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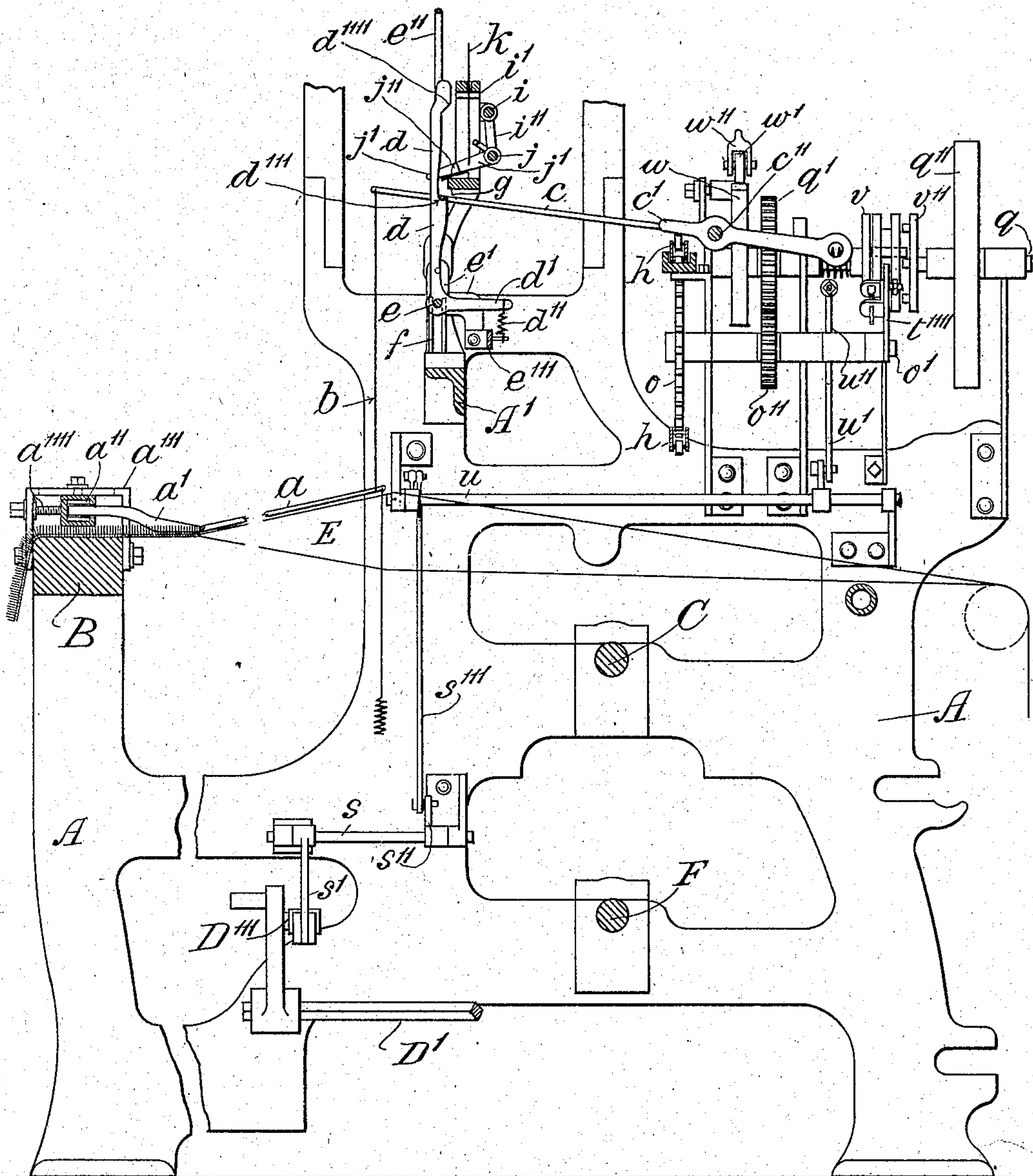
PATENTED MAR. 20, 1906.

W. C. GRAY & W. McKENZIE.
LOOM FOR WEAVING PILE FABRICS.

APPLICATION FILED JAN. 23, 1906.

5 SHEETS—SHEET 1.

Fig. 1.



