

No. 744,442.

PATENTED NOV. 17, 1903.

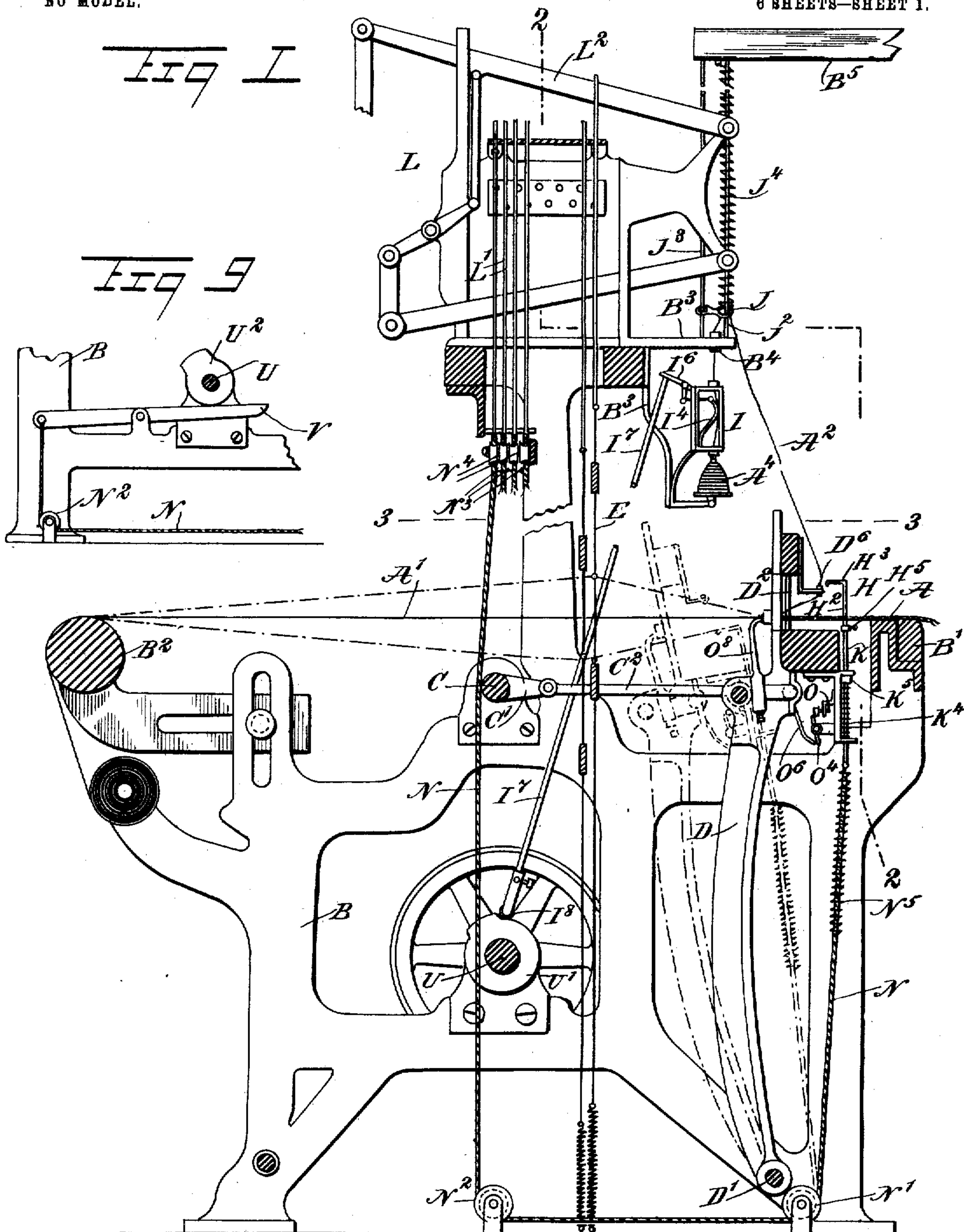
E. VAHLE.

LOOM.

APPLICATION FILED JAN. 6, 1902.

NO MODEL.

6 SHEETS—SHEET 1.



WITNESSES:

H. Walker
Geo. H. H. H.

INVENTOR

Ernest Vahle

BY *Munn & Co*

ATTORNEYS

No. 744,442.

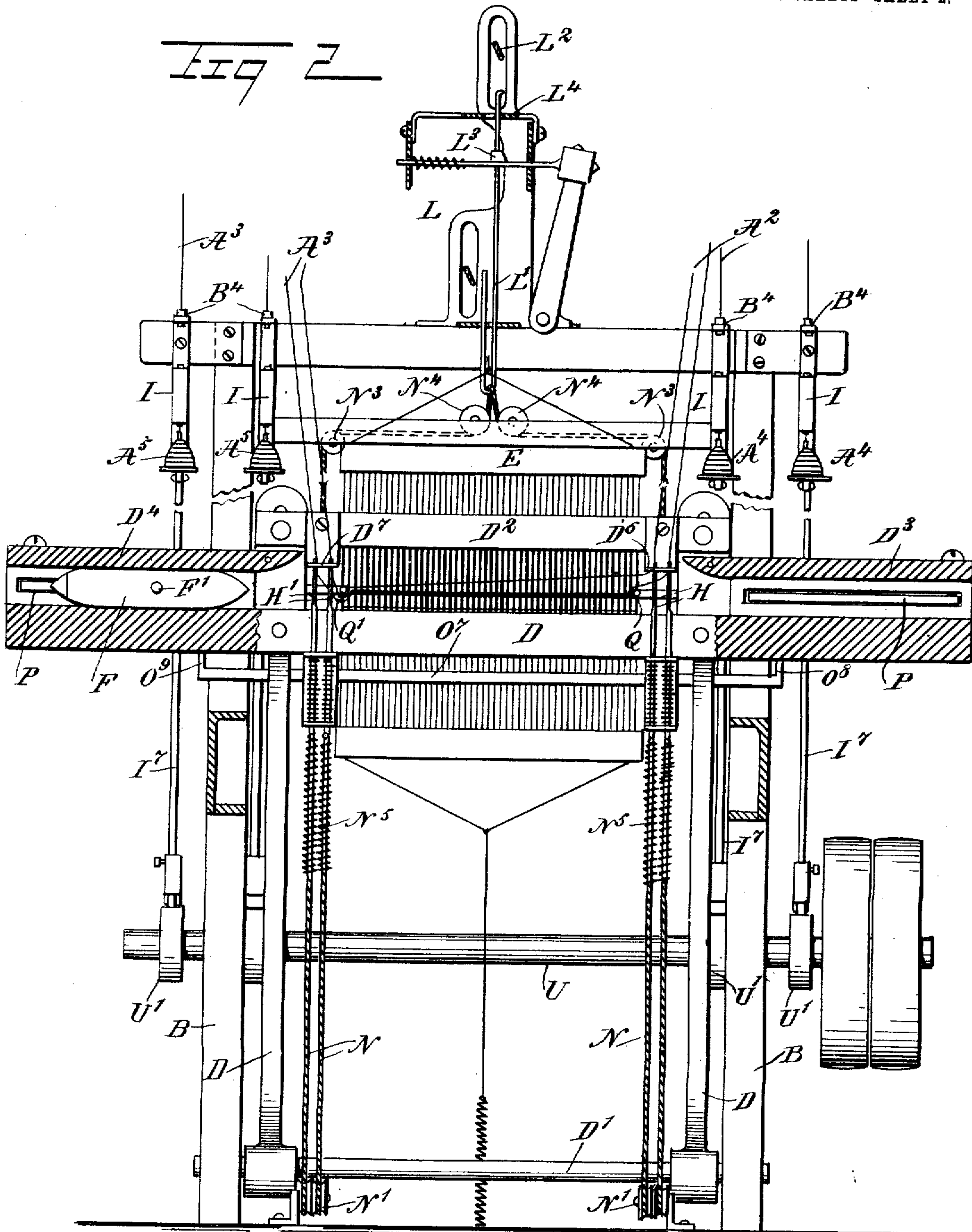
PATENTED NOV. 17, 1903.

E. VAHLE.
LOOM.

APPLICATION FILED JAN. 6, 1902.

NO MODEL.

6 SHEETS—SHEET 2.



WITNESSES:

H. Walker
Perf. Hoster

INVENTOR

Ernest Vahle

BY *Munn & Co.*

ATTORNEYS

Fig 12

No. 744,442.

