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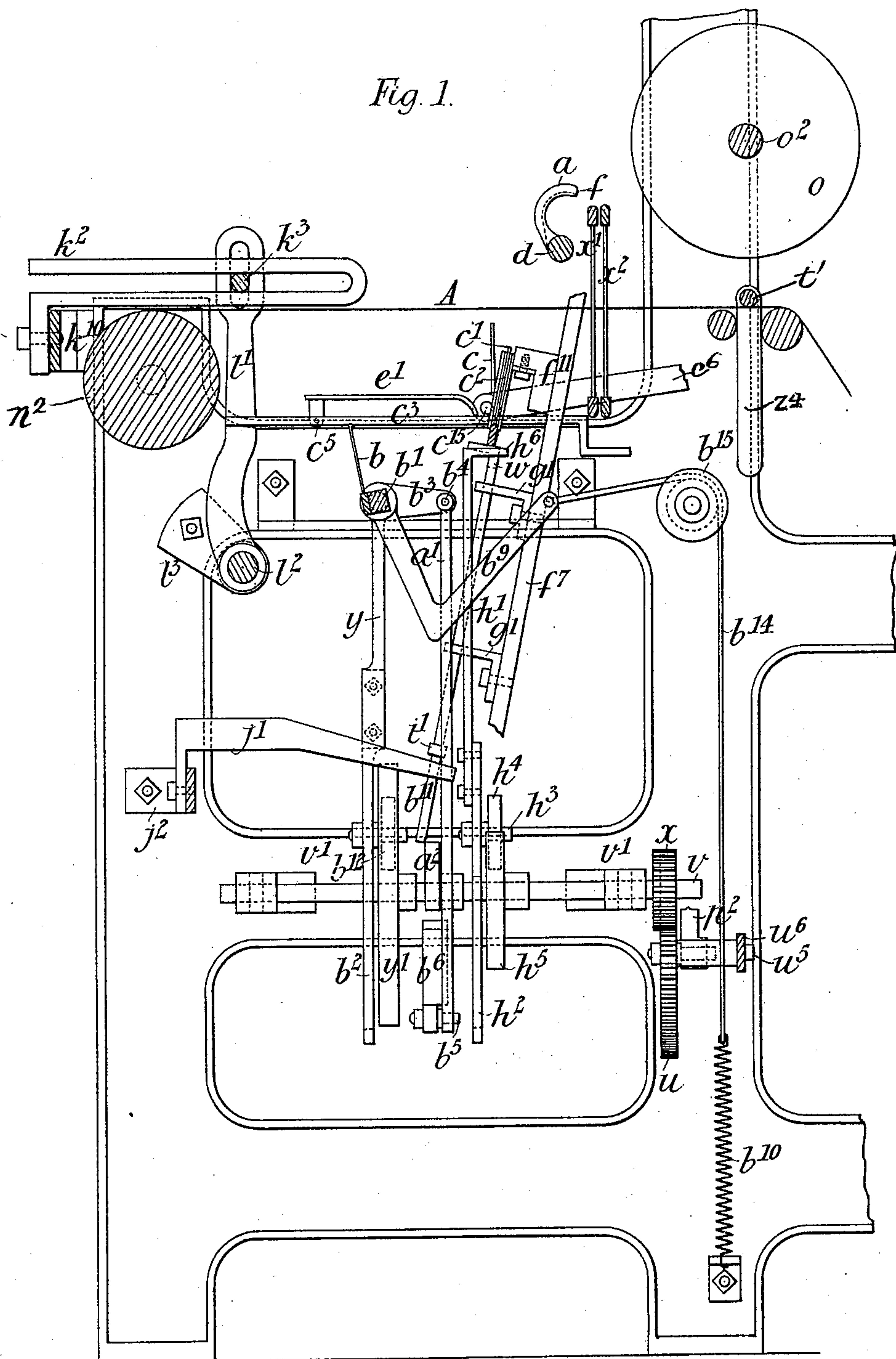
26 Sheets—Sheet 1.

A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

Fig. 1.



Witnesses.  
Walter O. Shell.  
John Cullen

Inventor.  
Antoine Siret.  
John J. Halsted & Son  
his atty's



(No Model.)

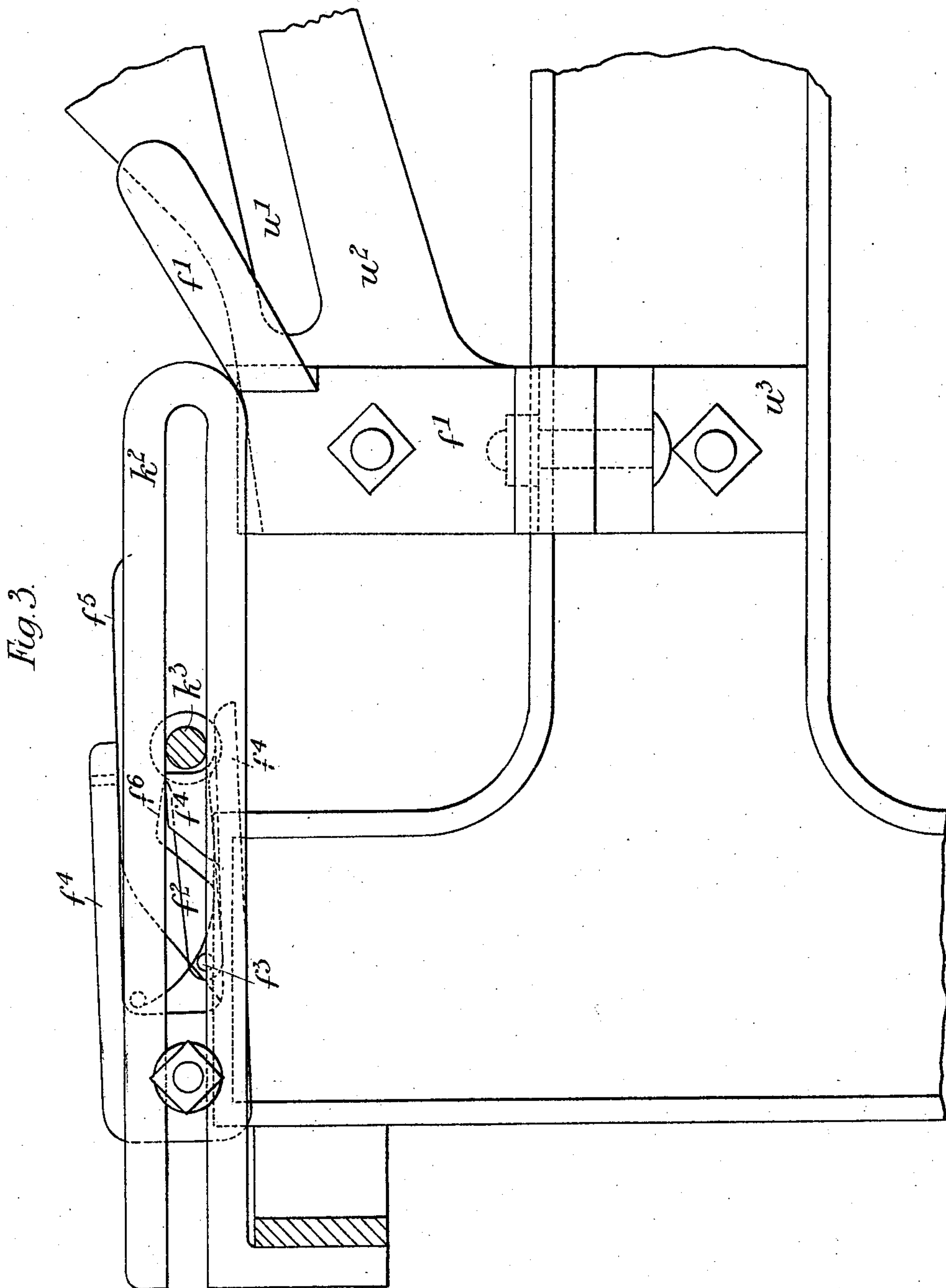
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A. SIRET.

# LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.



Witnesses.  
 Walter P. Abell,  
 John Bullen

Inventor.  
Antoine Loret  
By  
John J. Keated & son  
his Attys

(No Model.)

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A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

Fig. 4.