Witnesses.
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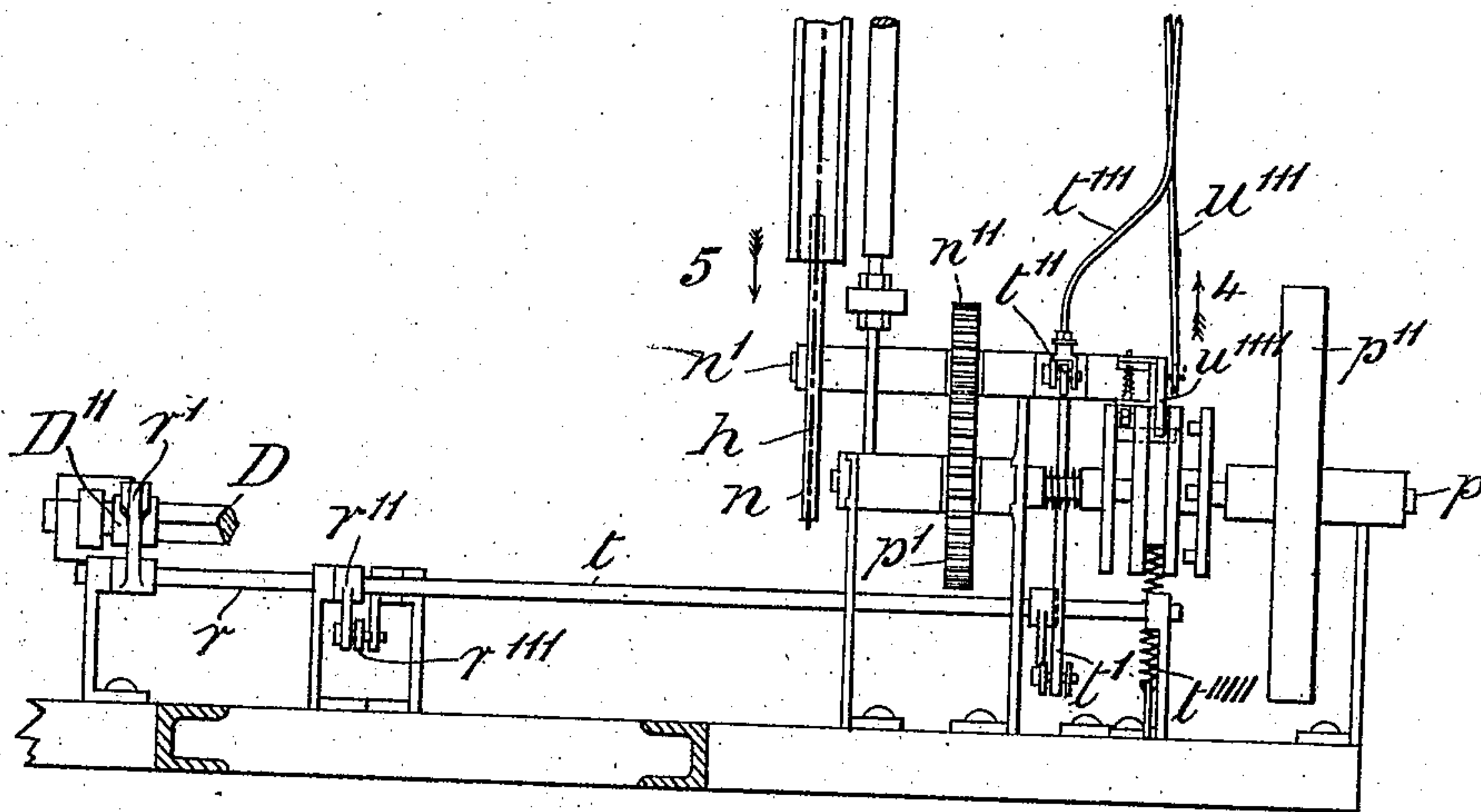
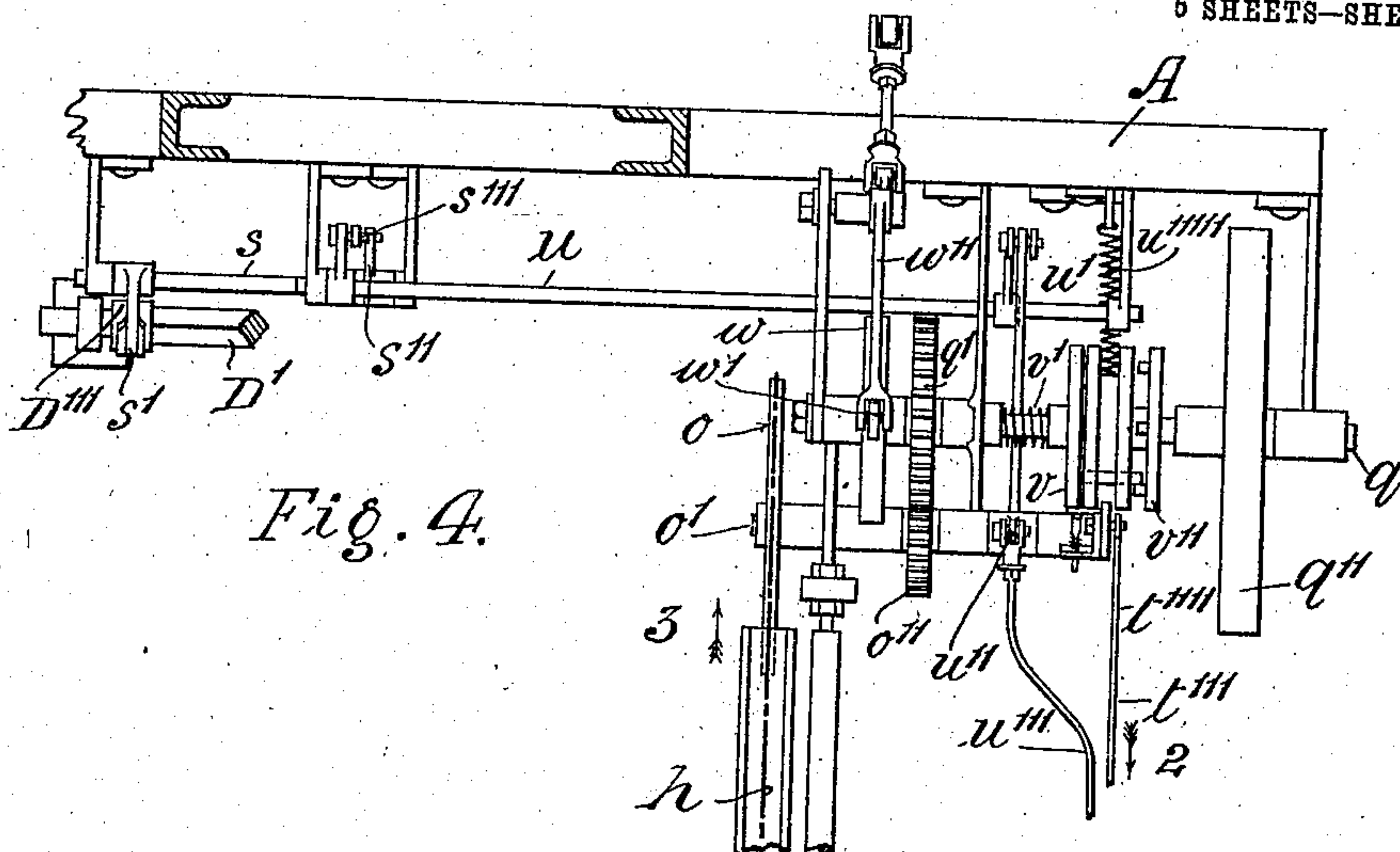
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5 SHEETS—SHEET 3.



