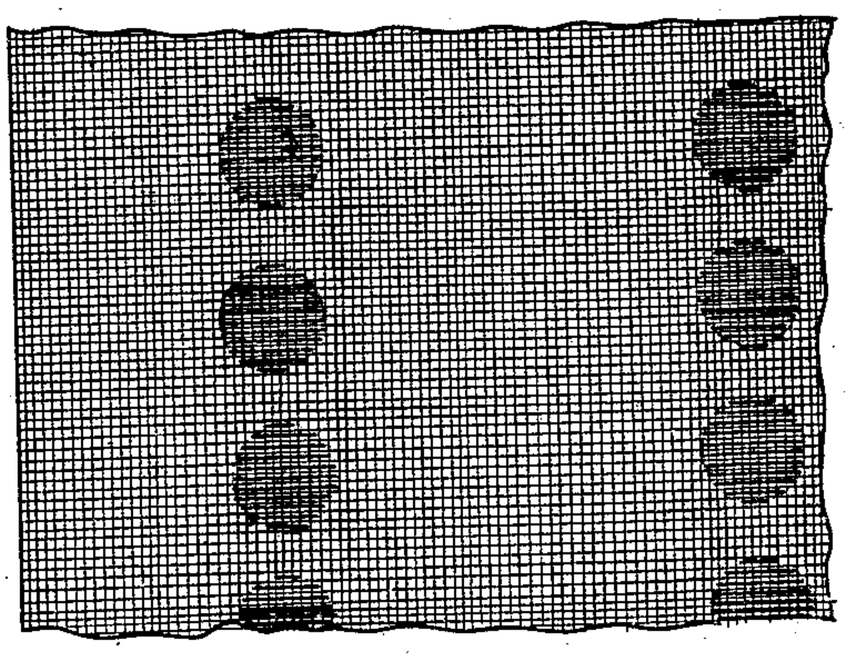

Fig. 9.

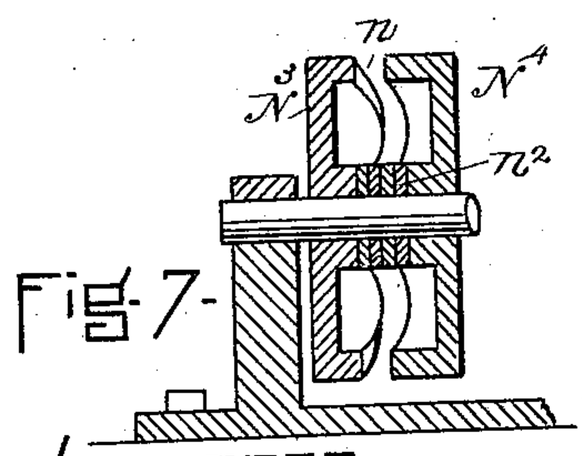

Fig. 7.

WITNESSES,
Frank L. Parker
Fred B. O'Neil

INVENTORS,
Geo. H. Hodges
Thos. Lonergan
by Geo. O. G. Crosby Atty

UNITED STATES PATENT OFFICE.

GEORGE H. HODGES AND THOMAS LONERGAN, OF CANTON, MASSACHUSETTS;
SAID LONERGAN ASSIGNOR TO THOMAS D. LONERGAN, OF SAME PLACE.

LAPPET-LOOM.

SPECIFICATION forming part of Letters Patent No. 400,915, dated April 9, 1889.

Application filed March 12, 1886. Serial No. 195,023. (No model.)

To all whom it may concern:

Be it known that we, GEORGE HENRY HODGES and THOMAS LONERGAN, both of Canton, in the county of Norfolk and State of Massachusetts, have invented a new and useful Improvement in Lappet-Looms, of which the following is a specification.

Our invention has for its object the construction of a loom for producing a woven material in which there is laid over a portion of that surface of the warp which is to form the upper surface of the cloth a thread which forms no part of the body of the cloth, but serves only as an ornamental or embroidery thread, said thread being in all cases held in place by the filling. The elements necessary to produce this result, so far as is now known, are, in addition to the well-known elements of the loom—viz., the mechanism for changing the shed, throwing the shuttle, and beating up the filling—one or more sets of thread-carrying needles capable of a movement through the warp toward what is to be the under side of the cloth before the shuttle is thrown, and a movement in the opposite direction out of the warp while the lay is beating up the filling, and, when desired, a lateral movement after the throw of the shuttle and while the filling is being beaten up.

Our invention relates to certain attachments to an ordinary loom, whereby the requisite motion is given to the needles without limiting materially the speed of the loom, the usual parts of which being made, so far as their movements are concerned, in the manner usual in ordinary looms.

It consists, generally speaking, in the use of mechanism whereby the needles are enabled to receive their movement from the regular moving parts of the loom, the needle bar or bars being given an upward movement with reference to the shed, partly due to the movement of the lay on which the needle-bar is mounted and partly to the mechanism operated by the lay, and being allowed a downward movement due both to gravity and the backward movement of the lay, the needle-bar also being given a lateral movement due to the operation of certain mechanism permanently connected therewith.