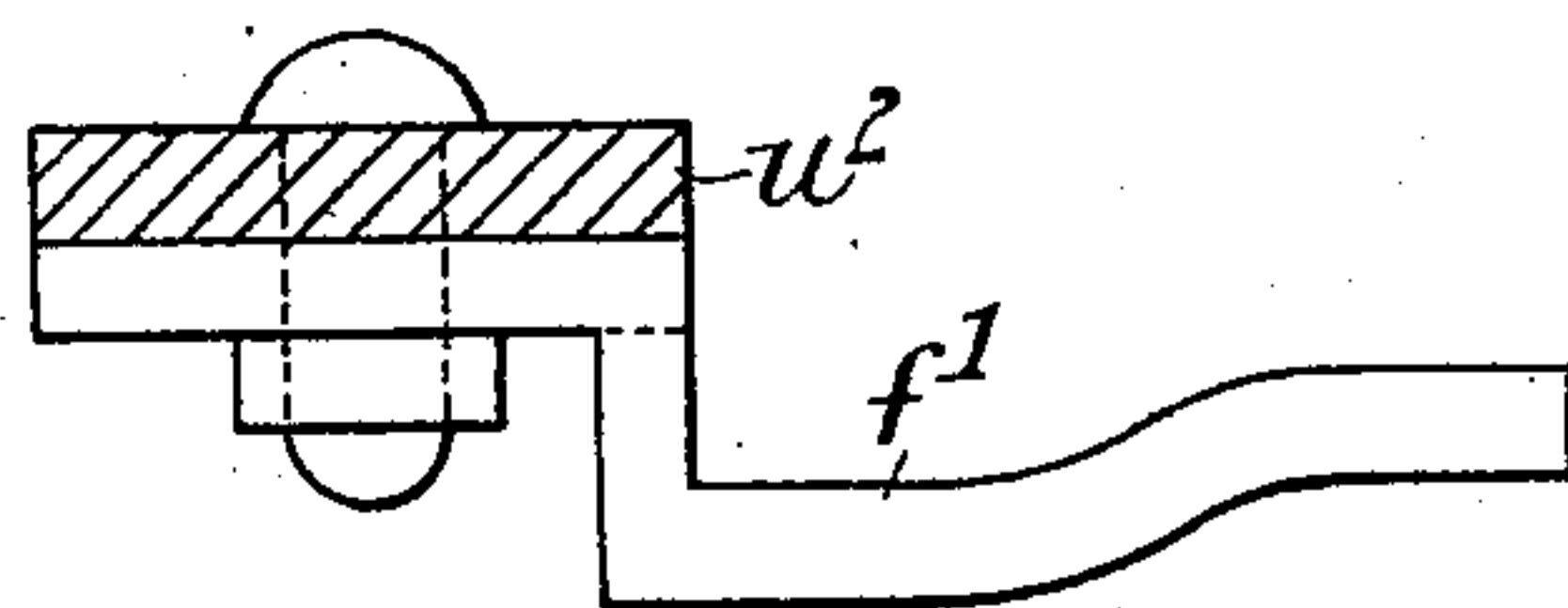


Fig. 4<sup>A</sup>

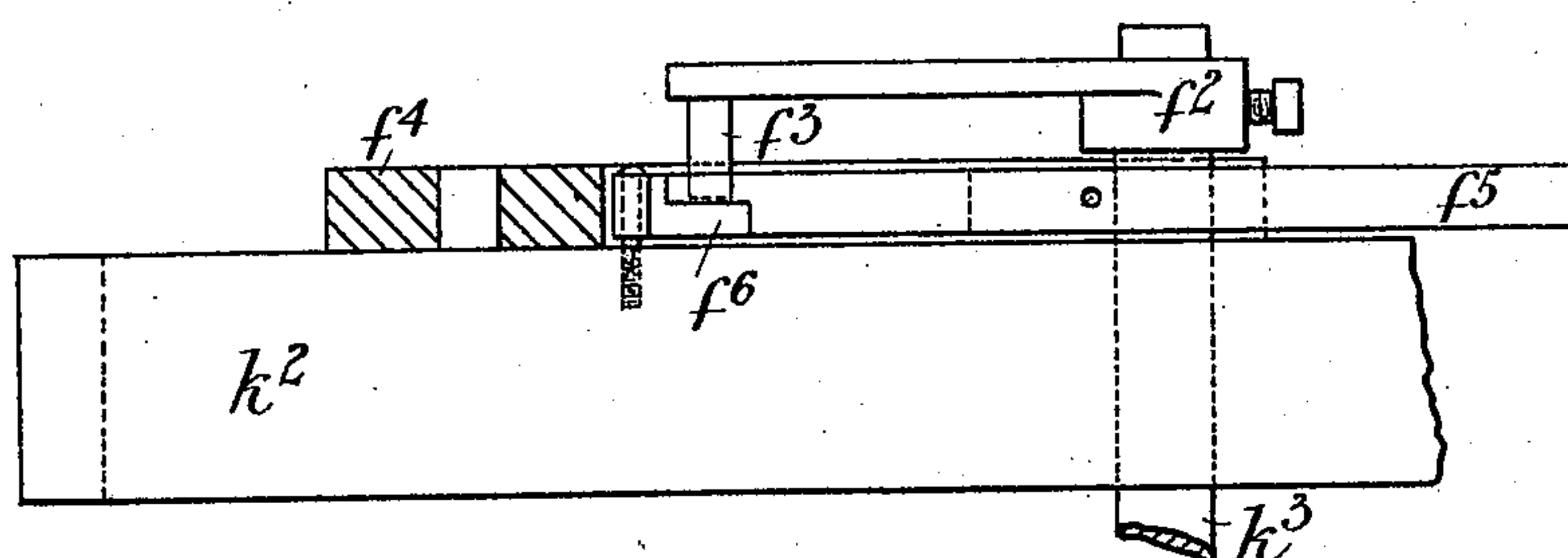
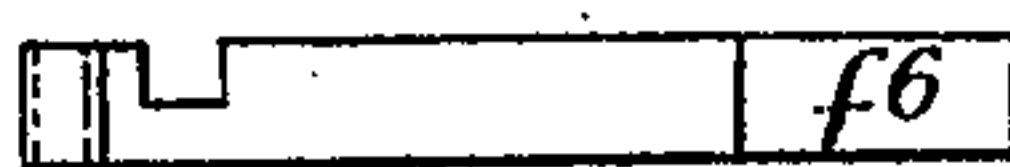


Fig. 4<sup>B</sup>



Fig. 5.



Witnesses.  
Walter P. Abell.  
John Bullen

Inventor:  
Antoine Siret  
By  
John J. Halsted & Son  
His Attys



(No Model.)

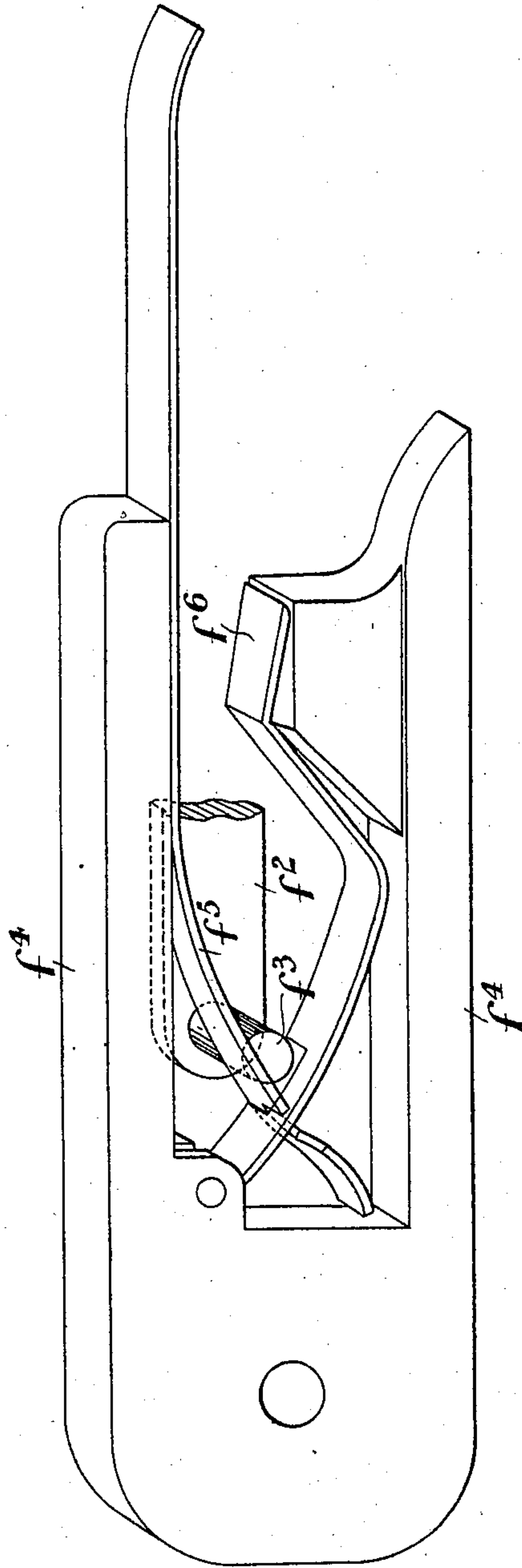
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No. 582,398.

Patented May 11, 1897.

Fig. 5a



Witnesses

Yam S. Rohu.  
J. F. Beale.

Inventor

Antoine Siret.  
By John Haldes for  
his Attorneys.