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5 SHEETS—SHEET 5.

Fig. 9.

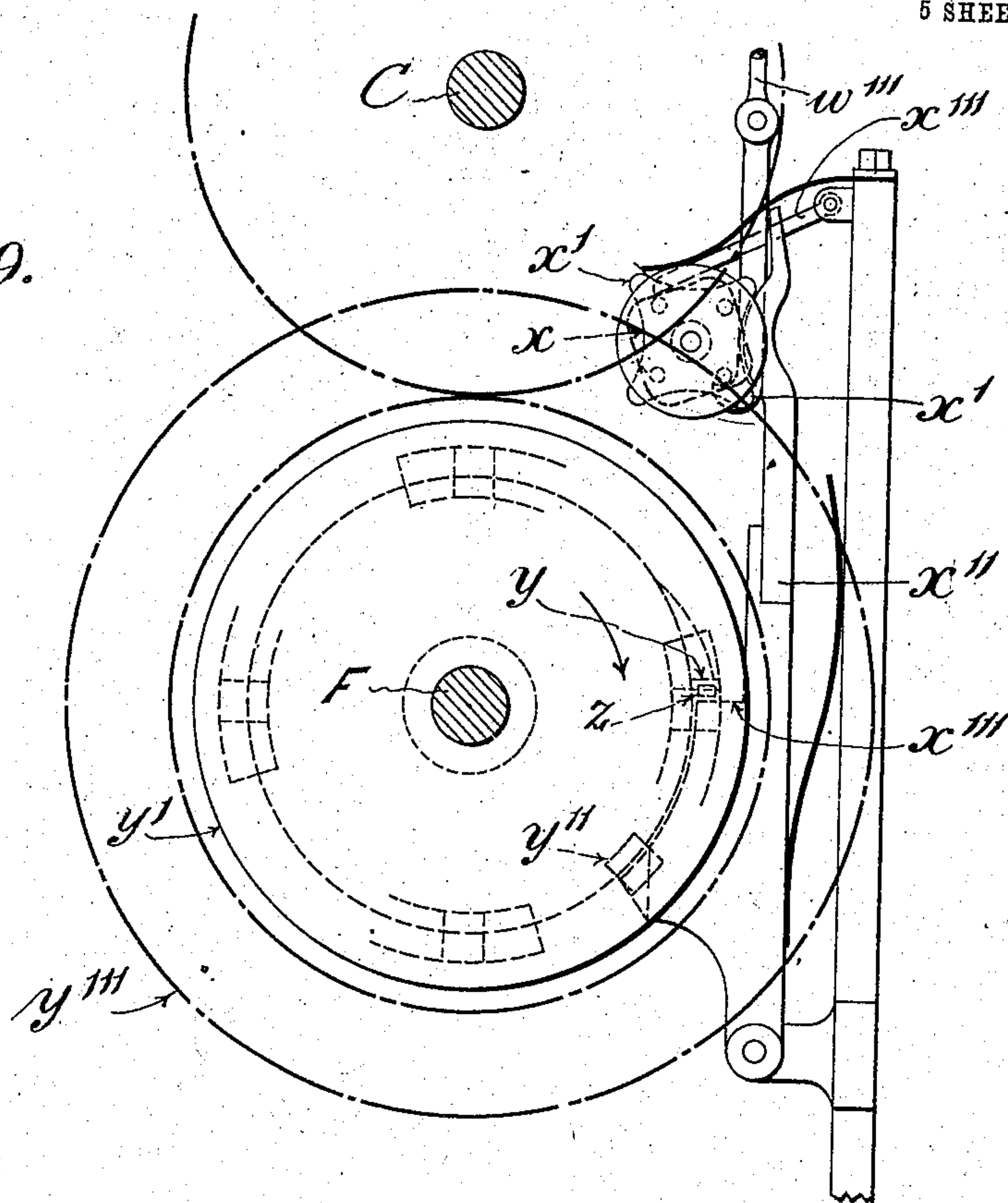


Fig. 10.