In the drawings is shown the simplest form of our attachment in connection with an ordinary picker-staff loom of the variety well known in the market as the "Bridesburg" loom. Our attachments are here shown adapted to operate two sets of needles; but they may be adapted to operate a greater or less number of needle-bars, and may be applied equally well to any other kind of loom, whether constructed to weave cloth, ribbon, or webbing, as will be understood by all skilled in the art.

Figure 1 is a front elevation; Fig. 2, a side elevation; and Fig. 3 is a transverse section, showing such a loom to which our attachments are applied. Figs. 4 and 5 show details of the stitch-making mechanism. Figs. 6, 12, and 13 show details of the needle-moving mechanism, and Figs. 9, 10, and 11 show patterns of cloth which can be made by the use of our invention. The remaining figures show other details, and will be referred to below.

A is the frame.

B is the main or crank shaft to which power is applied.

C is the lay, and C′ the swords, pivoted at *a* in the frame A, the lay being operated by the cranks *b* on shaft B and the crank-arms *b′*.

D is the reed, of ordinary construction, mounted upon the lay in the usual way, but set, say, a quarter of an inch farther back from the shuttle-race than is usual, in order that the needles may descend between it and the shuttle-race. It performs the ordinary function of holding the warp-threads and of beating up the filling in the usual way.

d d′ are the harnesses and their springs. Upon the loom shown in the drawings it is possible to use as many as five harnesses, though but two are shown in place, it being immaterial, so far as our invention is concerned, whether there be two harnesses or more than that number.

E E are the shuttle-boxes, of usual construction. The shuttle *e* is thrown along the shuttle-race *e′* by picker-staffs operated by cams upon the main shaft B in the usual manner.

As mechanisms for throwing the shuttle are so well known and form no part of our invention, the picker-staffs, &c., are not shown in the drawings.

Upon the upper side of the lay-beam, just

above each sword-arm C′, are attached two uprights or ways, F, between which slides a box, G, (see Fig. 12,) which serves as a convenient means of attaching to the needle-bars the mechanism for giving them a vertical movement and as a bearing which shall guide them in their vertical movement in the ways F. Each box G is provided with two holes, each corresponding in size and shape with the size and shape of the cross-section of a needle-bar, each box thus serving, in addition, as a support to and a guide in its horizontal movement for one end of each needle-bar. Each box is also provided with an ear, *g*, for attachment to the connecting-rod G′, by which a vertical movement is imparted to it.

H J are the needle-bars, each provided with needles *h j*. Each needle-bar is capable of a lateral movement in the boxes G, and the boxes are capable of an up-and-down movement in the ways, so that the needle-bars and the needles attached to them are capable of an up-and-down movement and a lateral movement in either direction. The up-and-down movement is given to the boxes by means of the roller K upon one of the swords C′. (See Fig. 2.) During the forward movement of the lay, when the beating up of the filling is to be given, it is necessary that the needles be removed from between the reed and the filling, so that they will not injure the cloth during the beating up, that they may draw the last stitch tight, and that they may be in position to move laterally, and thus pass over the threads of the warp for the purpose of making the next stitch. (See Fig. 4.)

To each box G is attached by the ear *g* an upright connecting-rod, G′, (see Fig. 12,) which is connected with the rocker-arm G^2 upon the rock-shaft G^3. This rock-shaft G^3 is mounted in brackets projecting from the swords C′. (See Fig. 1.) To this rock-shaft is also attached a rocker-arm, G^4, which is connected at its outer end to the link G^5, pivoted to the lower end of the cam-lever G^6, fulcrumed to the frame A at *a′*, and during the last half of the forward movement of the lay and during the first half of its backward movement resting normally upon the roller K.

The operation of this part of our attachment is as follows: When the lay has moved forward about one-half its stroke and has reached the position shown in Fig. 5, where the needle-eyes are about on a level with and the threads lie along the surface of the lower shed, the roller K strikes the cam-lever G^6 and lifts it during the remainder of the lay's forward motion. The cam-lever, through the link G^5 and rocker-arm G^4, gives to the rock-shaft G^3 about one-sixteenth of a revolution. The end of each rocker-arm G^2 receives from the shaft an upward movement, which it imparts through the connecting-rod G′ to the boxes G, (see Fig. 12,) and consequently to the needle-bars H J. As the lay moves backward, these motions are reversed, and the boxes G, holding the ends of the needle-bars, fall in the ways F until the eyes of the needles are even with or below the lower shed, so that the needle-threads will lie on the bottom of the shed and allow the shuttle to pass over them. Then the roller K leaves the cam-lever G^6, and by the under side, G^7, of one of the rocker-arms G^2 on the rock-shaft G^3 striking the standard G^8 the needles are prevented from falling farther in the ways F, though, because of their attachment to the lay, they still move back through the shed and out of the way of the shuttle. When the lay comes forward again, they are moved forward with it until the roller K strikes the lever G^6, and the operation above described is repeated. For purposes of adjustment the links are slotted, as shown. The purpose and times of these movements will be referred to below. The mechanism for giving this up-and-down movement may be duplicated upon the other sword if thought best, though we have found one set of connections sufficient.