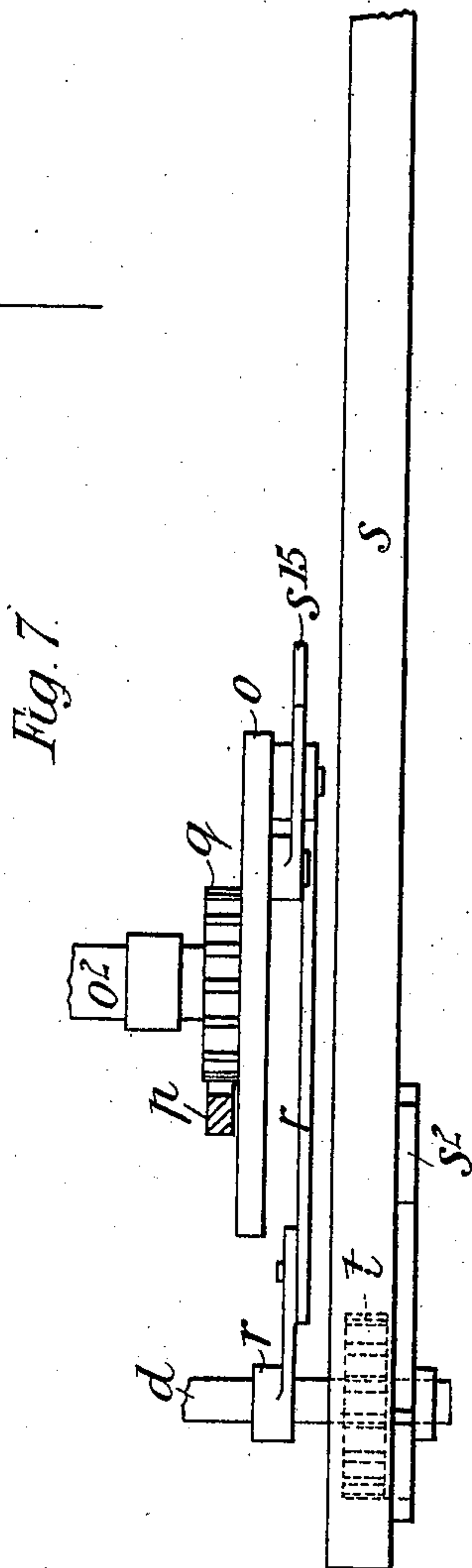
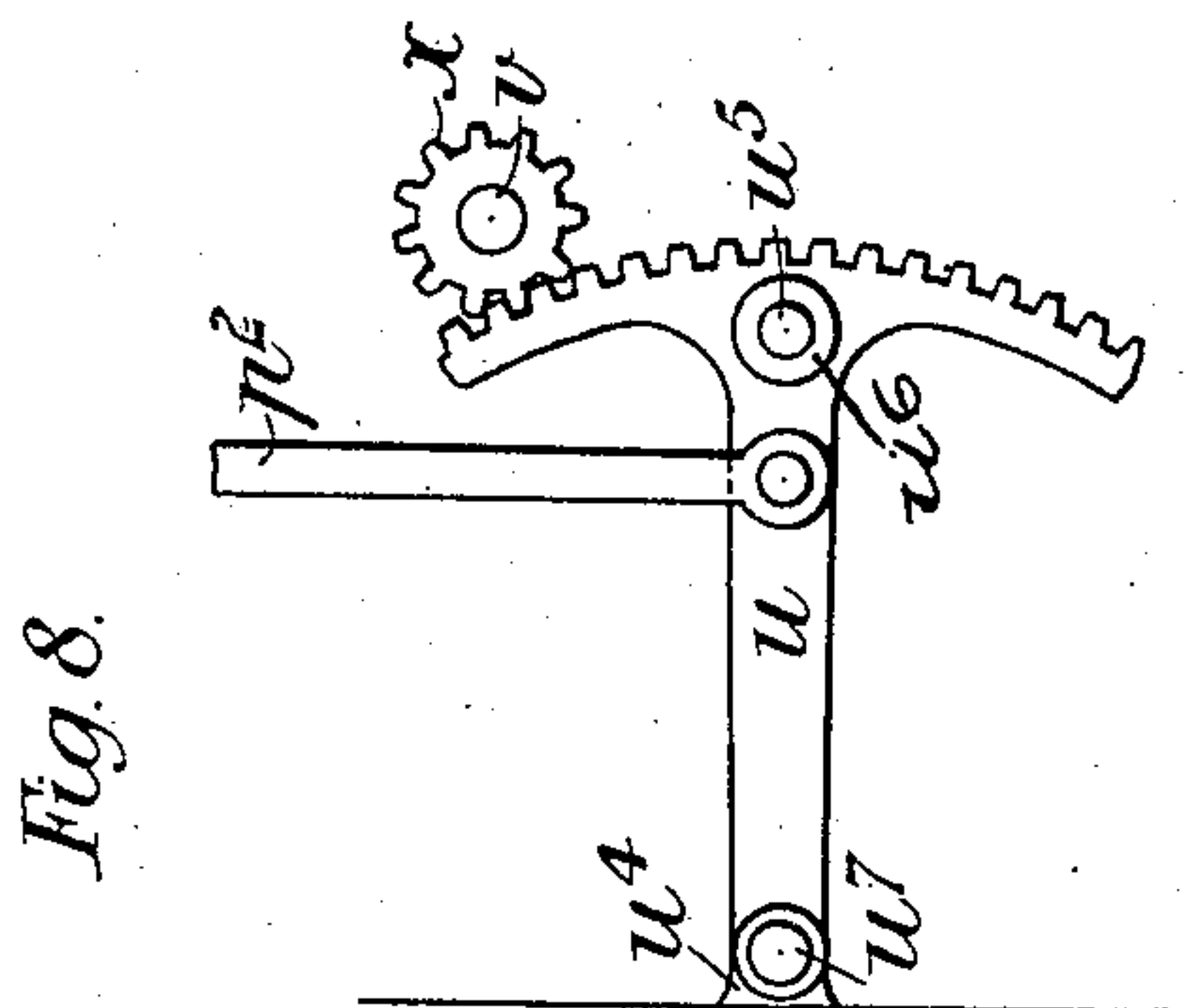
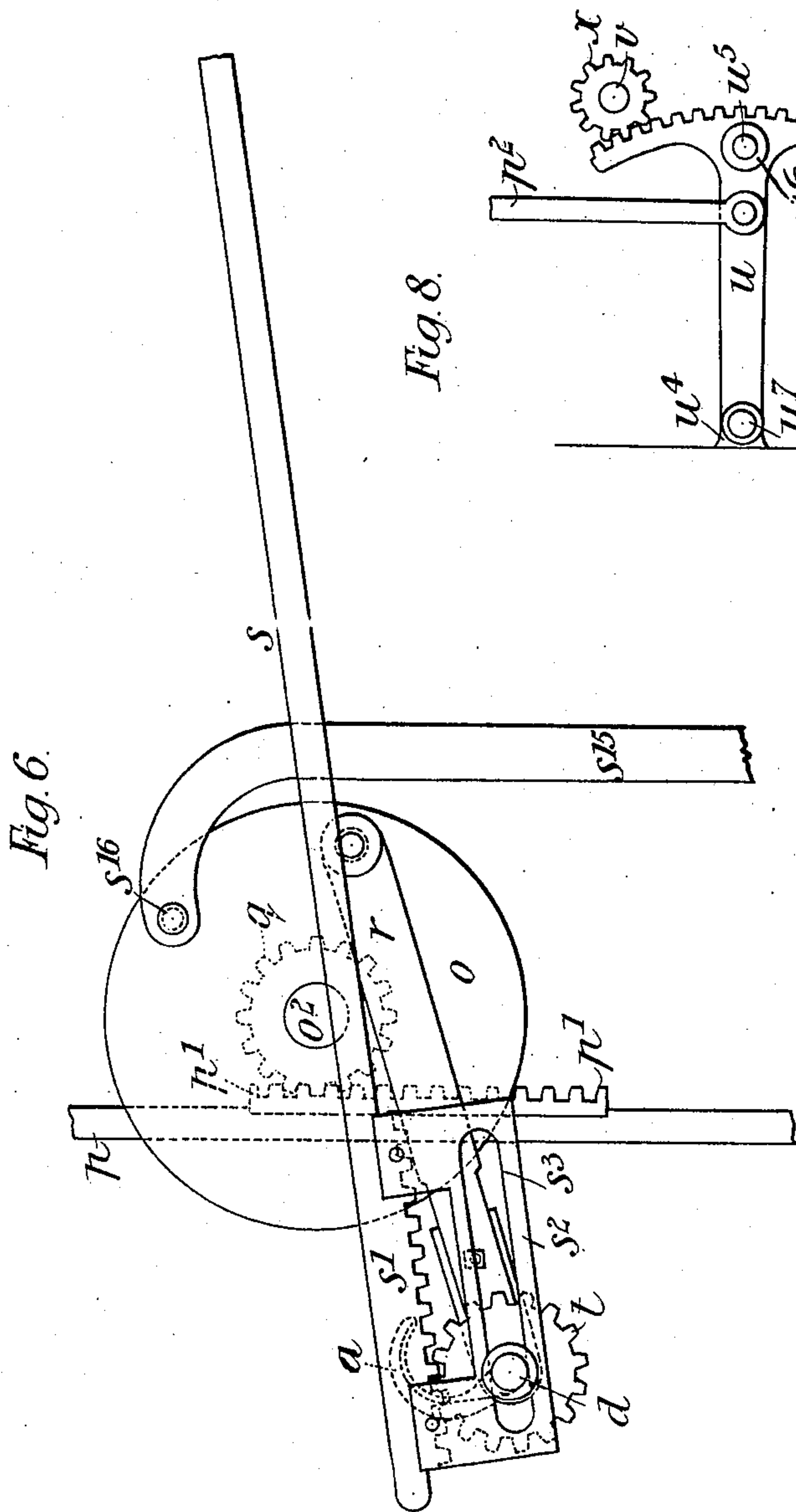
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LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.



Witnesses.  
Walter P. Abell.  
John Cullen

Inventor.  
Antoine Siret.  
By  
John J. Halsted & Son  
his Attys

(No Model.)

26 Sheets—Sheet 7.

A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

Fig. 9.

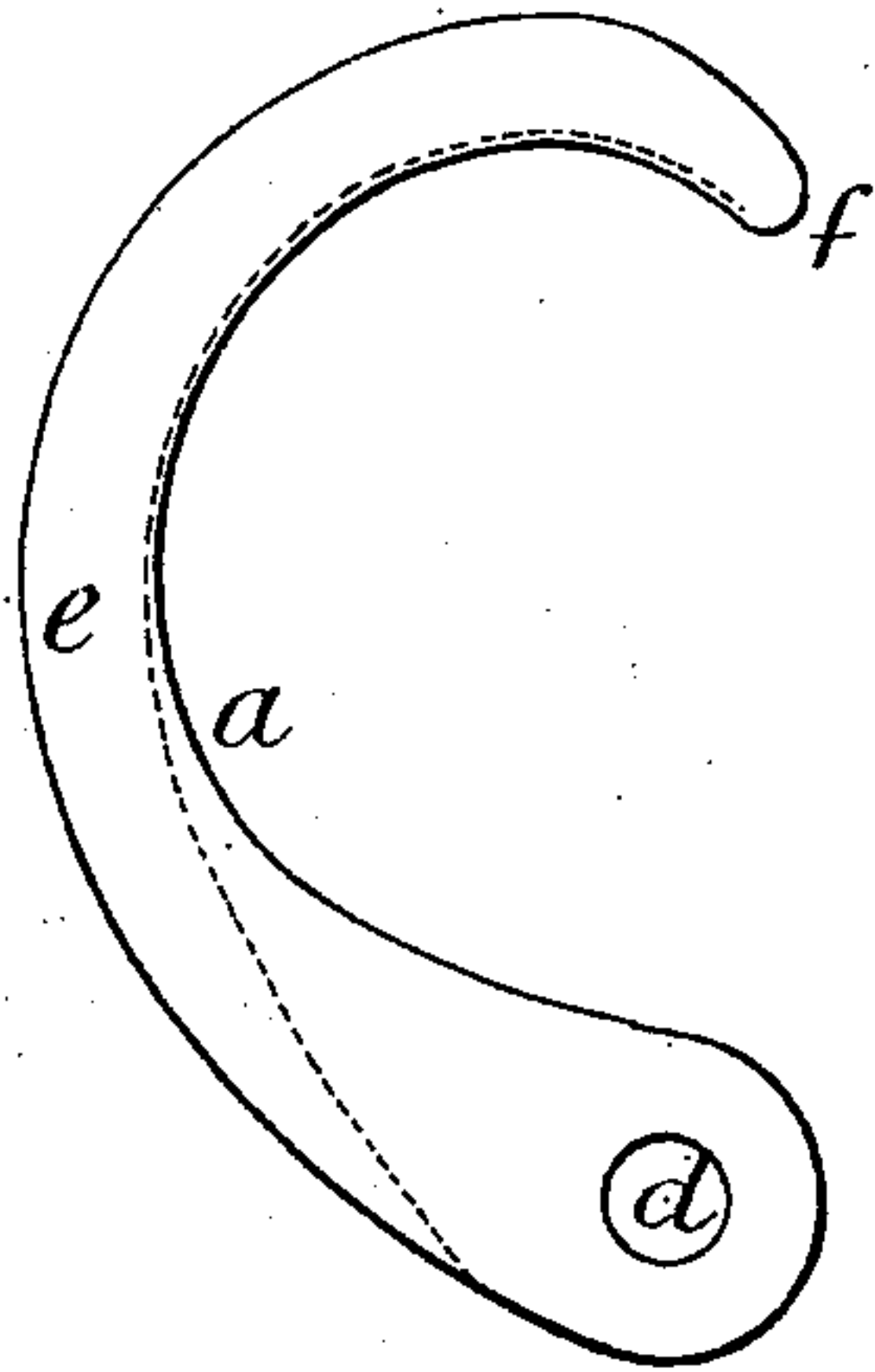


Fig. 10.