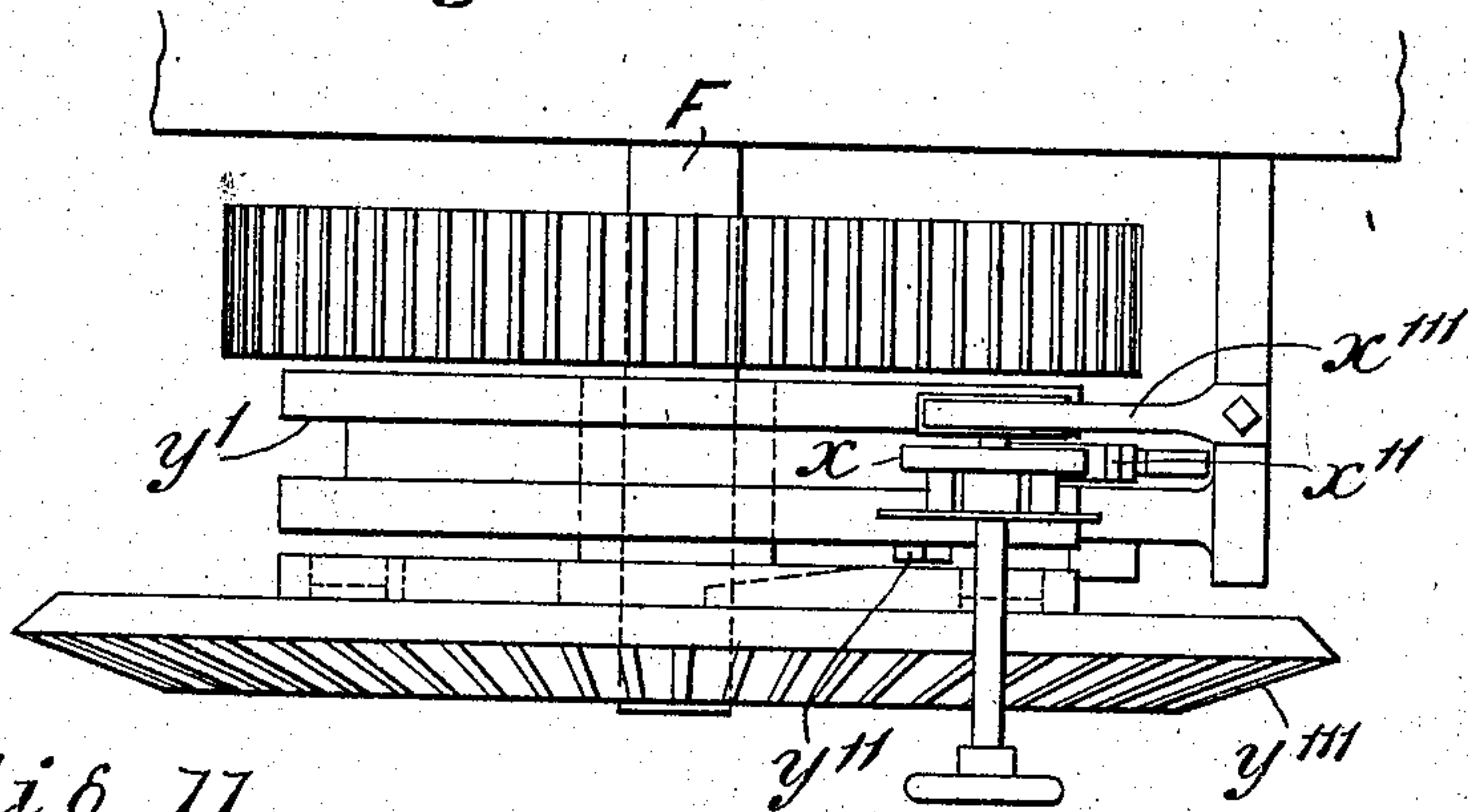
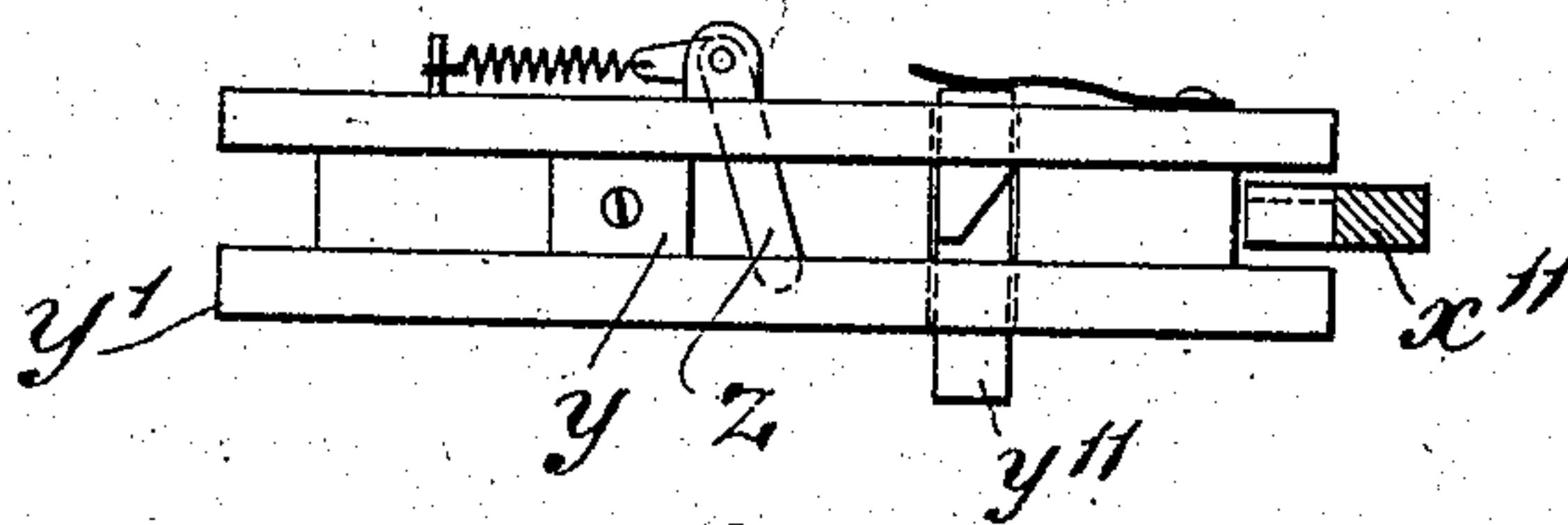


Fig. 11.