It will be noticed that in the loom above described the lay is pivoted to the frame upon one side of the shed and the needle-bars are located upon the other side of the shed. This we believe to be an important feature, because the backward-and-forward movement of the lay favors the movement of the needles through the shed and out again, and consequently the needles need only be given a very short substantially vertical movement independent of the oscillation of the lay. This independent upward movement of the needles is for the purpose of moving them from in front of the reed, so that they will not interfere with the beating up of the filling, and their independent downward movement is for the purpose of dropping them as far as is necessary to enable the last half of the backward oscillation of the lay to carry them well into the lower shed and keep their threads level therewith while the shuttle is thrown. Thus substantially no time and but little power are lost in a loom to which this attachment is made, and such a loom may be run at substantially the same speed as if the attachment were not in operation:

The needle-bars receive a lateral motion by means of the following mechanism:

L is the wiper-shaft, operated from the main shaft B by the gears *l l′*. Upon this shaft are two cams, H′ J′, shaped as shown (see Fig. 3) and set opposite to each other on the shaft L, so that each will operate upon its treadle H^2 J^2 in turn to throw it quickly down, the shaft L being so timed that it revolves once while the shaft B revolves twice, and that each cam will act upon its treadle to drop it quickly just as the lay beats up and is finishing its forward stroke.

Each treadle is hinged to the cross-bar a^2 at the back of the frame. At its forward end each treadle is attached to two springs, *h′ j′*. The springs *h′* are attached to the ends of a strap, *m*, passing over the wheel M, and the springs *j′* to the ends of the strap *m′*, passing

over the wheel M′. (See Fig. 13.) Each strap is fastened to the top of its wheel, so that a pull upon either end of the strap will turn the wheel. The springs serve as a yielding connection between the ends of each strap and the treadles, so that each treadle may complete its downward stroke without reference to the movement of the wheels. The axle m^2 of the wheels M M′ is journaled upon the lay, so as to move back and forward with it. As one treadle descends, it raises the other in place by means of the straps $m\ m'$, to be acted upon by its cam at the proper time.

To each wheel M M′ is rigidly attached a lever, $H^3\ J^3$, the axle of the wheel serving as the fulcrum of the lever. The upper end of each lever is attached to a horizontal connecting-rod, $H^4\ J^4$, pivotally connected with the piece $H^6\ J^6$, which slides in suitable bearings on the lay.

The slide H^6 is connected by means of the upright H^5 to the end of the needle-bar H, and the slide J^6, by means of the upright J^5, to the needle-bar J, so that any motion given by either treadle will impart a lateral movement to each needle-bar through the straps $m\ m'$, the wheels M M′, levers $H^3\ J^3$, connecting-rods $H^4\ J^4$, slides $H^6\ J^6$, and uprights $H^5\ J^5$. The connection between each needle-bar and its upright $H^5\ J^5$ is so made that each bar can slide up and down on its upright according to the motion given to it by the connecting-rod G′, but will be moved sidewise when the uprights $H^5\ J^5$ are moved sidewise. The connection between rod H^4 and the frame H^5, H^6, and H^7, which transmits lateral motion to the needle-bar H and the connections between rod J^4 and its corresponding frame, J^5, J^6, and J^7, are pivotal, so as to allow the play rendered necessary because the movement of the levers H^3 and J^3 is part of a circle. In order to get the necessary strength with thin and light metal, it is best to use a long slide, $H^6\ J^6$, and brace $H^7\ J^7$, as shown. The treadles being timed to operate alternately and each when the needle-bars are raised and the needles are out of the warp, it will be seen that the needle-bars will be thrown first in one direction and then in the opposite direction.

The extent of motion of each bar is controlled by a pattern-wheel, N, resembling a cam, grooved at n about its periphery. (See Fig. 1.) As there are two needle-bars in the loom shown in the drawings, there are two pattern-wheels. The number of pattern-wheels N, wheels M M′, and connections will correspond with the number of needle-bars used. The lower ends of the levers $H^3\ J^3$ project into grooves n in these pattern-wheels, as shown. Each of these extremities of the levers being a little narrower than the groove is capable of a lateral movement in it, the length of which, however, is governed by the width of the groove. When, therefore, the treadle H^2 is depressed, the lower ends of the levers H^3 J^3 are thrown in the corresponding direction—say to the right, looking at the front of the loom in Fig. 1 of the drawings—until the lower end of each lever strikes upon the wall of the corresponding grooves, n. Each groove thus limits the motion of the lever, and the motion of each lever controls the lateral movement of its needle-bar. The springs h' j' allow each treadle to complete its stroke without reference to the limited motion of the levers H^3 J^3.