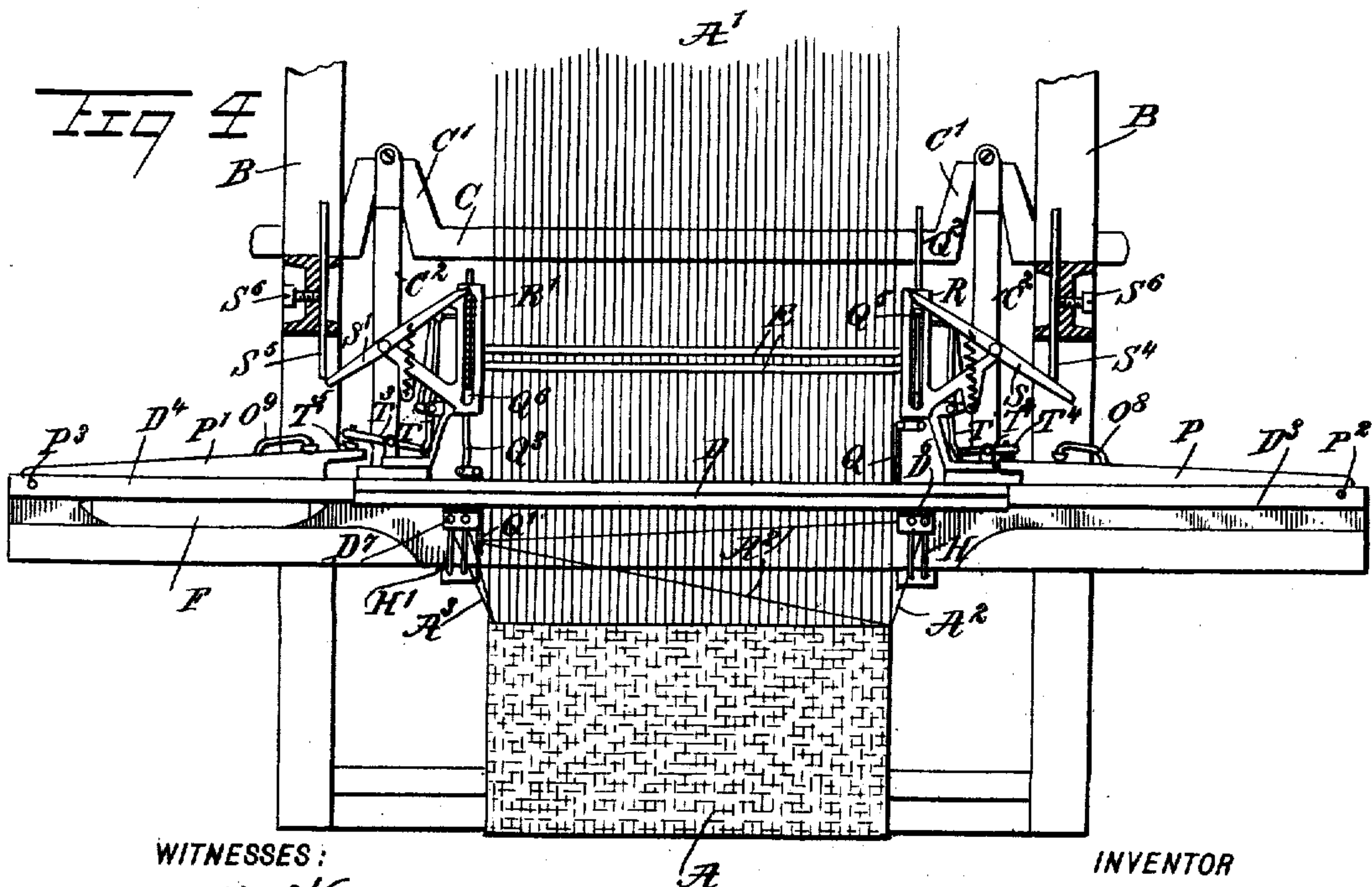
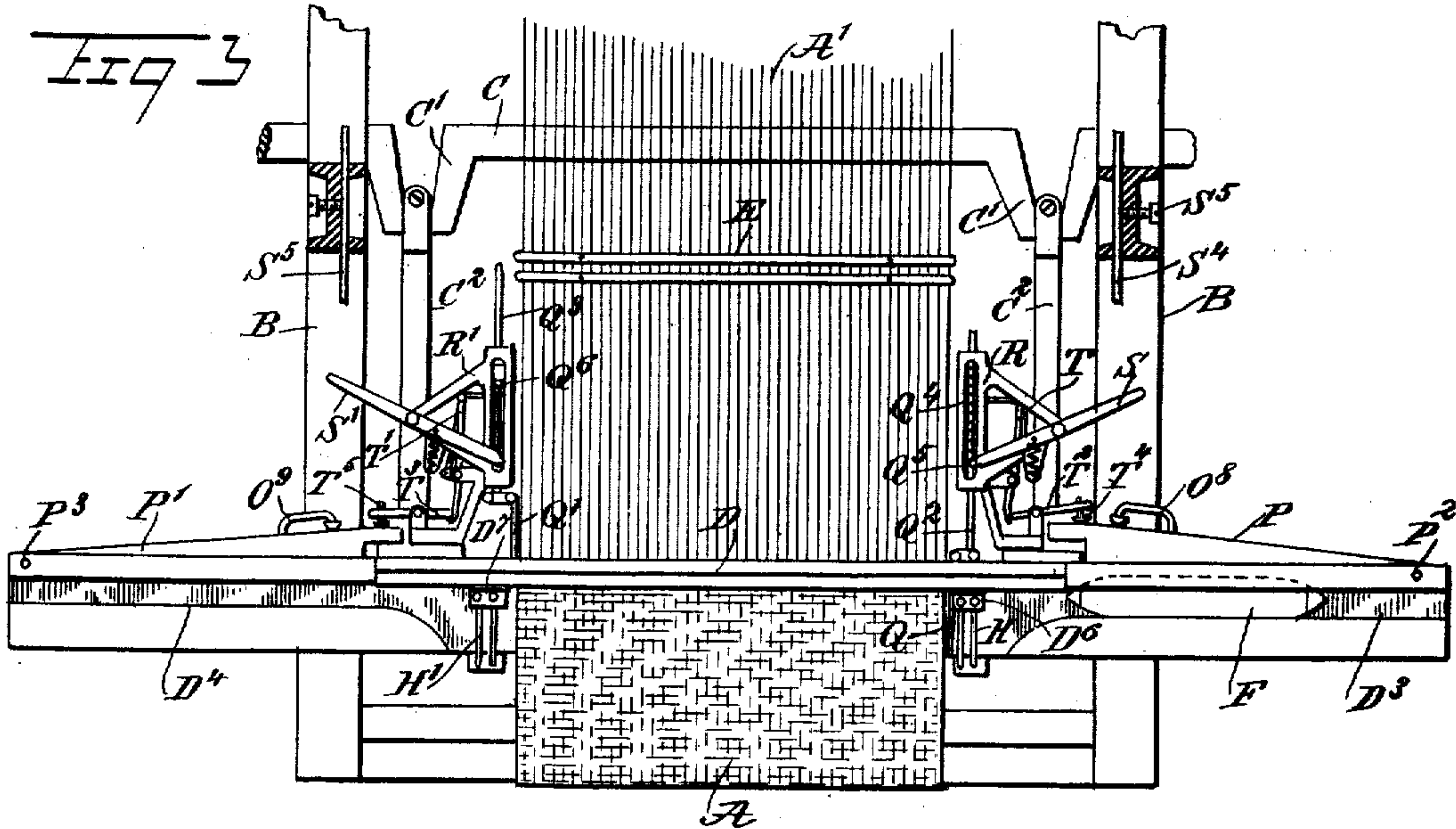
PATENTED NOV. 17, 1903.

E. VAHLE.
LOOM.

APPLICATION FILED JAN. 6, 1902.

NO MODEL.

6 SHEETS—SHEET 3.



WITNESSES:

H. Walker
Rev. J. Foster

INVENTOR

Ernest Vahle
BY *Munn & Co.*

ATTORNEYS

No. 744,442.