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UNITED STATES PATENT OFFICE.

WILLIAM C. GRAY AND WILLIAM MCKENZIE, OF AYR, SCOTLAND.

LOOM FOR WEAVING PILE FABRICS.

No. 815,526.

Specification of Letters Patent.

Patented March 20, 1906.

Application filed January 23, 1905. Serial No. 242,233.

To all whom it may concern:

Be it known that we, WILLIAM CRAWFORD GRAY and WILLIAM MCKENZIE, subjects of King Edward VII of Great Britain, residing at Ayr, in the county of Ayr, Scotland, have invented certain new and useful Improvements in Looms for Weaving Pile Fabrics, of which the following is a specification.

The present invention relates to new and improved means for weaving pile fabrics; and in general terms it consists of means for forming the pile of the weft-threads passed over pile-wires, which are manipulated by certain devices, as will be hereinafter set forth; and it further consists of the parts and combinations to be hereinafter described, and definitely pointed out in the claims.

Heretofore pile carpets or fabrics—such as tapestry, velvet, and the like—have been produced in well-known way by means of a printed warp on the beam, or in the case of "Wilton" fabrics by warp carried from various bobbin-frames at the back of the loom or in the manner adopted in weaving chenille or axminster carpets. In all these methods the seamless pile carpets or fabrics are produced with difficulty and at considerable expense, either by reason of the printing of the warp-yarns or the number of colored threads required to be brought from the back of the loom and the amount of space this occupies and the loss of time incurred in changing the colors of the warp-threads.

In carrying out our invention we form the loops and produce the desired pattern or design by means of the weft, which is carried from side to side of the loom by the shuttle in the usual way, any ordinary jacquard and loom of the desired width and warp wound on a single beam only or on a double beam, if required, being used.

In forming the pile-loops from colored weft to give the pattern or design we produce a carpet or pile fabric on an entirely new principle of weave, which while forming the loop of the pile binds it firmly into the fabric, by which means a saving of time and expense in changing the colors for various designs is effected and production of pile fabrics expedited.

In order to form the loops or pile from weft-yarn and to produce the desired pattern or design as called for by the jacquard or pattern mechanism, we employ a series of wires extending longitudinally in the direction of the warp and adapted to rest in their

lower inoperative position in grooves or ways in the lay between each dent of the reed, the said wires being elevated as called for by the pattern-indicating mechanism to form the loops by any suitable means.

In the accompanying drawings, forming a part of this specification, Figure 1 is a transverse sectional elevation of a pile-fabric loom embodying our improvements, the weft-pile or loop-forming wires being shown in their highest position. Fig. 2 is a rear elevation of the right-hand portion of the loom illustrated at Fig. 1, some of the parts shown in Fig. 1 being omitted. Fig. 3 is a detached elevation of the means for releasing the pile-wires required to be brought into position for forming the loops as determined by the pattern-indicator mechanism. Fig. 4 is a plan view of the rear of the loom, showing the mechanism for driving the endless chain intermittently in the direction of the traverse of the shuttle to elevate the pile-wires to form the loops, the said pile-wires and connections being omitted. Fig. 5 is an enlarged elevation of the pile-wires and connections detached. Fig. 5^a shows a modification of the means for actuating the loop-forming wires. Fig. 6 is a plan view of the parts shown in Fig. 5. Fig. 7 is a detail showing the loops formed by the weft. Fig. 8 is a side elevation of a section of the endless traveling chain employed. Fig. 9 is an elevation of the means for stopping the loom after every pick and preventing further operation thereof until the loops are formed from the last shoot of weft inserted. Fig. 10 is a plan view of the parts shown in Fig. 9, and Fig. 11 is a plan view of a portion thereof detached.

Referring to the drawings, letter A denotes the end or side frames of the loom, B the breast-beam, C the crank-shaft, and D D' the picking-shafts, one at each side of the loom, all as ordinary.

According to our invention, the gist of which is in the formation of the pile or pile-loops from the weft, as distinguished from the production of pile-loops from the warps, we employ a series of pile-wires *a*, extending longitudinally in the direction of the warp and pivotally connected at their front ends to plates *a'*, secured within an adjustable casing *a''*, secured by screws and nuts to brackets *a'''* on the ends of the breast-beam, the screws passing through elongated slots in the brackets, and the casing *a''* being adjusted to or from the loom by setting-up screws, as *a''''*.

The rear or free ends of the pile-wires pass through the dents of the reed on the lay, (not shown,) and when in their lowest positions they rest below the shuttle-race, so as to lie clear of the shuttle in its traverse through the shed.

To the free ends of the pile-wires are attached one end of cords *b*, whose opposite ends are secured to wires *c*, secured to or formed integral with disks or plates *c'*, pivotally mounted on a cross-shaft *c''*, supported in bearings in brackets bolted to the loom-framing, the rear ends of the said disks or plates being sufficiently extended to the rear of the shaft *c''* to form guides for each other and prevent one plate or disk catching on an adjacent disk.

In conjunction with each wire *c* is a catch *d*, pivotally mounted on a cross-shaft *e*, secured at each end in a frame *e'*, having an up-and-down vertical motion imparted to it by connector *e''*, from any suitable moving part of the jacquard, (not shown,) so as to move in unison with the said jacquard, the ends of shaft *e* entering grooves or ways in fixed brackets *f*, and steadying and guiding the frame.