In order that the position of the pattern-wheels N may be continuously changed, and so alter the throw of the needle-bars and the length of the stitches to be made according to some preconceived plan, there is placed upon one of the cams, J′, a pin, V, which once in every complete revolution of the cam, and just before the other cam, H′, throws its treadle, lifts a latch, V′, upon the lever V^2, fulcrumed at V^3, the farther end of the lever carrying a pawl, V^4, which throws the ratchet-wheel N′, and consequently the pattern-wheels which are fast upon the same shaft as the ratchet-wheel. This latch is held up by the spring j^2 against a set-screw, j^3, working in an upright forming part of the lever, so that an accidental back movement of the cam will not damage the lever, the set-screw also serving to adjust the position of the latch so that it will be struck by the pin V after an adjustment of the lever for a different stitch. The set-screw j^4 sets the lever so that its pawl will move the ratchet-wheel N′ the distance of one tooth or more than one tooth, according to the length of the pattern desired, it thus being possible to use the same pattern-wheel in the production of different pieces of cloth, each of which will have a different pattern, but each pattern being, so to speak, an elongation of the other, as will be better understood from what is said below. Whenever the cam J′ has thrown its treadle J^2 and the needle-bars have been moved, the pin V lifts the latch V′ and its end of the lever V^2 and rotates the ratchet the required distance by means of the pawl V^4. The pawl j^5 drops and prevents any back motion of the ratchet. The pin having passed the latch, the lever drops again by its weight into its former position, the pawl sliding back over the ratchet, and is ready to be operated by the pin V when the cam comes round again on its next revolution.

The mechanism for making the stitch consists of a series of needles projecting downward from the needle-bars, as shown at $h\ j$. For an ordinary pattern, such as is shown in Figs. 9 and 10, but one set of needles, and consequently one needle-bar, is necessary; but where two or more patterns are to be made at the same time a corresponding number of needle-bars, pattern-wheels, and connections are necessary. In Fig. 11 is shown work which can be done by a machine with two needle-bars, such as is shown in the drawings. Where two needle-bars are used, as shown, the needles of the upper bar are best

attached in front of the bar, while those on the lower bar project from its under surface. (See Figs. 4, 5, and 12.) These needles may be attached in any one of a number of known ways, the needles for the upper bar being set, for example, into sockets attached to or forming part of the upper bar, each needle being held in place by a set-screw. (See Fig. 1.) In the same way the needles of the lower bar may set into sockets therein and each be held in place by a set-screw. This construction forms no part of our invention, although it is a very convenient way of economizing space. The needles are eye-pointed needles, and are set so that the eye runs in the direction of the length of the needle-bar, the needles of the lower bar being so arranged that their eyes are lower than the points of the needles which are attached to the upper bar. There are also provided guides h^2, attached to one or both needle-bars and so set with relation to the needles that the front edge of each guide is a little in advance of the corresponding edge of the needle, so that the guide may protect the needles from the shuttle in case of any deviation of it from its path while being thrown.

The needle-threads p p' are wound upon bobbins P on top of the loom. They are passed around tension-rolls P′ P′, the motion of each of which is controlled by its strap P^2, which passes around one end of its roll and is caused to bear upon it by means of an adjustable weight of some kind. That in the drawings is an ordinary steelyard on which slides a weight. The upper tension-roll controls the thread which goes to the needles in the lower bar, and the lower roll that which goes to the needles in the upper bar. The threads before passing over their rolls pass under and over the rolls P^3, as shown, in order to be fed to the tension-rolls. The threads then pass over the bar P^4 and back of the take-up bar P^5, which moves forward and back between the stationary bar P^4 and the stationary bar P^6, its forward and back motion being given to it by two levers, P^7, to one end of which it is attached. These levers are fulcrumed one on each side of the loom, and are pivotally attached at P^8 to the lay C, so that when the lay moves forward and the needles are rising the bar P^5 will be moved back and carry with it the slack threads p p', and when the lay starts back the threads will be loosened, so that they will not drag through the eyes of the needles, and the needles may move down as far as may be necessary to carry the thread even with the lower shed without any unnecessary friction. The threads p for the needles of the upper bar pass through eyes h^3, and the threads p' for the needles of the lower bar pass through the eyes h^4 before reaching the needles.

When it is desired to make a pattern such as that shown in Fig. 11, and which can only be made by causing each set of needles to pass the other set laterally in each direction from time to time, thereby forming two distinct lines of embroidery which cross each other or intermingle at certain points, each line being made by its own set of needles, it is necessary that the two sets of needles and their threads shall be so arranged with respect to each other that neither set of needles shall in moving laterally in either direction cut or interfere with the threads of the other set. In the loom shown in the drawings the cutting of the threads p' is prevented by making needles h so short that when the needle-bars are moving laterally the points of said needles will clear the threads p' as they pass from the eyes of needles j to the fabric, and the cutting of the threads p by the needles j is prevented by feeding the threads directly from above, as from the eyes h^3, so that these threads do not pass under or by the needles j.