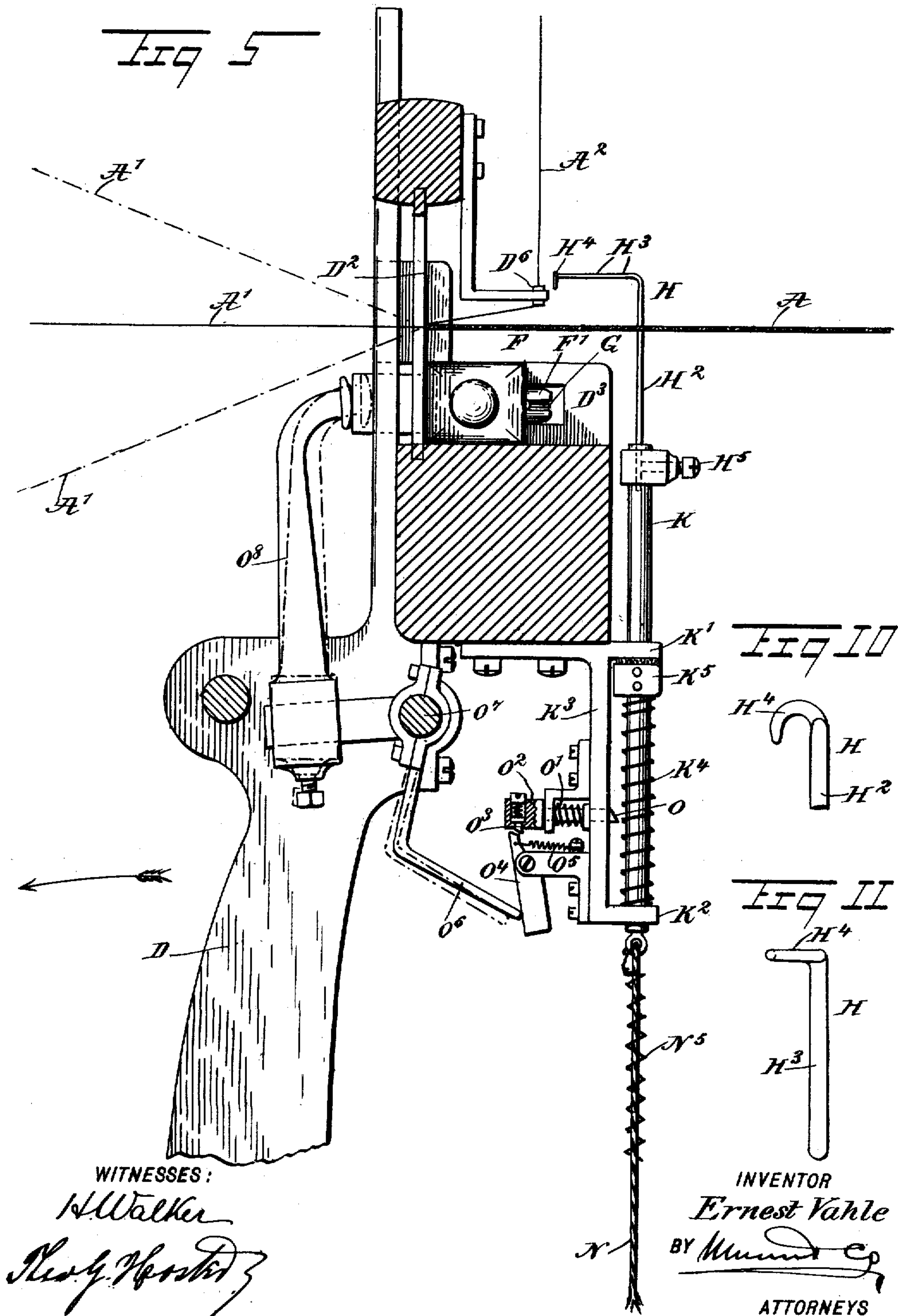
PATENTED NOV. 17, 1903.

E. VAHLE.
LOOM.

APPLIOATION FILED JAN. 8, 1902.

NO MODEL.

6 SHEETS—SHEET 4.



No. 744,442.

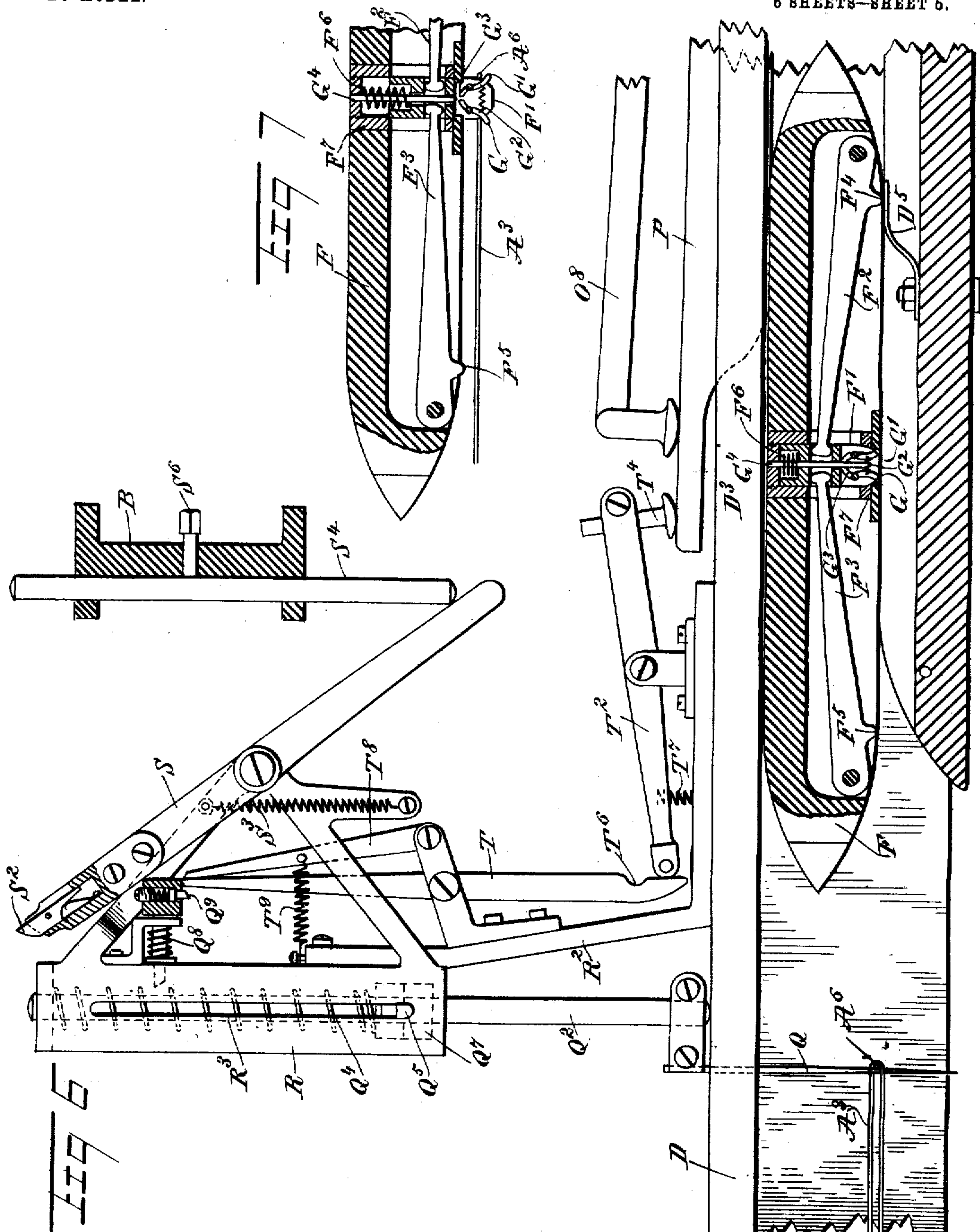
PATENTED NOV. 17, 1903.

E. VAHLE.
LOOM.

APPLICATION FILED JAN. 6, 1902.

NO MODEL.

6 SHEETS—SHEET 6.



WITNESSES:

H. Walker
Thos. G. Hester

INVENTOR

Ernest Vahle

BY

Munn & Co.

ATTORNEYS

No. 744,442.