Fig. 11.

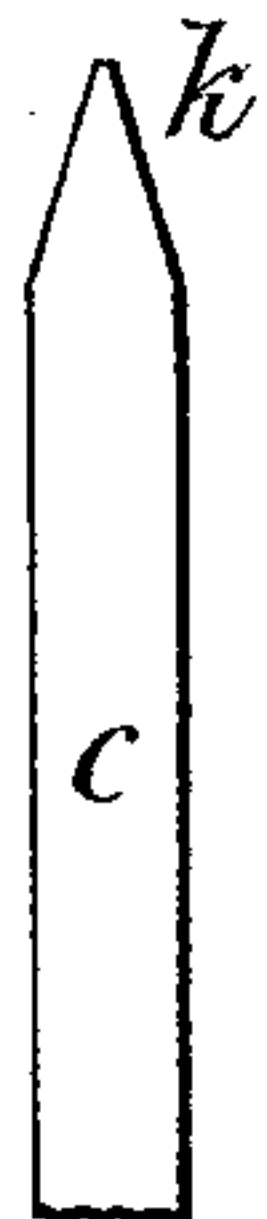


Fig. 12.



Fig. 13.

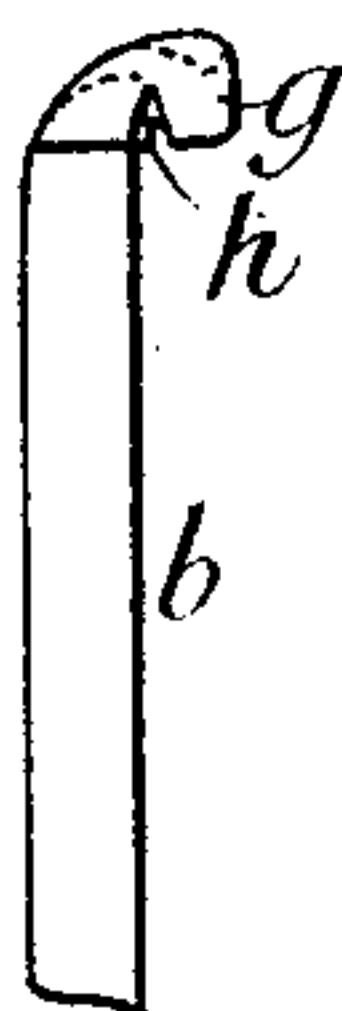


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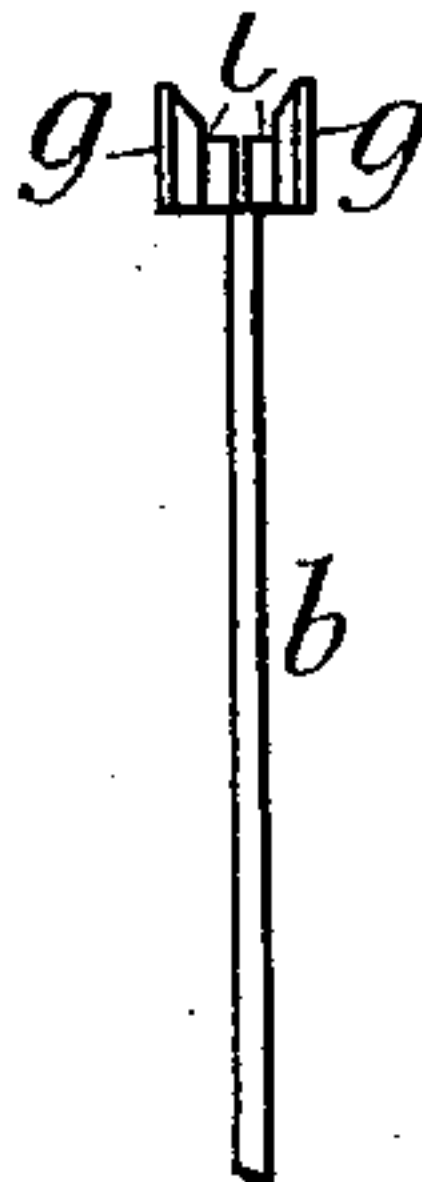


Fig. 15.



Witnesses.  
Walter P. Bell.  
John Cullen

Inventor:  
Antoine Siret  
By  
John J. Halsted & Co.  
his Attys.

A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

Fig. 16.

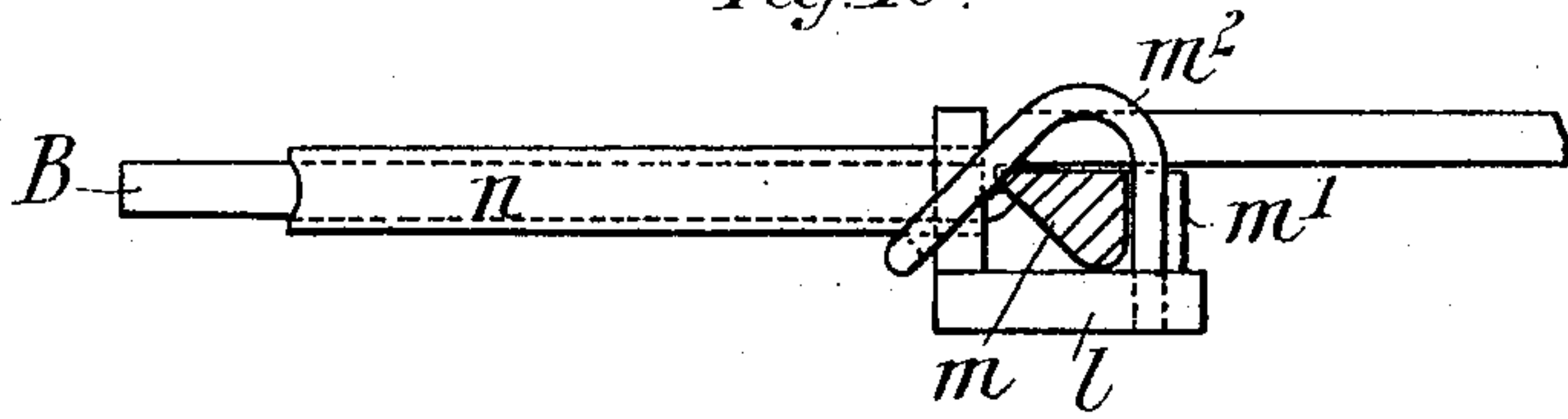


Fig. 16<sup>A</sup>

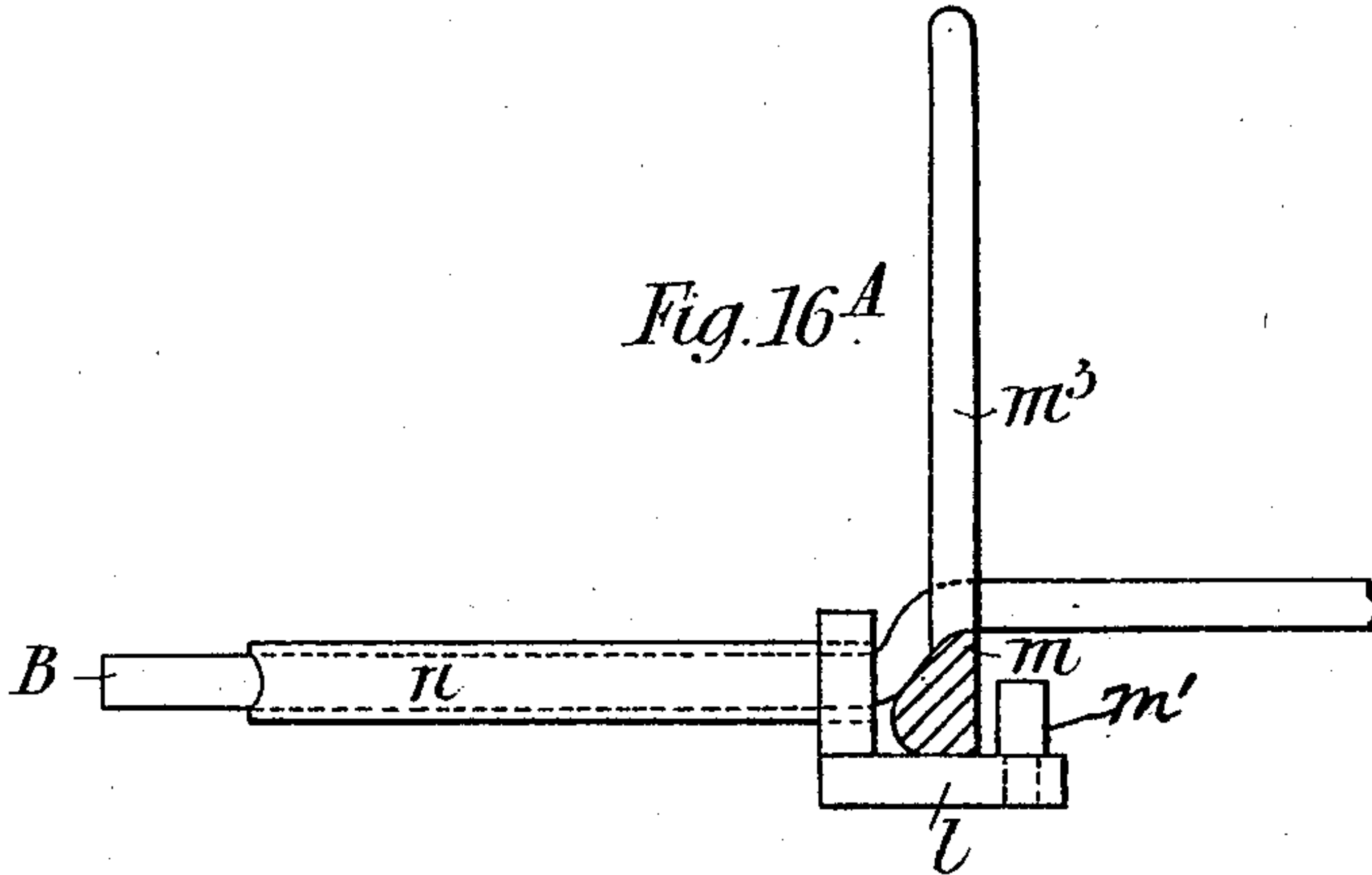


Fig. 17.