The operation of making a stitch by the use of an attachment constructed as shown is as follows: When the reed has beaten up the filling and the lay is about to begin its backward movement, the reed and needles are in the position shown in Fig. 4, the needles being up out of the way of the shuttle and the reed being about vertical. As the lay starts back, it allows the lever G^6 (see Fig. 2) to fall, and through the connections G^5 G^4, rock-shaft G^3, and connections G^2 G′ the boxes G, holding the ends of the needle-bars, will be caused to drop, thus causing the needles to pass into and through the shed. When the lay is about half-back, the stop G^7 strikes the standard G^8, and the further motion of the rocker-arms G^2 and the parts connected with it will be stopped, the eyes of the needles by this time having reached the level of the lower shed, e^2. (See Fig. 5.) As the lay continues to move back, the needle-threads are still kept level with or below the lower shed, e^2, although the needles are given no further motion independent of the lay until they are withdrawn later, (after the lay has moved forward,) so as to allow the reed to beat up the filling. During the backward movement of the lay the lower ends of the take-up levers P^7 move with the lay, so that the take-up P^5 releases the needle-threads and allows the needles to draw as much slack as is necessary. The needle-threads being down out of the way, the lay nearly back, and the shed being open, the shuttle is thrown across from one shuttle-box to the other, leaving the filling-thread in the warp and above the needle-threads. The lay completes its stroke and starts forward again while the shuttle is going across, and when it has accomplished the first half of its forward stroke the roller K on the sword C′ strikes the lever G^6 and causes the boxes G, containing the ends of the needle-bars, to begin their upward movement. The shape of the cam-lever G^6 and the adjustment of the other connections are such that the highest position of the needle-bars is reached just as the lay reaches the end of its forward stroke. Just before this

time one of the cams H′ J′—say H′—strikes its treadle H^2, forcing it down and drawing down with it the ends of the straps *m m′*, attached to the springs *h′ j′*. The wheels M M′ are rotated part of a revolution by this means, and the levers H^3 J^3 are given a corresponding movement, which causes them to impart a lateral movement to the needle-bars through the connections H^4 J^4 H^5 J^5. This motion begins just before the needles have reached the end of the upward stroke and is finished just after the needles begin to fall and before they reach the warp, when the operation above described is repeated. The threads are again carried down and held below the path of the shuttle until the shuttle has passed back through the shed and left the filling-thread, which holds the needle-threads in place. Then the needle-threads are tightened by the upward movement of the needles and the action of the take-up bar P^5. The needles are again moved sidewise over the warp as far as the width of the groove in the pattern-wheels will allow, and are then ready to descend in the manner first above described for the purpose of making a third stitch. When two stitches have been made, and the cam H′ is about to act on its treadle again, the pin V on the cam J′ moves the lever V^2 and the ratchet N′ one or more teeth, according as it is adjusted, and so rotates the pattern-wheels a corresponding distance.

The shape of the grooves in the pattern-wheels and the rapidity of their rotation determines the shape of the pattern. The pattern-wheels are preferably made as shown in Fig. 7. Each wheel is made in two pieces, N^3 N^4, separated so as to produce a space between them, which is called the "groove," by washers n^2, of sufficient thickness for the purpose. As the width of the groove governs the lateral throw of the needle-bar, the same wheel may be used at different times with a different number of washers to produce different patterns. A complete figure is produced by an entire revolution of the pattern-wheel. This is caused, as has been said, by the ratchet N′ on the same shaft with the pattern-wheels, which ratchet is operated by the lever V^2 from the pin V on the cam J′. As this lever can be so adjusted by the set-screws j^3 j^4 as to move the ratchet the length of one tooth, or more than one tooth, it is evident that the length of the figure can be adjusted at will. Thus the width of the figure can be adjusted by varying the width of the groove in the pattern-wheel and the length of the figure by varying the throw given to the ratchet-wheel by each movement of the lever, and consequently the number of revolutions of the pattern-wheels to a given number of throws of the shuttle, and consequently to a given number of stitches or lateral movements of the needle-bars. Each needle-bar is distinct in its lateral movements from the other, its pattern-wheel having, if desired, a different-shaped groove, so as to give an entirely different throw to it, and consequently cause it to produce an entirely different figure. In the loom shown, as the needles on the upper bar are in front of those on the lower bar and are so short that their points are not in danger of cutting the threads of the lower needles, the needles may be caused to pass each other, so that the figures produced by the two sets of needles will cross each other and intertwine, so as to produce such a pattern as is shown in Fig. 11. By using two ratchet-wheels operated independently from the cams H′ J′, each ratchet-wheel on the same shaft with one of the pattern-wheels and each differently timed, a still further adjustment of patterns may be effected by the same pattern-wheels.