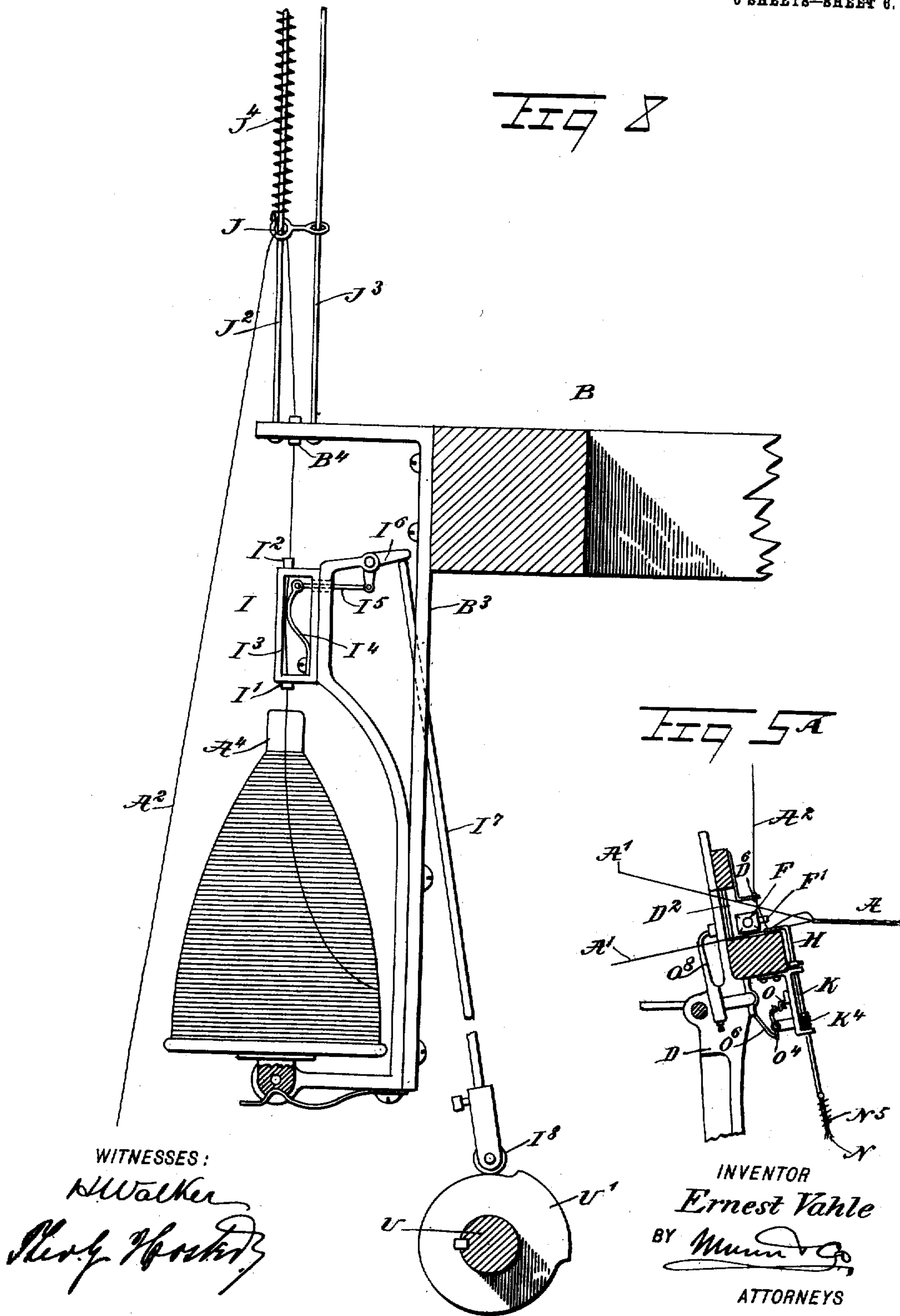
PATENTED NOV. 17, 1903.

E. VAHLE.
LOOM.

APPLICATION FILED JAN. 6, 1902.

NO MODEL.

8 SHEETS—SHEET 6.



UNITED STATES PATENT OFFICE.

ERNEST VAILE, OF WEST HOBOKEN, NEW JERSEY.

LOOM.

SPECIFICATION forming part of Letters Patent No. 744,442, dated November 17, 1903.

Application filed January 6, 1902. Serial No. 88,592. (No model.)

To all whom it may concern:

Be it known that I, ERNEST VAHLE, a citizen of the United States, and a resident of West Hoboken, in the county of Hudson and State of New Jersey, have invented a new and Improved Loom, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved loom for weaving all kinds of textile fabrics and arranged to carry the doubled-up weft-thread through the open shed by a spoolless shuttle, to produce a fabric having double weft-threads in each pick, the arrangement permitting the production of plain goods as well as figured goods with the aid of a jacquard.

The invention consists of novel features and parts and combinations of the same, as will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all of the views.

Figure 1 is a longitudinal sectional side elevation of the improvement, showing the lay in a beating-in position and the picker mechanism omitted. Fig. 2 is a transverse section of the same on the line 2 2 of Fig. 1. Fig. 3 is a sectional plan view of the same on the line 3 3 of Fig. 1. Fig. 4 is a like view of the same, showing the parts in a different position. Fig. 5 is an enlarged sectional side elevation of the lay and parts carried thereon. Fig. 5^a is a similar view of the same, on a reduced scale, with parts in a different position. Fig. 6 is an enlarged sectional plan view of the shuttle, the shuttle-race, and the mechanism controlled by the shuttle for operating the loop-needles and the locking device for the weft-thread guide. Fig. 7 is a like view of the shuttle, showing parts thereof in a different position. Fig. 8 is an enlarged rear sectional elevation of the weft-thread spool of the holding and releasing device for the weft-thread and adjacent parts. Fig. 9 is a side elevation of the actuating device for the weft-thread guide when weaving plain goods. Fig. 10 is an enlarged front elevation of one of the hooks for guiding the weft-thread to the open shed. Fig. 11 is a plan view of the same.

Fig. 12 is an enlarged perspective view of the fabric, showing the open shed, the weft-thread in position therein and looped onto the needle. Fig. 13 is a longitudinal sectional elevation of the weave.

In the fabric A to be woven by the loom warp-threads A' are bound in by doubled-up weft-threads A² and A³ alternately passed from opposite sides of the loom through the open shed—that is, in the first pick, say the doubled-up weft-thread A² is passed from the right to the left through the open shed from a spool A⁴, located on the right-hand side of the machine, and then during the next pick the doubled-up weft-thread A³ is passed from the left to the right through the open shed from a spool A⁵, located on the left-hand side of the machine, (see Fig. 2,) the ends of the weft-threads being held in the selvage of the fabric, as indicated in Fig. 12. In order to weave the fabric, it is at least necessary that two weft-threads A² and A³ from separate spools A⁴ and A⁵ be employed; but the number of spools and weft-threads for each side of the loom may be increased, especially when it is desired to weave figured goods. As shown in Fig. 2, two spools A⁴ and two spools A⁵ are provided for each side, and each of these spools carries a differently-colored weft-thread to allow of weaving figured goods according to a predetermined pattern, and in this case a jacquard is required to bring the desired weft-threads into action. In case plain goods are woven the weft-threads A² and A³ are alike in color, and in this case the jacquard can be dispensed with; but instead of the jacquard the device shown in Fig. 9 is employed to bring the weft-threads A² A³ for successive picks alternately into active positions. The loom for weaving this fabric is arranged as follows:

On the frame B are arranged the usual beams B' and B² for the fabric A and warp-threads A', as plainly indicated in Fig. 1, and in the said frame B is journaled the main or crank shaft C, having crank-arms C', connected by pitman C² with the lay D, fulcrumed at D' in the frame B and provided with the usual reed D² for beating in successively the doubled-up weft-threads A² A³. The warp-threads A' are held in the usual heddles E, and the doubled-up warp-threads A² are carried alternately through the open

shed by a spoolless shuttle F, mounted to travel from one shuttle-race D³ to the other shuttle-race D⁴ and back again, the shuttle being propelled from one shuttle-race to the other by a suitable picker mechanism. (Not shown.) The shuttle-races D³ and D⁴ are integral parts of the lay D, and consequently move with the same as the latter swings forward and backward when the loom is in action. The shuttle F is pointed at its ends in the usual manner and is provided in its front side with a retaining device for engaging the loops A⁶ of the doubled-up weft-threads A² A³ to alternately carry the same through the open shed. This retaining device consists, essentially, of a lug or button F', mounted to slide transversely in the shuttle-body, the lug when in an outermost position being adapted to engage the loop A⁶ and when moved into an inward position casts off the loop A⁶ shortly after the shuttle has passed through the open shed and entered the corresponding shuttle-race D³ or D⁴. In order to move this lug F' transversely in the shuttle F, I provide the following device, special reference being had to Figs. 6 and 7. The inner end of the lug F' is engaged by the inner ends of levers F² and F³, extending lengthwise in the shuttle F and in opposite directions from the lug F', the said levers being provided near their fulcrum ends with projections F⁴ F⁵, of which the projection F⁴ is adapted to engage a spring D⁵, arranged in the front of the shuttle-race D³, and the lug F⁵ is adapted to engage a similar spring D⁵, but located in the other shuttle-race D⁴. Now when the shuttle F passes into the shuttle-race D³, as indicated in Fig. 6, then the projection F⁴ engages the spring D⁵, so that the lever F² is swung inward, and in doing so moves the lug F' likewise inward to cast off the loop A⁶ of the weft-thread A³. In a like manner when the shuttle F moves into the shuttle-race D⁴ then the projection F⁵ engages the spring D⁵ in the said shuttle-race and causes a like inward movement of the lug F' to cast off the loop A⁶ of the weft-thread A². When the projections F⁴ and F⁵ are not in engagement with their corresponding spring D⁵, then the lug F' is held in an outermost position by a spring F⁶ pressing against the inner end of the lug F', as will be readily understood by reference to Figs. 6 and 7.