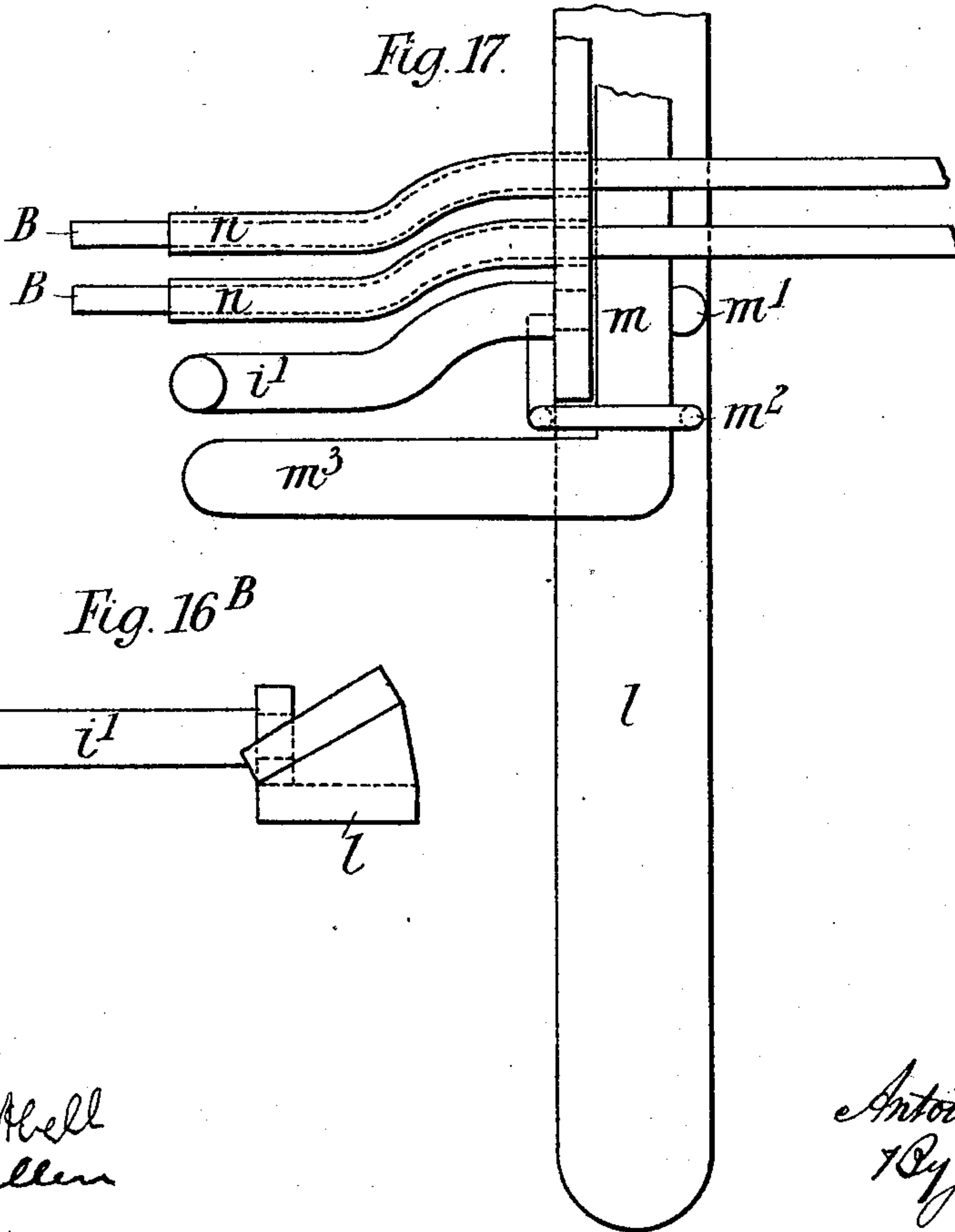
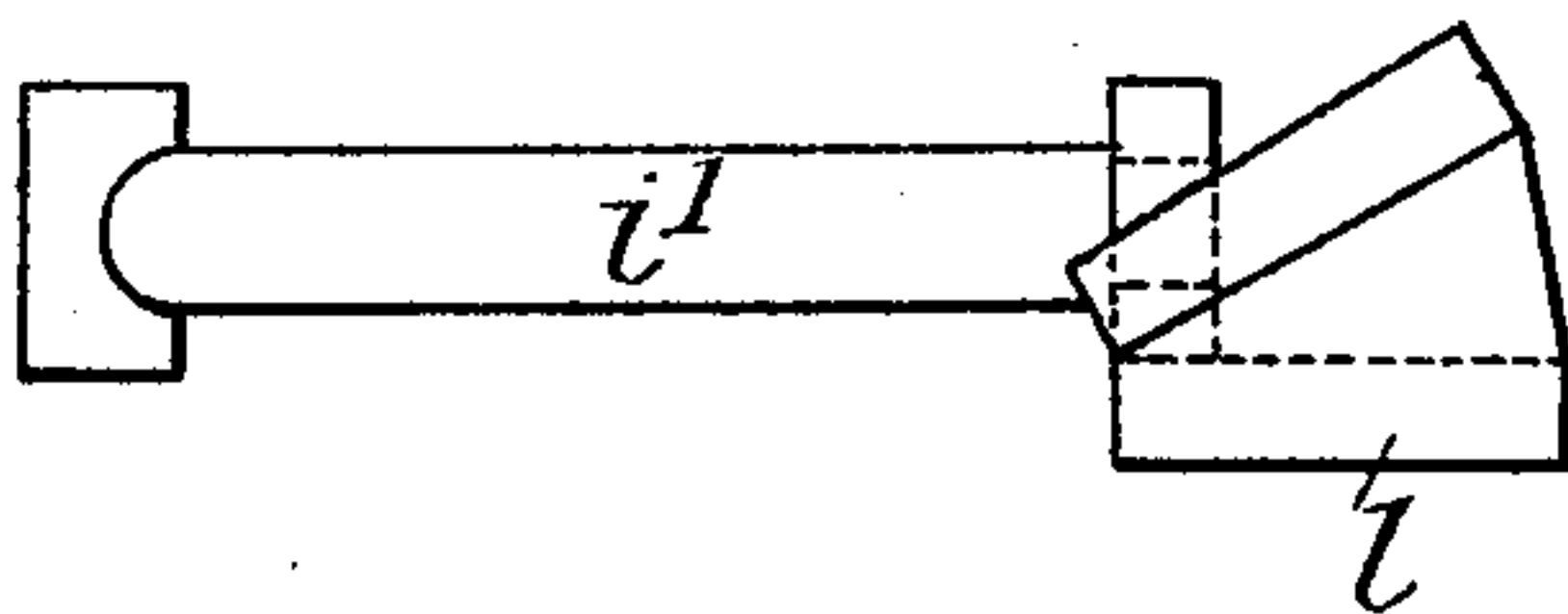


Fig. 16<sup>B</sup>



Witnesses:  
Walter P. Abell  
John Cullen

Inventor:  
Antoine Siret  
By John F. Hallett & Son  
his Attys



A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

Fig. 19.