Each catch *d* has a horizontal member *d'*, extending rearwardly, to the free end of which is attached one end of a spring *d''*, whose opposite end is secured to a pin projecting from a cross-rod *e'''*, forming a part of the rising-and-falling frame *e'*, said spring maintaining its respective catch *d* in a substantially perpendicular or operative position and causing the hooked portion or shoulder *d'''* thereon to pass under and engage with a pin *g* on the respective wire *c* when the latter is elevated to a predetermined height by the action of the endless chain *h*, as hereinafter described.

At a suitable height above the cross-shaft *e* is a cross-shaft *i*, journaled in bearings in framework *i'*, secured to brackets attached to the cross-girth *A'*, and on said shaft *i* are secured arms *i''*, one at each end of the shaft, the lower ends of the arms carrying a spindle *j*, upon which are loosely mounted a series of fingers *j'*, one for each of the catches *d*, said fingers *j'* being connected by cords *k* or like connections with the needles of the jacquard, so that according to the indication of the pattern-surface the said fingers *j'* will be raised, or allowed to fall, or remain in their lowest position. To the cross-shaft *i* is secured a lever-arm *j'''*, Fig. 3, to whose free end is connected one end of a rod *l*, the opposite end of said rod being provided with an elongated slot, in which is secured a stud projecting from a lever-arm *m*, carrying a bowl *m'*, resting upon a cam *m''*, fast on the crank-shaft *C*, and maintained in contact with said cam by a spring confined between the guide-plate *l'* and a collar *l''*, fast on the rod *l*.

At every revolution of the cam *m''* an upward-and-downward movement is imparted

to the rod *l*, which, through arm *j'''*, rocks the cross-shaft *i* and by the connecting-arms *i''* moves the spindle *j* from the position shown in full line in Fig. 5 to that shown in dotted line and back again, whereby an intermittent forward movement is given to the whole of the fingers *j'*.

In order to raise the pile-wires *a* from the lower plane of the shed to form the loops of weft-pile, we employ an endless traveling chain *h*, passing around chain-wheels *n o*, mounted on short shafts *n' o'*, arranged one at each side of the loom in a suitable position between each edge of the warp and the respective side frames *A*. The shafts *n' o'* carry pinions *n'' o''*, which mesh with respective gear-wheels *p' q'*, mounted on sleeves on shafts *p q*, which are driven constantly in opposite directions by straps from an overhead pulley or pulleys passing around the pulleys *p'' q''*, fast on said shafts, one of the straps being crossed and the other straight.

On each shaft *p q* are sliding and fixed clutch members of any suitable construction, which are engaged and disengaged by connections from the picking-shafts, or by separate chain-pulleys and lifting-levers similar to box motions in an ordinary Jacquard loom, in order that one or other of the chain-wheels shall be driven to traverse the chain across the loom in the same direction as that in which the shuttle is thrown, this direction of traverse of the chain therefore being determined by the picking motion.

On the picking-shafts *D D'* are secured arms *D'' D'''*, carrying studs or bowls which at each actuation of said picking-shafts strike against respective lever-arms *r' s'*, fast on rocking shafts *r s*, and rock said shafts in their bearings. The said shafts when thus rocked act through levers *r'' s''*, fast thereon, to draw down the connectors *r''' s'''*, and thereby rock supplementary shafts *t u* in the same direction. The movement of the shafts *t u* is transmitted, through levers and connecting-rods *t' u'*, to lever *t'' u''*, mounted loosely on the axes *n' o'*, and from thence, by connecting-rods *t''' u'''*, across the loom to levers *t'''' u''''*, mounted loosely on the axes *o' n'*, respectively.

The action of the chain-drive is as follows: If the picking-shaft *D* is actuated to pick the shuttle from that side of the loom, the shafts *r t* are rocked by the levers and connections and the connecting-rod *t'''* is drawn endwise in the direction of arrow 2, thereby withdrawing the end of lever *t''''* from engagement with a notch in the finger on the sliding clutch member *v* on shaft *q*, whereupon the spring *v'* immediately forces the sliding clutch member endwise on its shaft and brings the finger thereon into the path of the lugs on the fast clutch member *v''*, as shown at the upper end of Fig. 4. The sleeve carrying the spur-wheel *q'* is by this means ro-

tatably secured to the driven shaft *q*, and motion is therefore communicated, through pinion *o''*, to the chain-wheel *o*, which is rotated in the direction of arrow 3, thus traversing the chain *h* across the loom in the same direction, which is that in which the shuttle has been thrown by the actuating of the picking-shaft D. The same action takes place when the picking-shaft D' is actuated, the respective rock-shafts *s u* being thereby rocked and through levers and connections drawing the connecting-rod *u'''* in the direction of arrow 4 to bring about engagement of the clutch members on shaft *p*, and thereby drive the chain-wheel *n* in the direction of arrow 5 to traverse the chain in the contrary direction to that last traversed. The chain is thus always traversed in the same direction as the throw of the shuttle and is entirely under the control of the picking motion, and therefore positive and certain in action.