In order to prevent the loop A⁶ from accidentally sliding off the lug F', I provide the retaining-arms G and G', fulcrumed in a recess in the front end of the lug F', (see Figs. 5, 6, and 7,) and the said arms are normally pressed into an outermost retaining position by a spring G², so as to hold the loop A⁶ on the lug F'. The inner ends G³ of the arms G G' are adapted to be pressed apart by the pointed end of a pin G⁴, rigidly secured in the casing F⁷, in which the lug F' slides, so that when the lug moves into a rearmost position, as previously explained and shown in Fig. 6, then the inner ends G³ of the arms G G' move

in contact with the pin G⁴, and are thereby spread apart to draw the free ends of the arms G G' into an innermost position—that is, in the recess in the lug F'—to allow the loop A⁶ to readily slide off at the time the lug F' moves rearward. As soon as the lug moves outward and engages the next loop A⁶ then the arms G G' move again into an active position, as shown in Fig. 7, to hold the loop A⁶ against accidental displacement from the lug F'.

In order to bring the active weft-thread A² or A³ in and out of position at each end of the open shed for the lug F' to take hold of the loop A⁶, I provide guide-hooks II II' and mechanism for actuating the same, each guide-hook II II' operating in conjunction with corresponding weft-thread holding and releasing device I, located immediately above the corresponding spool A⁴ A⁵ and above which device I is arranged a spring-eye J, from which passes the corresponding weft-thread A² or A³ to an eye D⁶ or D⁷, held on the top rail of the lay D. The mechanisms for bearing the guide-hooks are simply duplicates one of the other, and the several holding and releasing devices I are alike in construction, also the eyes J and D⁶ and D⁷, so that it suffices to describe one of each duplicate device in detail.

Each of the guide-hooks II II' is provided with a shank II², from the upper end of which extends longitudinally the horizontal arm II³, terminating in a hook proper, II⁴, as plainly indicated in Figs. 5, 10, and 11, the hook II⁴ being adapted to engage the corresponding weft-thread A² or A³ below the eye D⁶ at the time the lay D is in a rearmost position. The shank II² of the hook is fastened by a set-screw II⁵ in the upper end of a rod K, mounted to slide vertically in suitable bearings K¹ and K², formed on a bracket K³, bolted or otherwise fastened to the under side of the lay D, as plainly indicated in Fig. 5. A spring K⁴ is coiled on the rod K and rests with its lower end on the bearing K² and presses with the upper end against a collar K⁵, normally resting against the under side of the bearing K¹. The rod K, and with it the guide-hook II or II', is drawn downward into an active position by the action of the jacquard L, and in order to do this the lower end of each rod K is connected with one end of a rope N, extending over pulleys N¹, N², N³, and N⁴, and connected at its other end with the lower end of a hook L' of the jacquard L, the said hook being adapted to be lifted periodically by the lever L² and to draw the rod K downward against the tension of its spring K⁴ and until the spring-catch O snaps off over the top of the collar K⁵, so as to lock the rod K temporarily against a return or upward movement. On each hook L' of the jacquard is arranged a wedge L³, (see Fig. 2,) adapted to engage a projection L⁴ on the frame of the jacquard, so that when the hook L' is elevated into an uppermost posi-

tion by the lever L^2 then the said wedge L^3 presses the hook L' to one side to disengage the upper end of the hook from the lever L^2 . As soon as this takes place the hook L' drops
 5 back to a lowermost position and a spring N^5 on each rope N draws the latter back, it being understood that the spring N^5 was exerting a pull on the rope N by the lifting of the hook L' . The catch O holds the rod K in a
 10 lowermost position during the time the lay D is in a rearmost position, so that the hook H^4 holds the corresponding weft-thread A^2 A^3 in the path of the shuttle to allow the lug F' thereof to engage the corresponding loop
 15 A^6 to allow of drawing the doubled-up weft-thread through the open shed from one side to the other. (See Fig. 5^a.) The catch O is released by the shuttle entering the opposite shuttle-race, so that the spring K^4 forces the
 20 rod K back to a normal uppermost position, thereby releasing the corresponding weft-thread A^2 or A^3 for the time being.

In order to withdraw the catch O from the collar K^5 , I provide the following device: The
 25 catch O is mounted to slide in the bracket K^3 (see Fig. 5) and is pressed on by a spring O' to normally hold the catch in an outermost position for engagement with the collar K^5 when the rod K is moved downward. On the
 30 inner end of the catch O is arranged a head O^2 , containing a spring-pressed catch O^3 , adapted to be engaged by one end of a lever O^4 , fulcrumed on the bracket K^3 and pressed on by a spring O^5 . The lower end of the lever
 35 O^4 is adapted to be engaged by an arm O^6 , secured on a transversely-extending rock-shaft O^7 , journaled in suitable bearings on the lay D , so as to move with the same. On the shaft
 40 O^7 are secured two upwardly-extending arms O^8 and O^9 , engaging the rear faces of the levers P and P' , fulcrumed at their outer ends P^2 and P^3 in the rear sides of the raceways D^3 and D^4 , the said levers extending in slots arranged in the raceways, so as to project with
 45 their forward faces into the raceways for the shuttle F to swing the levers P and P' outward at the time the shuttle passes into the corresponding raceway D^3 or D^4 . As previously stated, the rod K is locked by the
 50 catch O in a lowermost position during the time the shuttle passes through the open shed, so that the hook H^4 properly guides the corresponding weft-thread A^2 or A^3 to the open shed, and as soon as the shuttle enters the
 55 raceway D^3 or D^4 then it brings the corresponding lever P or P' outward, and thereby gives a swinging motion to the arm O^8 to rock the shaft O^7 , which by the arm O^6 imparts a swinging motion to the lever O^4 , and as the
 60 latter engages the spring-catch O^3 it is evident that the catch O is caused to slide rearward out of engagement with the collar K^5 to release the rod K . As soon as this takes place the spring K^4 immediately forces the rod K
 65 upward, so that the hook H^4 disengages the corresponding weft-thread A^2 or A^3 . The

weft-thread A^2 or A^3 is thus released previous to the lay beating in the weft-thread.

From the foregoing it will be seen that the shuttle when entering the raceways D^3 and
 70 D^4 controls the releasing of the weft-threads by the hooks H^4 . The shuttle F also controls the needles Q and Q' , employed for engaging the loop A^6 of the weft-threads A^2 and A^3 at the time the loops are cast off from the lug F'
 75 of the shuttle F —that is, at the time the shuttle passes into the corresponding raceway D^3 or D^4 . The needles Q and Q' extend longitudinally adjacent to the edges of the weave, as plainly indicated in Figs. 3 and 4. The needles
 80 Q Q' move bodily with the lay D and have a longitudinal movement to bring the needles into a forward position for receiving the loop A^6 as soon as the shuttle has left the open shed and passes into the corresponding race-
 85 way D^3 or D^4 . As soon as the doubled-up weft-thread A^2 or A^3 just laid in the open shed is beaten in by the lay then the needle Q or Q' moves rearwardly and out of the path of the shuttle, so that the latter can return
 90 to the other side of the loom during the next pick.

The mechanisms for operating the needles are arranged as follows, special reference being had to Figs. 3, 4, and 6: The needles Q
 95 and Q' are secured on the rods Q^2 and Q^3 , mounted to slide longitudinally in the casings R R' , attached by brackets R^2 to the raceways D^3 D^4 , and each of the said rods Q^2 is pressed on by a spring Q^4 and normally holds
 100 the corresponding needle Q or Q' in a forward position. On the rods Q^2 and Q^3 are secured or formed lugs Q^5 and Q^6 , extending through slits R^3 in the casings R R' , and the said lugs are adapted to be engaged by spring-catches
 105 S^2 held in the front ends of the levers S S' fulcrumed on the casings R R' , respectively, each lever S S' being pressed on by a spring S^3 to normally hold the lever S or S' in such position that the spring-catch S^2 , engaging the
 110 corresponding lug Q^5 , is in a normal forward position. The ends of the levers S S' are adapted to bear against stops S^4 S^5 , held adjustably in the frame B and adapted to be
 115 secured therein by set-screws S^6 to allow of properly adjusting the stops S^4 S^5 . It will be seen that when the needle Q or Q' is in a forward position and engages the loop A^6 and the lay swings rearward then the lever S or
 120 S' firmly moves in contact with the corresponding stop S^4 S^5 , so as to impart a swinging motion to the lever and cause the catch S^2 to draw the lug Q^5 or Q^6 , and with it the rod Q^2 or Q^3 and needle Q or Q' , in a rear-
 125 ward direction for the corresponding needle Q or Q' to disengage the loop A^6 . At the time this takes place the lay has reached almost an innermost position, and when the lay moves into a final rearward position then the catch S^2 slides off the corresponding lug
 130 Q^5 or Q^6 ; but at this time a catch Q^8 has moved in engagement with a collar Q^7 on the corre-

sponding rod Q^2 or Q^3 , so as to hold the latter in a rearmost position against the tension of the corresponding spring Q^4 .