If it be desired to make a pattern consisting of a series of figures which shall be separated each from the other—as, for example, such a pattern as is shown in Fig. 9—the stitch will be made with one needle-bar in the manner above described, so long as the figure itself or row of figures across the cloth is being constructed. When the last stitch of the figure has been made, the needles are held permanently up and the weaving of the plain cloth is continued until the time arrives for the making of the next figure.

The mechanism for holding the needles up is shown in Fig. 8. On the shaft on which are the pattern-wheels is mounted a notched wheel, R. R′ is a rocker-arm mounted upon the rock-shaft G^3. To this rocker-arm R′ is hinged the lever *r*, held in place by the spring *r′*. (See Fig. 8.) From the side of the lever projects a pin, r^2, the rocker-arm, lever, and pin being so placed that the pin will rest upon the periphery of the notched wheel R or lie in the notch below the line of the periphery, according to the position of the wheel. The wheel R is rotated by the ratchet N′, which rotates the pattern-wheel, as above described, just before the cam H′ throws its treadle and just before the needles have reached the highest point. So long as the pin r^2 lies in the notch in the wheel R the rock-shaft is free to be rotated by the lay to give the desired up-and-down movement to the needles. Soon the pin strikes the wall of the notch in such a way that it moves the lever *r* against the force of the spring *r′*. When, now, the rocker-arm R′ is moved up by the rock-shaft G^3 at the next forward movement of the lay, the pin r^2 will be drawn out of the notch in the wheel R, and the spring *r′* will cause the lever *r* and its pin to resume its normal position with relation to the rocker-arm R′, and the pin r^2 will rest upon the periphery of the notched wheel R. This action causes the lever *r* and the rocker-arm R′ to have a similar movement, which will lift the cam-lever G^3 out of the path of the roller K on the sword C′. The parts will remain in this position until the notched wheel R has been moved into such a position that the pin r^2 will drop into the notch again and the rock-shaft G^3

and parts connected thereto resume their normal position and work. The spring r' is to allow the lever r and its pin r^2 to yield slightly when the pin strikes the wall of the notch. It is evident that this notched wheel R should be so placed upon its shaft as to act when the needles are up and before they begin their downward movement.

The effect of preventing the needles from dropping for a time will be to allow the desired amount of cloth to be woven after the completion of one figure and before the beginning of the next. When the needles begin again, they first move laterally, so as to descend in the right place, and then continue to make the stitch in the ordinary way. The two sets of figures will be connected by a thread, which must be cut from the cloth before the cloth will be finished. When the needles are raised from the shed, as just described, so as to be inoperative for a time, it is desirable to provide some guide for the shuttle. In the loom without our attachment this function is performed by the reed. When our attachment is in operation, the guides h^2 perform this function as well as protect the needles from being struck by the shuttle. When our attachment is to be temporarily thrown out of use, as has just been described, this function is performed by a set of auxiliary guides, t, which are fast to a bar, T, and are moved up and down through holes in the lay, (see Figs. 4 and 5,) so as to lie alongside the shuttle-race when the shuttle is moving, and down again as the reed advances to complete its work. This bar slides up and down on uprights T′, (see Fig. 14,) and is actuated by levers T^2, fulcrumed at a^3 upon a support attached to the lay. These levers T^2 are moved by cams T^3 on the shaft L, which actuate the treadles T^4, hinged on the cross-bar a^2 of the frame and connected to the levers by the connecting-rods T^5. The treadles T^4 and levers T^2 are slotted where the connecting-rods T^5 are joined to them, so as to allow the parts the motion rendered necessary, because of the backward movement of the lay C, upon which the levers T^2 are fulcrumed. The cams T^3 are timed to throw the treadles once, just before each throw of the shuttle, and to allow the guides to drop just after the shuttle is thrown. These guides t should be so placed as never to interfere with the downward movement of the needles when these guides and needles are in use at the same time. Under these circumstances the guides h^2 are unnecessary.

The cloth above referred to, which is illustrated in Fig. 11, is made exactly like any other cloth made upon our loom so far as the general operation of the machine is concerned. For example, if one stripe on the cloth shown in Fig. 10 were made by needles belonging to one bar and the other stripe were made by needles belonging to the other bar, both being thrown a certain distance laterally in one direction and being returned a certain distance laterally in the other direction, the two pattern-wheels used being exactly alike, the figures produced by the several needles of one set would be identical with those made by the needles of the other set. If the pattern-wheels have grooves of different shapes, so that the needles will be thrown different distances laterally with respect to each other, two different sets of figures will be made.