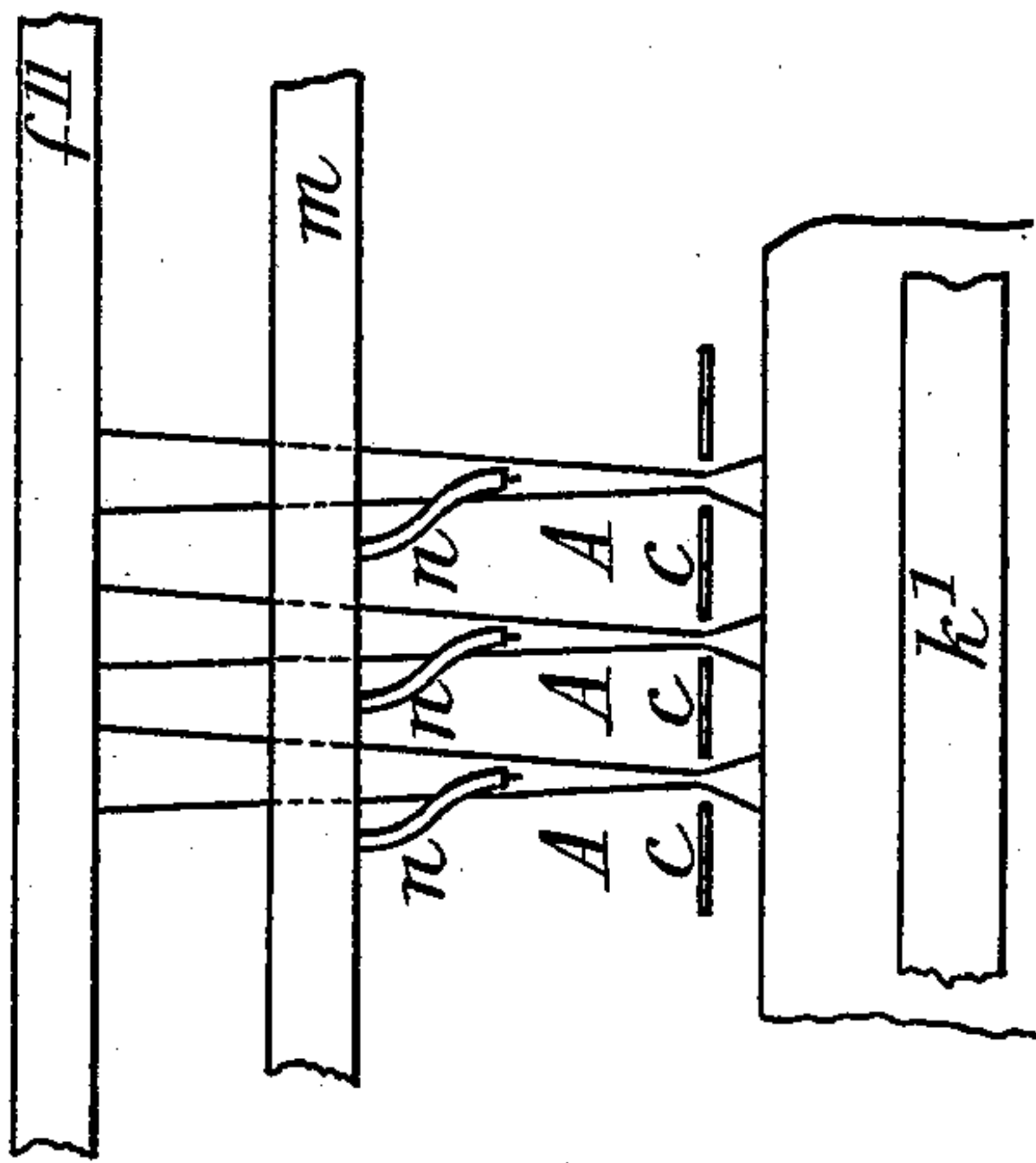


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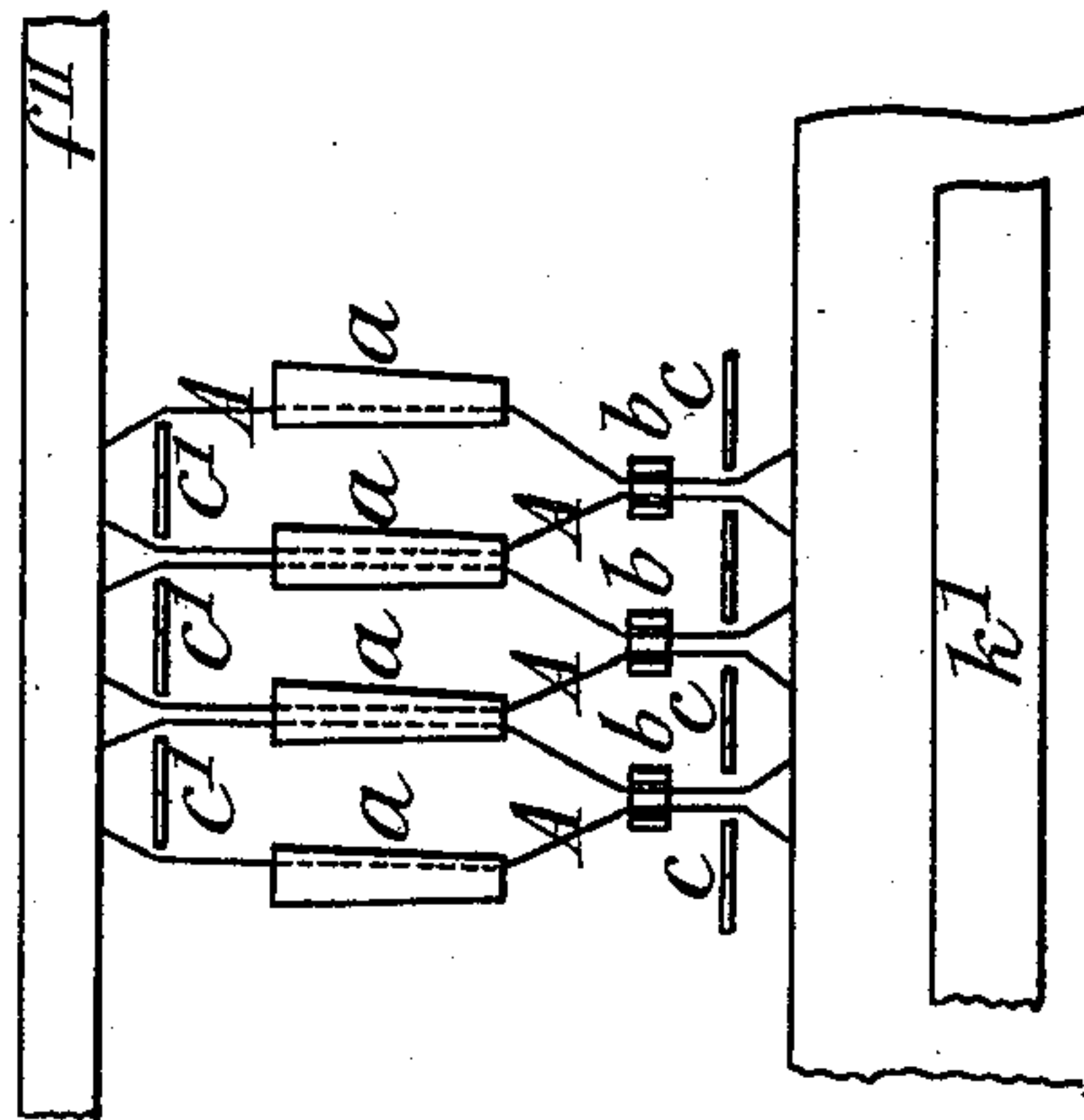


Fig. 18.

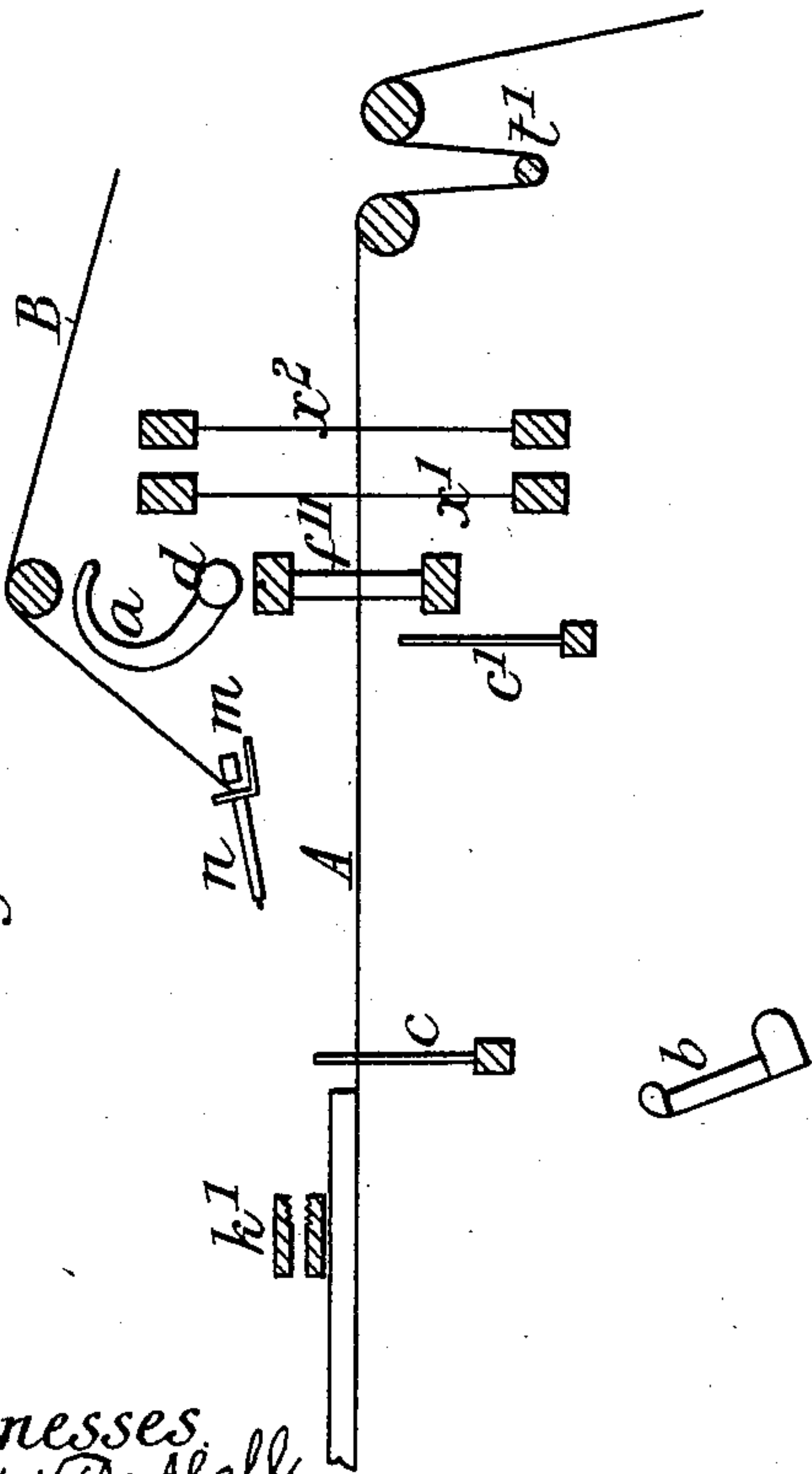
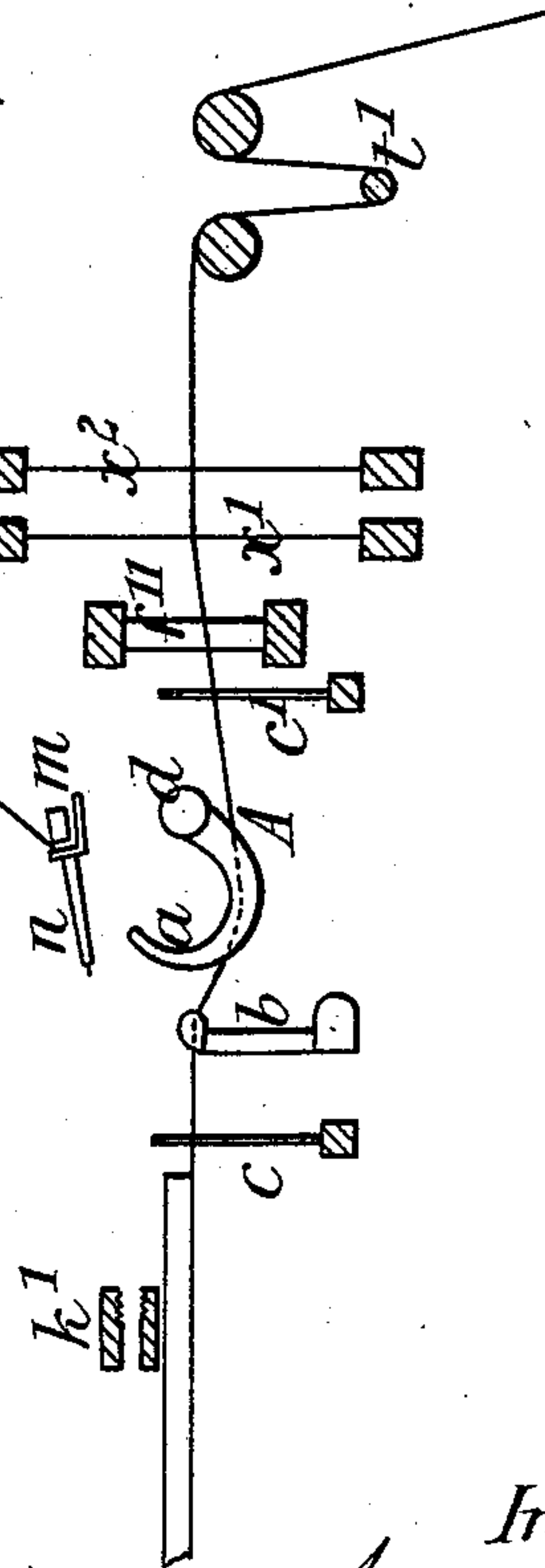