The catches Q^8 above referred to are spring-pressed and mounted to slide in bearings attached to the casing R or R' and are provided with spring-catches Q^9 , which move bodily therewith, of which the spring-catch Q^9 on the casing R is adapted to be engaged by a lever T , and a similar lever T' is adapted to engage the spring-catch Q^9 on the casing R' to withdraw the spring-catches Q^8 from the collars Q^7 and allow the spring Q^4 to move the rods Q^2 and Q^3 outward for the needles Q and Q' to engage the next loop A^6 . Now this releasing of the rods Q^2 and Q^3 by the spring-catches Q^8 is controlled by the shuttle F entering the corresponding raceway D^3 or D^4 , and for this purpose the levers T and T' are adapted to be engaged by levers T^2 T^3 , fulcrumed on the raceways D^3 D^4 and carrying buttons T^4 and T^5 , resting on the levers P and P' , previously described. Each of the levers T and T' is provided with a notch T^6 , and each lever T^2 is pressed on by a spring T^7 . A pivoted arm T^8 , pressed on by a spring T^9 , engages the corresponding lever T (or T') for the purpose hereinafter described. The lever T (or T') must disengage the catch Q^9 after the catch Q^8 has released the collar Q^7 to allow the catch Q^8 to move immediately back to its position shown in Fig. 6. As the lever T^2 does not allow a return movement of the lever T as long as the shuttle is in the raceway it is necessary to open the catch Q^9 to release the catch Q^8 from the lever T , and this is done by the spring-arm T^8 . When the catch Q is moved by the lever T , the spring-arm T^8 moves with the lever T , and the movement of said arm on its pivot causes the free end of the arm to push the catch Q^9 out of engagement with the lever T as soon as the collar Q^7 is released. The catch Q^8 now moves to the position shown in Fig. 6, while the lever T and its arm T^8 remain in the position into which the lever was moved by the lever T^2 . When the lever T^2 is released, then the spring-arm T^8 returns the lever T (or T') to position to engage the catch Q^9 . It is understood that during the time the shuttle passes through the open shed the corresponding needle Q or Q' is in a rearmost position—that is, out of the path of the shuttle—and the corresponding catch Q^8 then engages the collar Q^7 , while the lever T^2 or T^3 engages the notch T^6 in the corresponding lever T or T' . As soon as the shuttle passes into the raceway D^3 or D^4 and presses the lever P or P' outward, as before explained, then the corresponding lever T^2 or T^3 is caused to swing, thereby moving the end of said lever out of the notch T^6 and imparting a swinging motion to the lever T or T' to draw the catch out of engagement with the corresponding collar Q^7 and allow the spring Q^4 to move the rod Q^2 or Q^3 forward for the corresponding needle Q or Q' to receive the loop A^6 , which is cast off the

shuttle F on the withdrawal of the lug F' . The needle Q or Q' now holds the loop A^6 during the forward or beating-in stroke of the lay D , and when the lay D returns on the next stroke the needle Q or Q' is withdrawn by the action of the lever S or S' , as above explained, so that the needle is again out of the path of the shuttle for the latter to pass through the open shed at the next pick.

The holder for each weft-thread A^2 or A^3 is arranged as follows, special reference being had to Figs. 1 and 8: The weft-thread A^2 or A^3 after leaving the corresponding spool A^4 or A^5 passes forwardly through eyes I' I^2 , located one above the other and held in a frame I^3 , secured to a bracket B^3 , attached to the main frame B . A spring I^4 is secured in the frame I^3 and is curved to press one side of the weft-thread against the side of the frame I^3 to clamp the thread in position for the time being. The free end of spring I^4 is pivotally connected by link I^5 with a bell-crank lever I^6 and adapted to be engaged by a rod I^7 , carrying a friction-roller I^8 in contact with the peripheral surface of a cam U' , secured on the cam-shaft U of the loom. Now by the arrangement described the weft-thread A^2 or A^3 is periodically clamped and held in position by the spring I^4 and is periodically released at the time the cam U' imparts a sliding motion to the rod I^7 to swing the bell-crank lever I^6 and to draw the spring I^4 out of engagement with the thread. The thread after leaving the upper eye I^2 passes through an eye B^4 , carried on the bracket B^3 , and then the thread passes through the eye J , mounted to slide vertically on rods J^2 and J^3 , secured at their lower ends on the bracket B^3 and attached at their upper ends to an overhead support B^5 , as indicated in Fig. 1. A spring J^4 is coiled on the rod J^2 to normally hold the eye J in an uppermost position, the spring permitting, however, the eye J to slide downward on its rods J^2 or J^3 when a pull is exerted on the thread by the shuttle passing from one side of the loom to the other. This is at the time the weft-thread is laid double in the open shed. Now as soon as the pressure on the weft-thread is released the eye J is drawn forward by its spring J^4 to take up any slack that is in that portion of the weft-thread extending from the eye J through the open shed and to the end secured in the selvage of the fabric. It is understood that when the shuttle goes through the open shed the eye J is drawn downward against the tension of its spring J^4 , but during this time the thread is held by the spring I^4 in the frame I^3 to prevent unwinding of the weft-thread from its spool A^4 or A^5 . When the shuttle has passed through the open shed and the loop A^6 has been cast off from the lug F' and the corresponding needle Q and Q' has moved in position to receive the loop, then there is some slack in the weft-thread, and this slack is immediately taken up by the spring J^4 pulling the eye J , so that the loop A^6 engages the

needle Q or Q' very firmly. Immediately after this the hook H¹ disengages the weft-thread, and consequently the latter again becomes slack, and this slack is also taken up by the
 5 further upward movement of the eye J caused by the spring J⁴. As soon as the lay starts to go back after having beaten in the weft-thread then the spring I⁴ is moved out of engagement with the warp-thread, and now
 10 the eye J moves into a final uppermost position by the action of the spring J⁴, and in doing so unwinds a portion of the weft-thread from the spool A¹ or A⁵. The amount unwound from the spool corresponds to the
 15 amount needed in the next pick, it being further expressly understood that as soon as enough thread has been unwound from the spool A⁴ for the purpose mentioned the spring I⁴ again clamps the thread in position in the
 20 frame I³ to prevent unwinding of the thread during the time the shuttle lays the doubled-up weft-thread in the open shed.

The operation is as follows: When the lay is in a rearmost position, as illustrated in
 25 Fig. 4, and the shuttle F has passed through the open shed from the shuttle-race D³ into the shuttle-race D⁴ and cast off the loop A⁶, then the needle Q' engages and holds this loop, so that the doubled-up weft-thread extends in
 30 the open shed and can now be beaten in on moving the lay D forward. When this has been done and the lay moves into a rearmost position, then the needle Q' is withdrawn from the loop, as previously explained,
 35 and the hook H' on the left-hand side of the machine engages the weft-thread A³ and holds the same across the open shed at the left-hand side in such a manner that when the shuttle moves from the shuttle-race D⁴
 40 through the open shed then its lug F' engages the weft-thread A³ to form the loop A⁶ and to carry the now doubled-up weft-thread through the open shed, and when the shuttle moves into the shuttle-race D³ the lever P is
 45 actuated to cause the needle Q to move into an active position, so as to receive the loop A⁶ as soon as the same is cast off from the lug F'. Thus the weft-thread A³ is doubled up in the open shed and is now beaten in on
 50 the next forward movement of the lay D. When this has been done and the lay moves back into a rearmost position, then the needle Q is withdrawn and the hook H is moved into engagement with the weft-thread A² to
 55 draw the same across the open shed, so that the shuttle F on the next movement from the right to the left carries the weft-thread along to again lay the doubled-up weft-thread in the open shed. The above-described operation is then repeated.
 60

It is understood that the several devices operate in unison to produce the desired result. It is further understood that whatever weft-thread A² or A³ is called for in the pattern is
 65 moved into an active position by the corresponding hook H or H' from a card of the jacquard. When it is desired to weave plain

goods, then the device shown in Fig. 9 is employed—that is, a single hook H or H' is only used, and each hook is drawn downward by
 70 a cam U², held on the cam-shaft U and engaging a lever V, connected with one end of the rope N.

By employing a spoolless shuttle and carrying the weft-threads to the shuttle from
 75 spools located outside and independent of the shuttle the weaver is enabled to control the weaving more accurately and the endless annoyances due to spools in shuttles as heretofore constructed are completely avoided.
 80

As any desired number of weft-threads can be employed on each side of the machine and interwoven with the warp, it is evident that any desired pattern can be produced in the
 85 weave. In fact, the loom can be readily adapted for doing any kind of weaving.