The levers *t'''* and *u'''* are reinstated in their normal positions to disengage the clutch members after each actuation of the respective picking-motions by strong springs *t''''* *u''''*, attached at one end to the levers and at the opposite ends to fixed studs. The endless chain in this instance is provided at one or two points of its length with a series of links having their upper edges inclined to form when joined together inclined planes leading to and from a central link, such as *h'*, Fig. 8, provided with friction-bowls *h''*. The disks or plates *c'* or the wires *c* rest upon the chain *h*, and as the inclined links are brought under said wires in the traverse of the chain to right or left the wires *c*, of which there are as many as there are loops to be formed across the fabric, are gradually raised in succession until they rest upon the bowls *h''*, at which point the studs or pins *g* are engaged by the shoulders or hooked portions *d'''* of the catches *d*.

The traverse of the chain commences after the shuttle has been thrown across the loom, and therefore the forming of the loops, or a greater portion of them, takes place while the shuttle is in the box, the raising of the pile-wires *a* by the elevation of the wires *c* by the chain drawing the requisite length of weft from the shuttle to form each individual loop, and as the pile-wires are raised one after the other there is no undue strain placed upon the weft in drawing it off the bobbin in the shuttle. The lifting of the pile-wires may be commenced immediately after the shuttle leaves the box from which it is thrown.

When the shuttle has been thrown across the loom, the loom is automatically stopped at every revolution, as afterward described, to allow of the loops being formed, and when this is accomplished the loom self-actingly starts again and beats up the last shoot of weft and inserts another pick.

After the wires *c* have been elevated to their first position by the chain to engage the pins *g* with the catches *d* the frame *e'* is raised bodily by the jacquard from the dotted-line to full-line position in Fig. 5 and elevates the wires *c*, and with them the pile-wires *a*, to place the latter in or above the upper plane of the shed.

The pile-wires which are not required by the pattern or design to be actuated to form the loops of weft are by the indication of the pattern-surface allowed to remain in the upper plane of the shed by the non-actuation of the fingers *j'*, being retained and held in inoperative position by the catches *d*, which remain in engagement with the pins *g* on the wires *c*; but the pile-wires *a*, which are required to form the loops of weft at the next pick, are indicated upon by the elevation of the fingers *j'* by the cords *k* from the needles of the jacquard, and while in their elevated position the rocking of the spindle *j* in a forward direction brings the lugs *j''* on said fingers into engagement with the inclined or cam surfaces *d''''* on the catches *d*, whereby said catches are forced off the pins *g* and the wires *c* and pile-wires *a* allowed to descend to their lowest positions, with the pile-wires in or below the bottom plane of the shed, whereby the next shoot of weft is carried over said pile-wires and subsequently drawn up into loops by the raising of the pile-wires, as before described.

Light springs connected to the ends of each pile-wire assist in drawing them and the wires *c* downward when released.

The lugs on the fingers *j'*, which are not raised by the jacquard, do not act upon the catches when rocked in a forward direction, and consequently the pile-wires remain in their elevated position above the shed.

All the pile-wires may be allowed to descend together or be held in inoperative position, according to the operation or non-operation of the jacquard-needles governing the fingers *j'*.

It will thus be manifest that any desired pattern or design may be produced in weft-pile as called for by the jacquard or pattern mechanism and that weft of different colors can also be employed in the production of the design or pattern.

The endless chain is or may be provided with two lifting-surfaces, so that if a shuttle is sent across from the same side of the loom two or more times in succession, necessitating the chain traveling the same number of times in the same direction, there will always be a lifting-surface in position at both sides of the loom to act with the traverse of the chain. The chain may have lugs thereon instead of inclined surfaces and friction-bowls to raise the wires *c*.

The plates *a'*, to which the pile-wires are

pivoted, are provided on the upper surfaces with knife-edges to sever the loops of pile as they are forced onto same.

An alternative method of operating the loop-forming wires *a* is shown in Fig. 5^a. In this arrangement the wires *a* are connected to looped or slotted connectors *a'''*, operated direct from the jacquard. The wires *c* pass through the loops or openings in the connectors *a'''* and are provided with hooks or catches *c^d*, adapted to be engaged by the catches *c^c* on the tumbler or angle-levers *c^a*, pivoted loosely on the cross-rod *c^b*. The wires *c* are normally held in their raised position by springs *c^e*, attached to the plates *c'* and to the levers *c^f*, fast on the transverse shaft *c''*. Projections *c^h* on said levers *c^f* limit the upward movement of the wires *c*. The wires *c* are all depressed for every pick of the loom by the transverse rod *c^g*, reciprocated vertically by suitable connections from the crank-shaft or other source of motion.

In the operation of the parts the jacquard lifts the wires *a* (not required) clear of the shed, and the wires *c* are depressed by the rod *c^g*. The operation of the chain *h* on the angle-levers *c^a* then moves said levers clear of the catches *c^d* on the wires *c* and allows the springs *c^e* to draw them up, one after the other, across the loom. The wires *a*, which by the selection of the jacquard have been left down, will thus be raised through the shed, as previously described, and form loops of the weft. The wires *a*, which by the selection of the jacquard have been raised up clear of the shed, are through the loops in the connectors *a'''* not affected by the upward movement of the wires *c*.

In order to self-actingly start and stop the loom, we mount on the sleeve carrying, say, the spur-wheel *q'* or on the boss of said wheel a cam *w*, on which rides a bowl *w'*, carried by a lever *w''*, Figs. 2 and 4, which is connected by links and levers to a vertically-movable rod *w'''*, (see Figs. 9, 10, and 11,) having at its lower end a hook or catch which normally extends under a stud on a barrel *x*, carried by bracket from any part of the framing. When the said rod is lifted by the action of the cam, it engages a stud on the barrel *x* and turns the latter a quarter of a revolution, one of the extensions *x'* on the barrel-bearing against the spring-actuated lever *x''* and moving it outwardly on its fulcrum, whereby the shoulder *x'''* thereon is moved clear of a stop-piece *y*, fast on a boss *y'*, secured on the low shaft *F* of the loom, and at the same time the lower end of said lever releases the sliding bolt *y''*, which is thereupon forced by a spring or other means into the path of a lug on the driven bevel *y'''*, loose on said shaft, and the shaft *F* and wheel *y'''* are thus secured rotatively together and the loom started.