The arrangement of needles and threads above referred to, which allows the needles to pass each other either way without interfering with each other's threads, is for the purpose of allowing the machine to be used to unite two figures, one over or crossing the other, thus forming a piece of cloth in which the sets of stitches from the needles of the several bars intermingle or pass each other laterally from time to time. (See Fig. 11 of the drawings.) Such a piece of cloth may be made in a variety of patterns. That shown in Fig. 11 consists of two zigzag stripes, which cross each other from time to time, such a pattern clearly illustrating the peculiarities of the cloth and its mode of manufacture. To produce such a piece of cloth as is there shown, the needle-bars are moved laterally in the manner above described; but the needle which is making the left-hand of the two stripes at the lower edge of the piece shown in Fig. 11 is brought at each stitch a little farther to the right and the needle which is making the right-hand stripe is brought at each stitch a little farther to the left until the needles work side by side, make stitches side by side, and then pass so that the needle which formerly was working on the left of what may be called the "middle line" of the figure is now working on the right of that line and the needle which was working on the right of that line is now working on the left, the effect produced being that of two stripes crossing each other, and the result being a cloth in which two or more sets of stitches cross each other from time to time, each being held in place by a shuttle-thread. This capability of our machine may be utilized in a variety of ways, the cloth in each case showing a crossing or intermingling of the stitches at various times, according to the shape of the pattern-grooves. These changes, both as to time and extent, depend solely upon the shape of the grooves in the pattern-wheel used and can easily be regulated by those who have had experience in wheels of like nature.

It is evident that many other modes of imparting the necessary motions to the needle-bars and guides by equivalent means may be adopted; but the above seem to us the simplest means. It is also evident that only one needle-bar may be used, or that several needle-bars may be used at once, the necessary moving mechanism being added or omitted, as the case may require, and that the attachment may be added to a loom having one shuttle or more than one, thus rendering it possible to make a variety of kinds of embroidered

cloth by means of our attachment with great economy of time and of embroidery-thread. As the embroidery-thread is only held down at the end of the stitch by the one filling-thread, it is necessary to use scarcely more thread for the figure than will show on the upper surface of the cloth.

The economy of time is caused by the fact that the needles move to the bottom of the shed before the lay is half-back. Then their motion independent of the lay ceases, and they are carried out of the way of the shuttle by the lay itself. Thus the needles need be given only a short motion with reference to the lay through the shed and out again at the proper time, the movement of the lay itself favoring the desired change of position of the needle-eyes, which in return does not hinder in any way the movement of the lay. Thus our attachment can be used without detracting materially from the ordinary capacity of the loom.

The reed should be as near the shuttle-race as is practicable without interfering with the vertical movements of the needles.

It is evident that other mechanism, the equivalent of the above-described pattern-wheels for controlling the lateral movements of the needles, may be used, and that other equivalent forms of communicating the necessary vertical movements to the needle-bars can be adopted besides that above described; but that above described seems to us the best and simplest for this purpose, the mechanism for controlling the pattern being entirely independent of the mechanism for throwing the needle-bars, and the mechanism for giving the needles their up-and-down movement being ordinarily the same which operates the lay.

What we claim as our invention is as follows:

1. A lay, one or more needle-bars, bearings therefor, and ways on the lay in which said bearings may move vertically, the roller K, located as described upon one of the swords of the lay, a cam-lever, G^6, located as described with respect to said roller K, whereby said lever may be raised during a portion of the forward movement of said lay and allowed to fall during the backward movement of said lay, and connections, substantially as described, between said cam-lever and said bearings, whereby each movement of the lever shall cause a corresponding movement of the bearings, all as and for the purposes set forth.

2. A lay, one or more needle-bars, bearings therefor, and ways on the lay in which said bearings may move vertically, the roller K, located as described upon one of the swords of the lay, a cam-lever, G^6, located as described with respect to said roller K, whereby said lever may be raised during a portion of the forward movement of said lay and allowed to fall during the backward movement of said lay, and connections, substantially as described, between said cam-lever and said bearings, whereby each movement of the lever shall cause a corresponding movement of its bearings, in combination with a stop located to receive the mechanism above described for operating the needle-bar bearings during the backward movement of the lay and limit the downward movement of said bearings, all as and for the purposes set forth.

3. The lay, a needle-bar, bearings therefor in which said needle-bar may be moved longitudinally and ways on the lay in which said bearings may be moved vertically, means, substantially as above described, whereby there is given to said needle-bar a vertical reciprocating movement during each oscillation of the lay, a grooved pattern-wheel, means, substantially as described, whereby said pattern-wheel is rotated step by step, treadles H^2 J^2, cams H′ J′, located as described with respect to said treadles, an oscillating lever supported on said lay and connected with said treadles in substantially the manner described, and means, substantially as described, whereby one end of said lever is connected with said needle-bar, the other end of said lever being located in the groove of said pattern-wheel, all as set forth.

4. In combination with the needle-bar, the bearings therefor, the lay C, the ways thereon for said bearings, roller K, attached to one of the swords of said lay, cam-lever G^6, pivoted upon the frame, rocker-arm G^4, link G^5, rock-shaft G^3, connections, substantially as above described, between said rock-shaft and the bearings, whereby the oscillating motion of the lay imparts an intermittent vertically-reciprocating movement to the bearings and needle-bar, all as set forth.