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

1. A loom having a spoolless shuttle provided with a retaining device for carrying the
 90 weft-thread through the open shed, the said retaining device being mounted to slide transversely in the shuttle-body, and provided with fulcrumed arms, as set forth.
 95

2. A loom having a spoolless shuttle, a retaining device for carrying a doubled-up weft-thread through the open shed one end of the
 100 weft-thread being held in the selvage of the weave, the said retaining device comprising a lug or button mounted to slide transversely in the shuttle-body, and provided with retaining-arms, and a guide-hook for guiding the weft-thread to the retaining device, as set forth.
 105

3. A loom having a spoolless shuttle, and a retaining device on the shuttle for engaging the loop of the doubled-up weft-thread to
 110 carry the latter through the open shed, the said retaining device comprising a lug mounted to slide and retaining-arms fulcrumed on the lug, as set forth.

4. A loom having a spoolless shuttle and means on the shuttle for engaging the loop
 115 of the doubled-up weft-thread to carry the latter through the open shed, one end of the doubled-up weft-thread being fixed in the edge of the weave, means externally of the shed for guiding the weft-thread to the shuttle, and controlled by the shuttle, a needle for
 120 engaging the loop of the doubled-up weft-thread as soon as the loop is cast off from the shuttle, and means controlled by the shuttle for moving the needle in position, as set forth.

5. A loom having a lay provided with a reed
 125 and shuttle-races, a spoolless shuttle mounted to travel in the shuttle-races and through the open shed, and a retaining device on the shuttle to engage the loop of the doubled-up weft-thread to carry the latter through the
 130 open shed, the said retaining device comprising a movable button or lug carried by the shuttle and provided with retaining-arms as set forth.

6. A loom having a lay provided with a reed and shuttle-races, a spoolless shuttle mounted to travel in the shuttle-races and through the open shed, a retaining device on the shuttle to engage the loop of the doubled-up weft-thread to carry the latter through the open shed, the said retaining device being provided with fulcrumed retaining-arms, one end of the doubled-up weft-thread being fixed in the edge of the weave, and means on the lay and moving with the same, for guiding the weft-thread to the retainer, as the shuttle advances and moves to the open shed, as set forth.

7. A loom having a spoolless shuttle and means on the shuttle for engaging the loop of the doubled-up weft-thread to carry the latter through the open shed, one end of the doubled-up weft-thread being fixed in the edge of the weave, means externally of the shed for guiding the weft-thread to the shuttle, a needle for engaging the loop of the doubled-up weft-thread as soon as the loop is cast off from the shuttle, the needle extending lengthwise of the weave, and means controlled by the shuttle for moving the needle in position after the shuttle has passed through the shed, as set forth.

8. A loom having a lay provided with a reed and shuttle-races, a spoolless shuttle mounted to travel in the said shuttle-races and through the open shed, a retainer mounted to slide in the shuttle and adapted to project therefrom to engage the loop of the doubled-up weft-thread to carry the latter through the open shed, the said retainer being provided with fulcrumed retaining-arms, and means for moving said retainer inward to release the loop as soon as the shuttle has passed through the shed, as set forth.

9. A loom having a lay provided with a reed and shuttle-races, a spoolless shuttle movable in the shuttle-races and through the open shed, a retainer on the said shuttle for receiving the loop of the doubled-up weft-thread, guide-hooks on the lay for guiding the corresponding weft-thread to the retainer, a needle on each side of the loom for engaging and disengaging the loop cast off from the retainer, means for actuating the said needles and controlled by the said shuttle, and means controlled by the shuttle for actuating the said guide-hooks, as set forth.

10. A loom having a lay, a spoolless shuttle having a loop-retainer, guide-hooks on the lay for guiding the weft-threads to the loop-retainer holding and releasing device for periodically holding and releasing the weft-threads, an unwinding device for unwinding each weft-thread from its spool at the time the said holding and releasing device releases its weft-thread, the said unwinding device being intermediate the said holder and the said guide-hooks, and comprising an eye through which the thread passes, rods on which the eye is mounted to slide vertically, and a spring for normally holding the eye in an uppermost position, and means for actu-

ating the holding device in unison with the movement of the lay, as set forth.

11. A loom having a lay, a spoolless shuttle having a loop-retainer, guide-hooks on the lay for guiding the weft-threads to the loop-retainer holding and releasing device for periodically holding and releasing the weft-threads, an unwinding device for unwinding each weft-thread from its spool at the time the said holding and releasing device releases its weft-thread, the said unwinding device being intermediate the said holder and the said guide-hooks, the said unwinding device comprising an eye mounted to slide and through which passes the weft-thread, guide-rods for the eye to slide in, and a spring for holding the eye normally in an uppermost position, as set forth.

12. A loom having a lay, a spoolless shuttle having a loop-retainer, guide-hooks on the lay for guiding the weft-threads to the loop-retainer holding and releasing device for periodically holding and releasing the weft-threads, an unwinding device for unwinding each weft-thread from its spool at the time the said holding and releasing device releases its weft-thread, the said unwinding device being intermediate the said holder and the said guide-hooks, and comprising an eye through which the thread passes, rods on which the eye is mounted to slide vertically, and a spring exerting tension on the eye in an upward direction, and means for actuating the said guide-hooks, as set forth.

13. A loom having a holding and releasing device for the weft-thread, means for periodically actuating the said device to alternately hold and release the weft-thread, an eye through which passes the weft-thread from the holding and releasing device, rods on which the eye is mounted to slide vertically, a spring exerting tension on the eye, and a guide-hook for guiding the weft-thread, from the said eye to the shuttle, as set forth.

14. A loom having a holding and releasing device for the weft-thread, means for periodically actuating the said device to alternately hold and release the weft-thread, a spring-pressed eye through which passes the weft-thread from the holding and releasing device, rods on which the said eye has vertical guided movement, a guide-hook for guiding the weft-thread from the said eye to the shuttle, and means for imparting movement to the said guide-hook to engage the weft-thread and bring the same in proper position at the entrance to the open shed for the shuttle to take hold of the weft-thread, as set forth.

15. A loom having a holding and releasing device for the weft-thread, means for periodically actuating the said device to alternately hold and release the weft-thread, a spring-pressed eye through which passes the weft-thread from the holding and releasing device, rods on which the eye is mounted to slide and a guide-hook for guiding the weft-thread from the said eye to the shuttle, the said

guide-hook being movable on the lay and arranged to bodily move with the same, as set forth.

16. A loom having a holding and releasing device for the weft-thread, means for periodically actuating the said device to alternately hold and release the weft-thread, a spring-pressed eye mounted to slide and through which passes the weft-thread from the holding and releasing device, a guide-hook for guiding the weft-thread from the said eye to the shuttle, the said guide-hook being movable on the lay and arranged to bodily move with the same, means for moving the guide-hook into an active position, means for locking the guide in this position, and a releasing device for the said locking means and controlled by the shuttle, as set forth.

17. A loom having a spoolless shuttle, a retaining device on said shuttle adapted to engage alternately loops on weft-threads arranged on opposite sides of the open shed, the said retaining device being provided with fulcrumed retaining-arms, and means for bringing the weft-threads in front for alternately engaging the retaining device with the weft-threads, as set forth.

18. A loom having a spoolless shuttle a retaining device on said shuttle adapted to engage alternately loops on weft-threads arranged on opposite sides of the open shed, the said retaining device being provided with fulcrumed retaining-arms, means for bringing the weft-threads in front for alternately engaging the retaining device with the weft-threads and means for casting the loops off the retaining device after the shuttle has passed through the open shed, as set forth.

19. A loom having a spoolless shuttle, a retaining device on said shuttle and adapted to engage alternately loops on weft-threads arranged on opposite sides of the open shed, the said retaining device being provided with retaining-arms, means for bringing the weft-threads in front for alternately engaging the retaining device with the weft-threads, means for casting the loops off the retaining device after the shuttle has passed through the open shed, and needles at the end of the open shed and adapted to receive the loops cast off from the retaining device, as set forth.

20. A loom having a spoolless shuttle, a retaining device carried by said shuttle and adapted to engage alternately loops on weft-threads arranged on opposite sides of the open shed, the said retaining device being provided with retaining-arms, means for bringing the weft-threads in front for alternately engaging the retaining device with the weft-threads, means for casting the loops off the retaining device after the shuttle has passed through the open shed, needles at the end of the open shed and adapted to receive the loops cast off from the retaining device, and means for moving the needles in and out of the path of the shuttle, as set forth.

21. A loom having a spoolless shuttle pro-

vided with a retaining device adapted to engage alternately loops on weft-threads arranged on opposite sides of the open shed, means for bringing the weft-threads in front for alternately engaging the retaining device with the weft-threads, means for casting the loops off the retaining device after the shuttle has passed through the open shed, needles at the end of the open shed and adapted to receive the loops cast off from the retaining device, and means for moving the needles in and out of the path of the shuttle, the said means being controlled by the shuttle, as set forth.

22. A loom having a lay, rods mounted to slide vertically in bearings carried by the lay, and guide-hooks carried by the rods and located at the ends of the open shed to alternately carry a weft-thread across the open shed, means for moving the rods to carry the guide-hooks into an active position, and means for locking the rods in this position, as set forth.