Excess movement of the barrel *x* is pre-

vented by means of a spring-actuated finger *x''''*, which bears upon a flat on a boss or flange fast on the stud carrying the barrel.

When the loom has completed a revolution, the lever *x''*, which has been returned to normal position by the flat spring acting thereon, engages at its lower end with an inclined face on the sliding bolt *y''* and forces said bolt inward and out of engagement with the bevel driving-wheel *y'''*, the rotation of the loom being stopped by the engagement of the shoulder *x'''* on the lever *x''* with a cushioning lever or finger *z*, which is forced inward against the fixed stop-piece *y* on the boss *y'*, against the action of the spring, which thus absorbs the momentum and prevents a sudden shock in stopping.

It will be understood that changes may be made in the character of the means for raising the pile-wires or in the number of chains employed, such changes being within the spirit of the present invention.

We do not confine ourselves to the precise details of construction and arrangement of the parts hereinbefore set forth, as variations or modifications may be made without departing from the principle of our invention.

Our improvements may be applied to any make of loom suited for the weaving of pile fabrics.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In looms for weaving pile fabrics, the combination of pile-wires such as *a* for elevating or raising the weft into loops, pivotally-mounted wires *c*, an endless chain caused to travel in the same direction as the shuttle by means controlled by the picking mechanism, or by separate chain-pulleys and levers, said chain having projecting surfaces thereon to raise the wires *c* and therefore the pile-wires singly in succession from side to side of the loom, catches such as *d* pivotally mounted in a rising-and-falling frame, and pivotally-mounted fingers *j'* connected with the jacquard-needles or parts acted upon by the pattern-surface to determine the disengagement of the wires *c* with the catches *d* according to the pattern or design being woven, all arranged and acting in the manner and for the purposes substantially as herein set forth.

2. In a loom, the combination with means for determining the release of the pile-wires *a* prior to the insertion of each pick to allow them to occupy a position in readiness to elevate the weft-thread and for raising said pile-wires to form loops of weft in the fabric, of the chain *h*, for controlling the action of the pile-wires, and means described for traversing the chain *h* in the same direction as that in which the shuttle has last been thrown, substantially as herein shown and described and for purposes specified.

3. In a loom, the combination of mechan-

ism substantially as shown and described for forming pile-loops successively from one side of the loom to the other, and means for automatically stopping the loom after each passage of the shuttle until the whole series of pile-loops have been successively formed across the width of the fabric, substantially as described.

4. In a loom for weaving pile fabrics, the combination of pile-wires extending in the direction of the warp, means for inserting a weft-thread above certain of said pile-wires, and devices for thereafter raising said pile-wires to draw weft-thread from the weft-inserting means in the formation of the pile-loops.

5. In a loom for weaving pile fabrics, the combination of pile-wires extending in the direction of the warps, means for inserting a weft-thread above certain of said pile-wires, and devices for thereafter raising said pile-wires successively from one side of the loom to the other to draw weft-thread from the weft-inserting means in the formation of the pile-loops.

6. In a loom for weaving pile fabrics, the combination of longitudinal pile-wires, means for maintaining selected wires in a raised position and permitting others, which are to form the pile-loops, to be in depressed position, means for inserting a weft-thread above the depressed wires, and devices for thereafter raising the depressed wires to draw weft-thread from the weft-inserting means in the formation of pile-loops.

7. In a loom for weaving pile fabrics, the combination of longitudinal pile-wires, means for laying a weft-thread above certain of said wires, devices for raising said pile-wires to draw weft from the weft-inserting means, and devices for stopping and starting the loom automatically after each insertion of the weft.

8. In a loom for weaving pile fabrics, the

combination of longitudinal pile-wires means for laying a weft-thread above certain of said wires, devices for automatically stopping and starting the loom after each insertion of the weft, means for successively raising the pile-wires from one to the other side of the loom to draw weft from the weft-inserting means in the formation of the pile-loops while the loom is stopped.

9. In a loom for weaving pile fabrics, the combination of longitudinal pile-wires, means for picking a shuttle across the loom, devices and means for operating the same in the direction of the last shuttle movement for successively raising the pile-wires from one side of the loom to the other in the formation of the pile-loops.

10. In a loom for weaving pile fabrics, the combination of longitudinal pile-wires, means for picking a shuttle across the loom, and a chain having a portion movable in the direction of the shuttle for raising the pile-wires in the formation of the pile-loops.

11. In a loom for weaving pile fabrics, the combination of longitudinal pile-wires, means for picking a shuttle across the loom, and a chain having a portion movable in the direction of the shuttle for raising the pile-wires in the formation of the pile-loops, and means for automatically stopping and starting the loom after each pick.

In testimony whereof we affix our signatures, in presence of two witnesses, as follows:

WILLIAM C. GRAY. [L. s.]
WILLIAM MCKENZIE. [L. s.]

Witnesses as to William C. Gray:

FRANK FINDLAY MCFADZEAN,
JAS. MORRIS.

Witnesses as to William McKenzie:

THOMAS H. BARRON,
ERNEST BOSTWICK.