5. In combination with the needle-bar, the bearings therefor, the lay C, the ways thereon for said bearings, roller K, attached to one of the swords of the said lay, cam-lever G^6, mounted upon the frame, rocker-arm G^4, link G^5, rock-shaft G^3, arms G^2, and connections, substantially as above described, between said arms and the bearings, whereby the oscillating motion of the lay imparts an intermittent vertically-reciprocating motion to the needle-bar and a stop, G^8, the lower surface, G^7, of one of said arms G^2 being adapted to engage intermittently with said stop G^8, as and for the purposes set forth.

6. The needle-bar and mechanism, substantially as described, for giving it a vertically-reciprocating motion, in combination with the rotating notched wheel R and mechanism, substantially as above described, whereby said needle-bar is periodically held from its downward movement, all substantially as described.

7. A lay, one or more needle-bars mounted thereon, the rock-shaft G^3, means, substantially as above described, whereby said rock-shaft is oscillated, and means, substantially as described, whereby each oscillation of the said rock-shaft imparts a vertically-reciprocating motion to said needle bar or bars, the rocker-arm R′, mounted upon said rock-shaft, the lever r, having pin r^2, and the spring r',

constructed and connected to said rocker-arm substantially in the manner described, in combination with the notched wheel R and mechanism, substantially as above described, whereby said notched wheel is rotated step by step, as and for the purposes set forth.

8. In combination with a needle-bar and means, substantially as above described, whereby said needle-bar is reciprocated vertically, the grooved pattern-wheel N and means, substantially as above described, whereby it is rotated intermittingly, the cam-shaft, cams H′ J′, located upon the cam-shaft, the treadles H^2 J^2, located beneath and operated by said cams, the drum M, the springs and straps connecting said treadles with said drum, the oscillating lever H^3, connected with said drum, as described, the lower end of said lever being located in the groove of said pattern-wheel, and devices, substantially as described, whereby the upper end of the lever is connected with said needle-bar, all as and for the purposes set forth.

9. The combination, with the lay and reed, of the needle-bars H J, each provided with a set of thread-carrying needles, and mechanism, substantially as above described, whereby said bars are reciprocated vertically and horizontally, the needles *j* on one bar lying nearer the reed than those, *h*, of the other bar, the points of the said needles *h* being above the line of the threads passing from the needles *j* to the fabric when the bars are moving laterally, and the thread-guides h^3 h^4, said guides h^3, belonging to said needles *h*, being located directly above said needles *h*, all substantially as and for the purposes set forth.

10. In combination, a lay, one or more needle-bars, H J, mounted thereon, and mechanism, substantially as above described, whereby they are given a vertical reciprocating movement with respect to the lay, the guard-carrying bar T, provided with auxiliary guards *t* and mounted upon uprights, the treadles T^4 and their cams and cam-shaft, and means of connection, substantially as described, whereby each movement of the treadle is imparted to the bar, as and for the purposes set forth.

11. The pattern-wheel N, provided with its ratchet N′, in combination with pawl V^4, its latch V′, and the pin V, the lever V^2, and cam J′, all substantially as and for the purposes set forth.

12. The pattern-wheel above described, made in two parts, in combination with one or more washers located between the parts of said pattern-wheel, as and for the purposes set forth.

13. In combination with the lay, needles, and tension mechanism of a lappet-loom, the take-up mechanism above described, consisting of the bars p^4 p^6, the levers p^7, connected at one end to and operated by the lay, and the take-up bar p^5, lying between the bars p^4 p^6 and carried by the other ends of such levers, whereby at each forward movement of the lay the otherwise slack thread is drawn tight over the said bars p^4 p^6, as and for the purposes set forth.

14. The cam-shaft L, the cams H′J′, mounted thereon, a pair of treadles, H^2 J^2, actuated by said cams, the lay, a wheel, N, axled to the lay, the strap *m*′, passing over and attached to said wheel, springs *j*′, forming an elastic connection between said strap and said treadles, a lever, J^3, attached to said wheel, a grooved pattern-wheel, N, one end of said lever being located in the groove thereof, a needle-bar, J, and means, substantially as described, whereby said needle-bar is connected to said lever, all adapted for the purposes set forth.

15. The lay, the needle-bar J, mounted upon the lay in substantially the manner described, in combination with the pivoted connecting-rod J^4, upright J^5, attached to said needle-bar, slide J^6, located and free to move in straps upon the lay, and the brace J^7, rigidly connected at one end to the outer end of said slide and at the other end with the upper end of said upright J^5, and means, substantially as described, whereby said rod J^4 is reciprocated laterally, as set forth.

In testimony whereof we have hereunto subscribed our names this 4th day of March, 1886.

GEORGE H. HODGES.
THOS. LONERGAN.

In presence of—
GEORGE O. G. COALE,
FRED B. O'NEIL.