23. A loom having a lay, rods mounted to slide vertically in bearings carried by the lay, guide-hooks carried by the rods and located at the ends of the open shed to alternately carry a weft-thread across the open shed, and a shuttle movable on the lay and through the open shed to alternately take up the weft-threads held across the ends of the open shed by the said guide-hooks, means for moving the rods to carry the guide-hooks into an active position, means for locking the rods in this position, means controlled by the shuttle for releasing the rods, and springs for returning the rods to inactive position when released, as set forth.

24. A loom having a lay and guide-hooks mounted on the lay and having a sliding movement thereon, the guide-hooks being located at the ends of the open shed to alternately carry a weft-thread across the open shed, a shuttle movable on the lay and through the open shed to alternately take up the weft-threads held across the ends of the open shed by the said guide-hooks, means for moving the guide-hooks into an active position, means for locking the guide-hooks in this position, and means controlled by the shuttle for alternately unlocking the said locking means for releasing the guide-hooks, as set forth.

25. A loom having a lay, rods mounted to slide thereon, needles secured to said rods and located at the ends of the open shed to alternately receive loops from weft-threads passing through the shed alternately from opposite sides, springs pressing on said rods to normally hold the needles in an active position, levers for moving said rods against the tension of their springs, devices for locking the rods in the inactive position of the needles, levers adapted to engage said devices to move the same to release the rods, mechanism controlled by the movement of the shuttle for actuating the said levers and means for disengaging the said devices and

levers immediately after the rods are released to permit the said devices to return to locking position, as set forth.

26. A loom having a lay and needles mounted to slide thereon and located at the ends of the open shed to alternately receive loops from weft-threads passed through the shed alternately from opposite sides, a shuttle movable on the lay and through the open shed to alternately cast off the loops of the weft-threads for engagement by the said needles, levers for moving the needles into an inactive position, spring-pressed catches mounted to slide and adapted to lock the needles in an inactive position, spring devices carried by the said catches and adapted to be engaged to move the said catches against the tension of their springs, and mechanism controlled by the shuttle and adapted to engage said spring devices to move the catches, as set forth.

27. A loom having a lay, rods mounted to slide thereon, needles carried by said rods and located at the ends of the open shed to alternately receive loops from weft-threads passed through the shed alternately from opposite sides, a shuttle movable on the lay and through the open shed to alternately cast off the loops of the weft-threads for engagement by the said needles, spring-pressed levers provided with spring-catches for engaging and moving the rods to carry the needles into an inactive rearward position, adjustable stops against which the ends of said levers are adapted to bear, springs for moving the rods to carry the needles forward into an active position, and spring-catches controlled by the said shuttle for locking the needles in an inactive position, as set forth.

28. A loom having a lay and needles mounted to slide thereon and located at the ends of the open shed to alternately receive loops from weft-threads passed through the shed alternately from opposite sides, and a shuttle movable on the lay and through the open shed to alternately cast off the loops of the weft-threads for engagement by the said needles, springs for forcing the needles into an active position, levers for moving the needles rearward against the tension of their springs, locking devices for holding the needles in their rearward positions, and means controlled by the said shuttle for unlocking the locking devices, as set forth.

29. A loom provided with a lay having shuttle-races, a spoolless shuttle adapted to pass alternately into the said shuttle-races, a spring-pressed lug slidable transversely in the shuttle, levers extending lengthwise in the shuttle and fulcrumed at one end, the inner or free ends of said levers engaging the inner end of the lug, projections on the levers near their fulcrum ends, and means in the shuttle-races for engaging the said projections, as set forth.

30. A loom provided with a lay having shuttle-races, a spoolless shuttle adapted to pass

alternately into the said shuttle-races, a spring-pressed lug slidable in the shuttle, means in the shuttle and shuttle-races for pressing the lug rearward against its spring, and retaining-arms on the said lug, adapted to open on the rearward movement to release the loop from the lug, as set forth.

31. A loom provided with a lay having shuttle-races, a spoolless shuttle adapted to pass alternately into the said shuttle-races, a spring-pressed lug slidable in the shuttle, a means in the shuttle and shuttle-races for pressing the lug rearward against the spring, the said means consisting of levers fulcrumed in the shuttle and engaging the lug and springs in the shuttle-races for engaging the levers, as set forth.

32. A loom provided with a lay having shuttle-races, a spoolless shuttle adapted to pass alternately into the said shuttle-races, a spring-pressed lug slidable in the shuttle, means in the shuttle and shuttle-races for pressing the lug rearward against its spring, retaining-arms on the said lug, adapted to open on the rearward movement to release the loop from the lug, and a fixed pin in the shuttle for engaging the said arms to open the same, as set forth.

33. A loom having a lay, a rod mounted to slide vertically in bearings carried by the lay, a guide-hook carried by the rod for guiding the weft-thread, a shuttle movable on the lay to take up the weft-thread from said guide-hook, means for normally holding the rod in the uppermost or inactive position, means for moving the rod to the lowermost or active position, means for locking the rod in the active position, and means controlled by the shuttle for releasing the rod, as set forth.

34. A loom having a lay, a shuttle movable on the lay, a needle mounted on the lay and adapted to receive the loop cast off from the shuttle, a rod carrying said needle, a casing in which the rod slides, a lug on said rod and extending through a slot in the casing, a spring engaging said rod to normally hold the needle in active position, a lever fulcrumed on the casing and having a spring-catch at one end adapted to engage said lug to move said rod against the tension of the spring to carry the needle to an inactive position, a stop against which the other end of said lever is adapted to bear, means for locking the rod to hold the needle in the inactive position and means controlled by the shuttle for moving the locking device to release the said rod, as set forth.

35. A loom having a holding and releasing device, comprising a support for the spool, a frame connected with said support, eyes located one above the other in said frame and through which the thread passes from the spool, a curved spring held in said frame and adapted to press the weft-thread against the side of the frame, means for moving said spring to periodically clamp and release the thread, a spring-controlled device mounted to slide and through which the thread passes

from the holding and releasing device, and means for guiding the thread from said device to the shuttle, as set forth.

36. A loom having a lay, a shuttle movable
5 on the lay and having a retaining device for the weft-thread, a guide-hook for guiding the weft-thread to the retaining device, a needle for engaging and disengaging the weft-thread
10 cast off from the retaining device, a holding and releasing device for the weft-thread, means for taking up the slack of the thread, means for actuating the needle and controlled by the shuttle, means for moving the guide-hook into active position, a spring-catch for
15 holding the guide-hook in this position, a lever for releasing the catch, and means controlled by the shuttle for actuating said lever, as set forth.

37. A loom having a lay a shuttle movable
20 on the lay a needle mounted on the lay and adapted to receive the loop cast off from the shuttle, a rod mounted to slide and carrying said needle, a projecting lug on said rod, a spring normally holding the rod with the needle
25 in active position, a lever adapted to engage said lug to move the rod against the tension of the spring, a spring-catch for locking the rod in said position, a lever adapted to engage and move the spring-catch to release the
30 rod, means controlled by the shuttle for actuating the said lever, and means for releasing the spring-catch from the said lever, as set forth.

38. A loom having a lay, a rod mounted to
35 slide vertically in bearings carried by the lay, a guide-hook carried by the rod for guiding the weft-thread, a shuttle movable on the lay to take up the weft-thread from said guide-hook, a spring for normally holding the rod in
40 the uppermost or inactive position, means for moving the rod to the lowermost or active po-

sition, a spring-catch for locking the rod in the active position, a spring-pressed lever adapted to engage and move the said catch to release the rod, and means controlled by the
45 shuttle for moving the said lever, as set forth.

39. A loom having a lay, a shuttle movable on the lay, a needle mounted to slide on the lay and adapted to receive the loop cast off from the shuttle, means for moving the needle
50 into an inactive position, means for moving the needle into an active position, a device for locking the needle in an inactive position, a lever for releasing said locking device, and a spring-pressed lever fulcrumed on the race-
55 way and controlled by the shuttle, the said lever being adapted when actuated, to impart a swinging motion to the first-mentioned lever, as set forth.

40. A loom having a lay provided with a shut-
60 tle raceway, a guide for guiding the thread, a shuttle for taking up the thread from the guide, means for engaging the thread with the shuttle and disengaging it therefrom, a needle for engaging and disengaging the
65 thread cast off from the shuttle, a lever projecting into the raceway, and adapted to be engaged by the shuttle to swing the lever outward, mechanism actuated by the said lever for controlling the guide, a spring-pressed le-
70 ver fulcrumed on the raceway and resting at one end on the first-mentioned lever, and mechanism actuated from said spring-pressed lever for controlling the needle, as set forth.

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

ERNEST VAHLE.

Witnesses:

JULIUS VOLCKHAUSEN,
CHRIST KLASSEN.