Fig. 20.



Witnesses  
Walter P. Abell.  
John Cullen

Inventor.  
Antoine Siret  
By  
John J. Husted for  
his atty's

A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

Fig. 23.

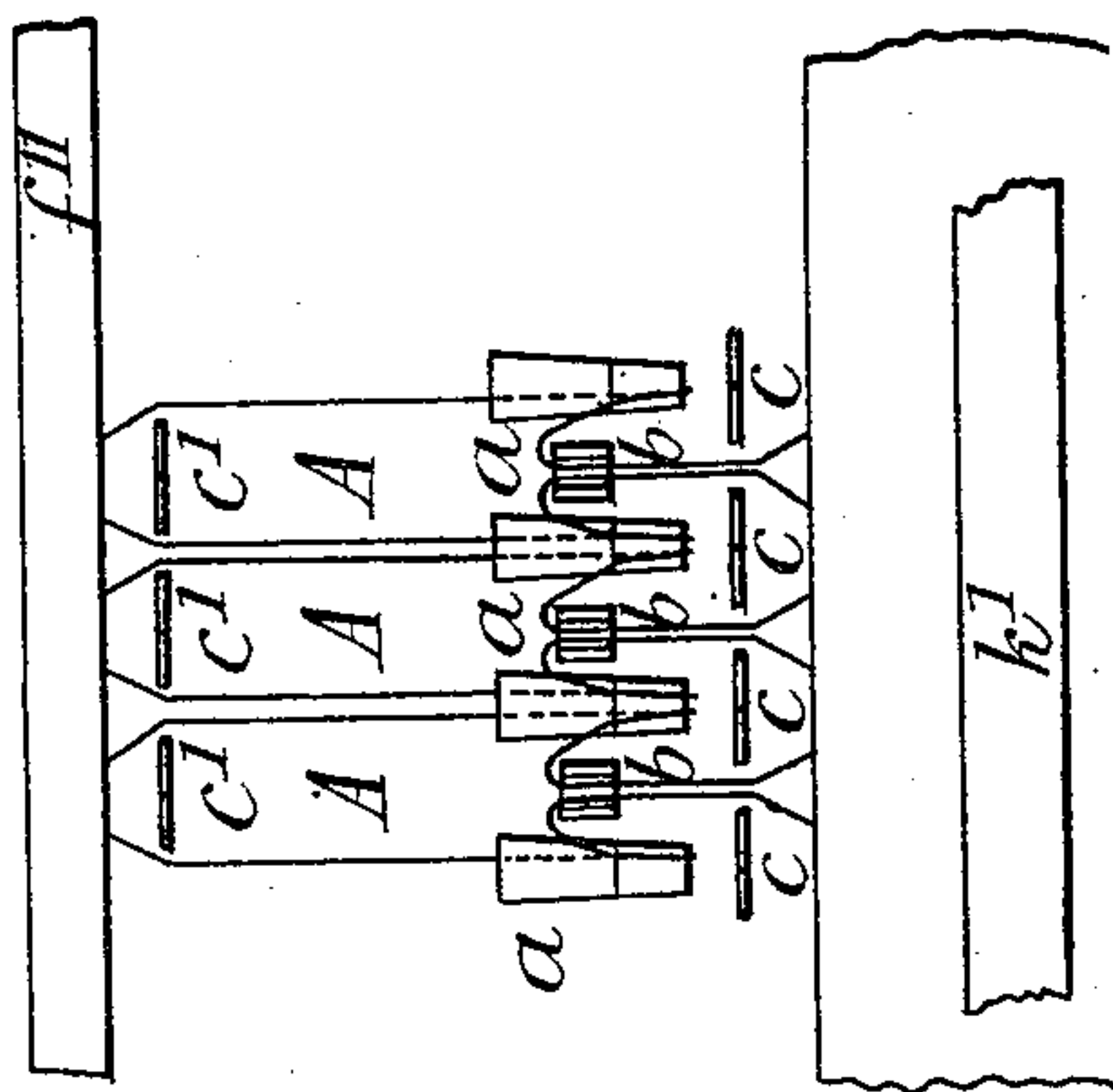


Fig. 25.

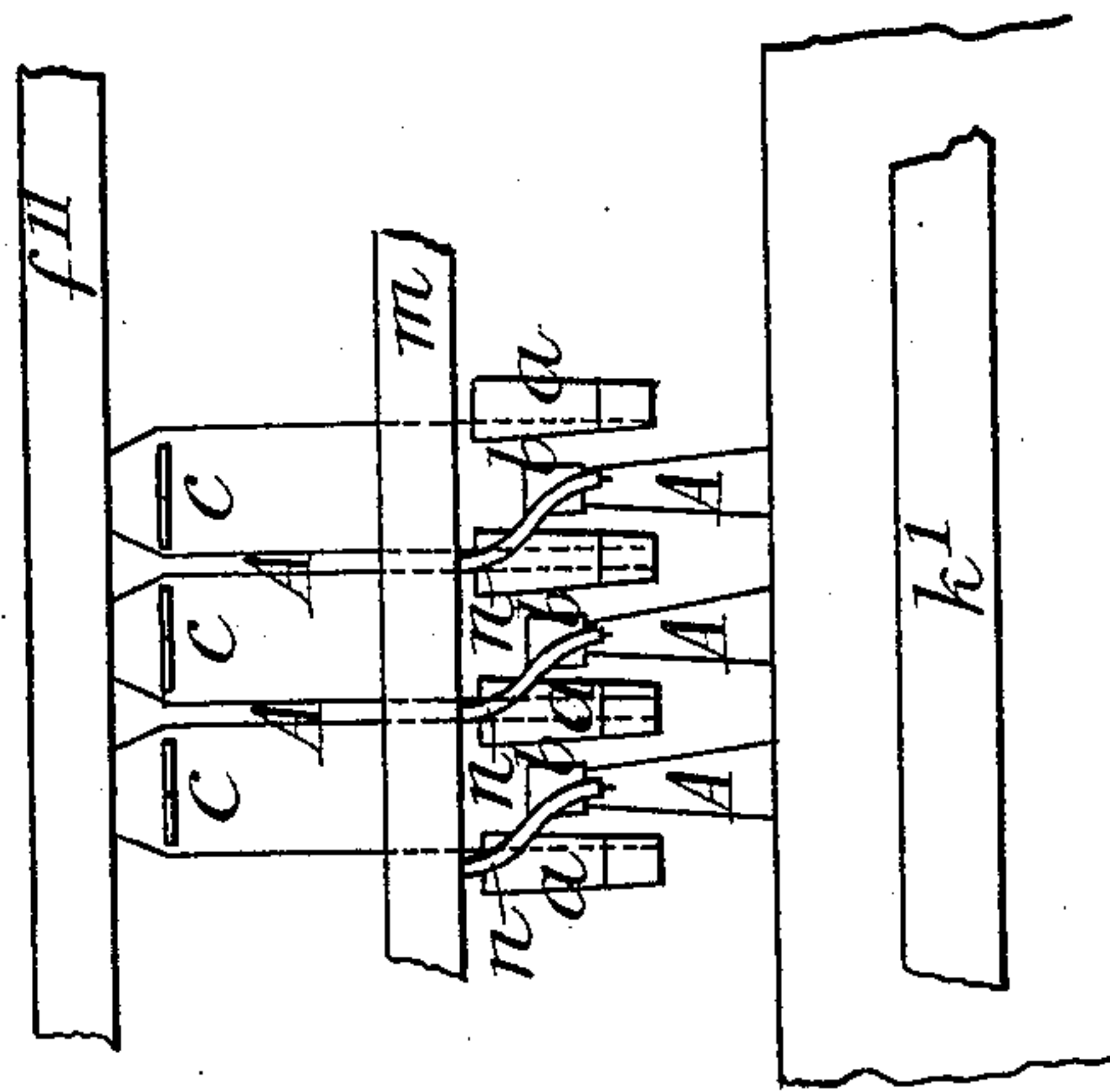


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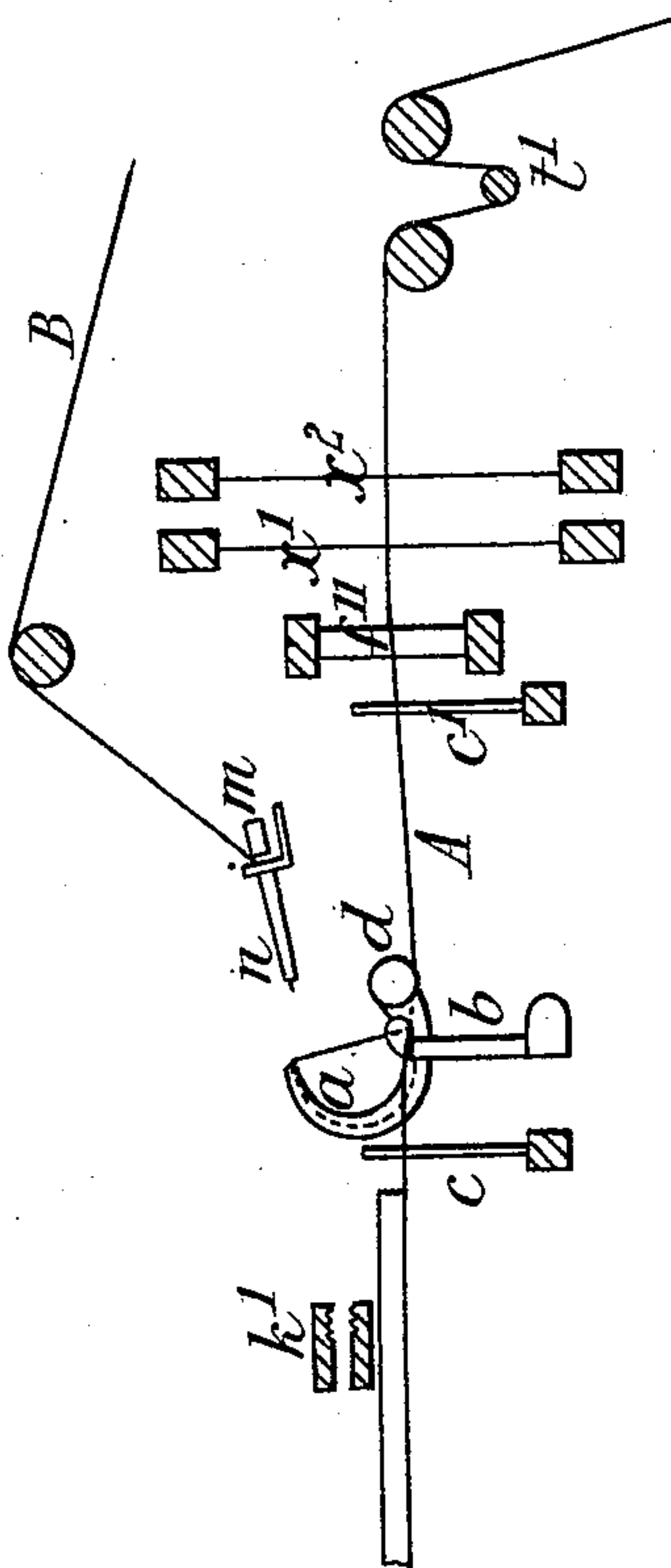
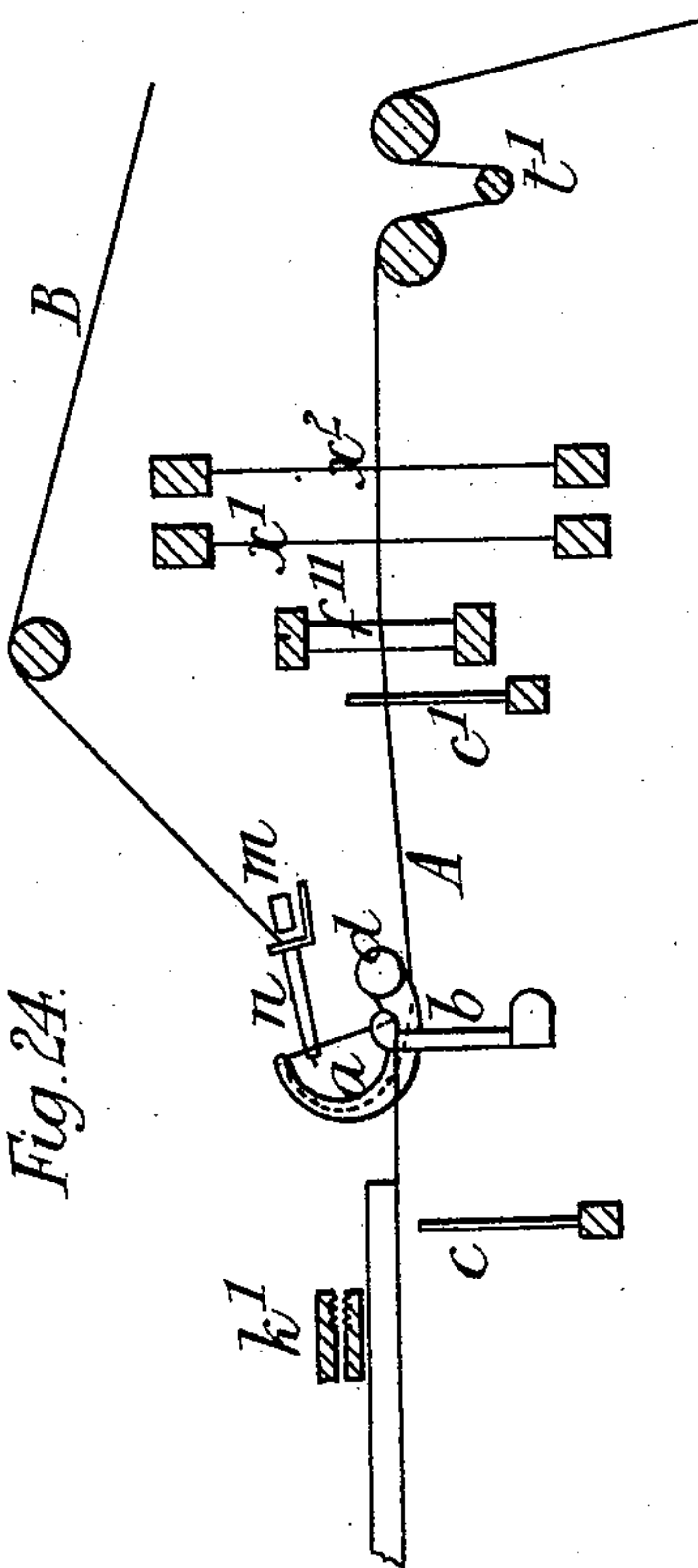


Fig. 24.



Witnesses.  
Walter P. Abell.  
John Cullen

Inventor.  
Antoine Siret.  
By John J. Hausted for  
his Atty's

(No Model.)

26 Sheets—Sheet 11.

A. SIRET.

## LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

Fig. 27.

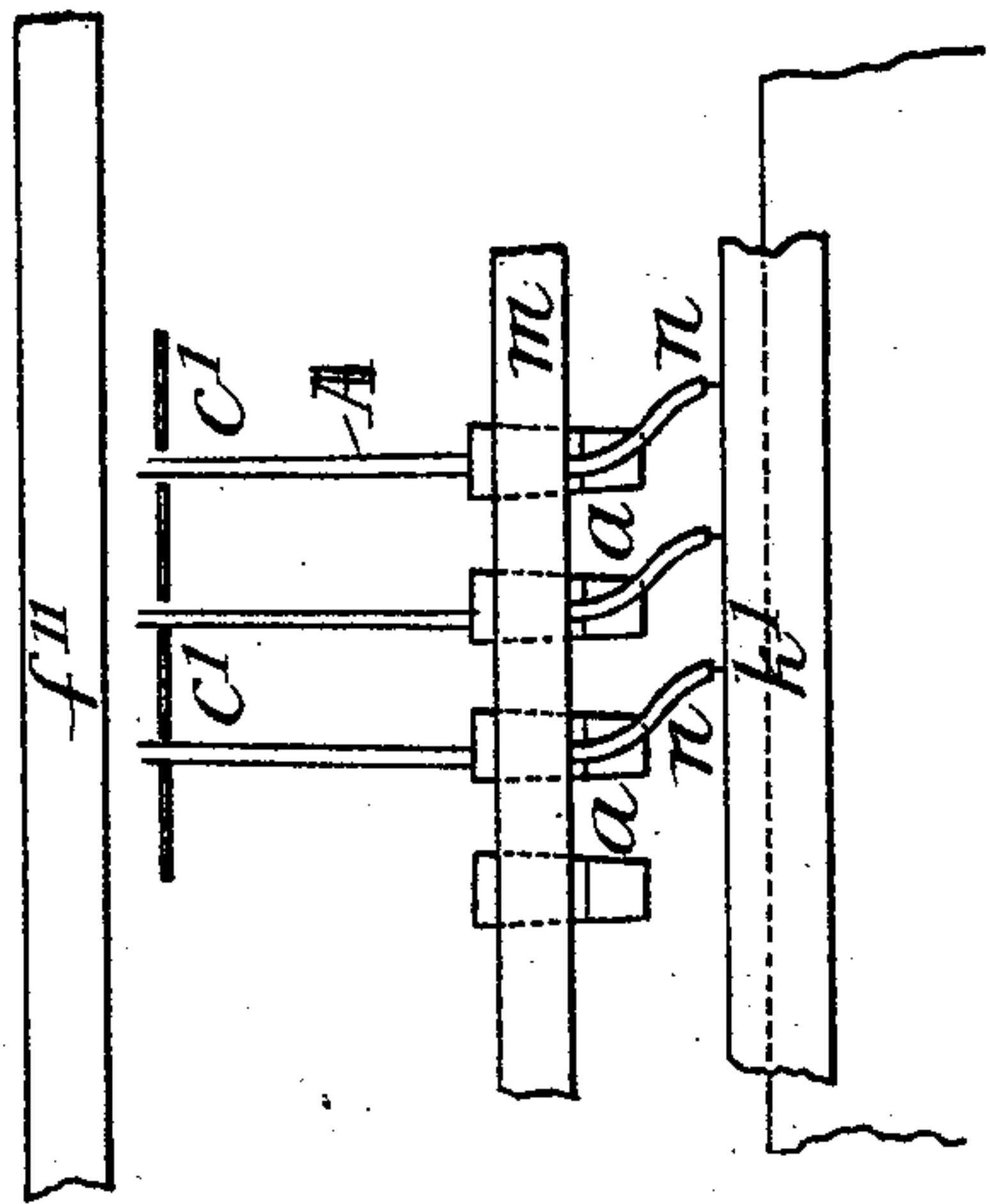
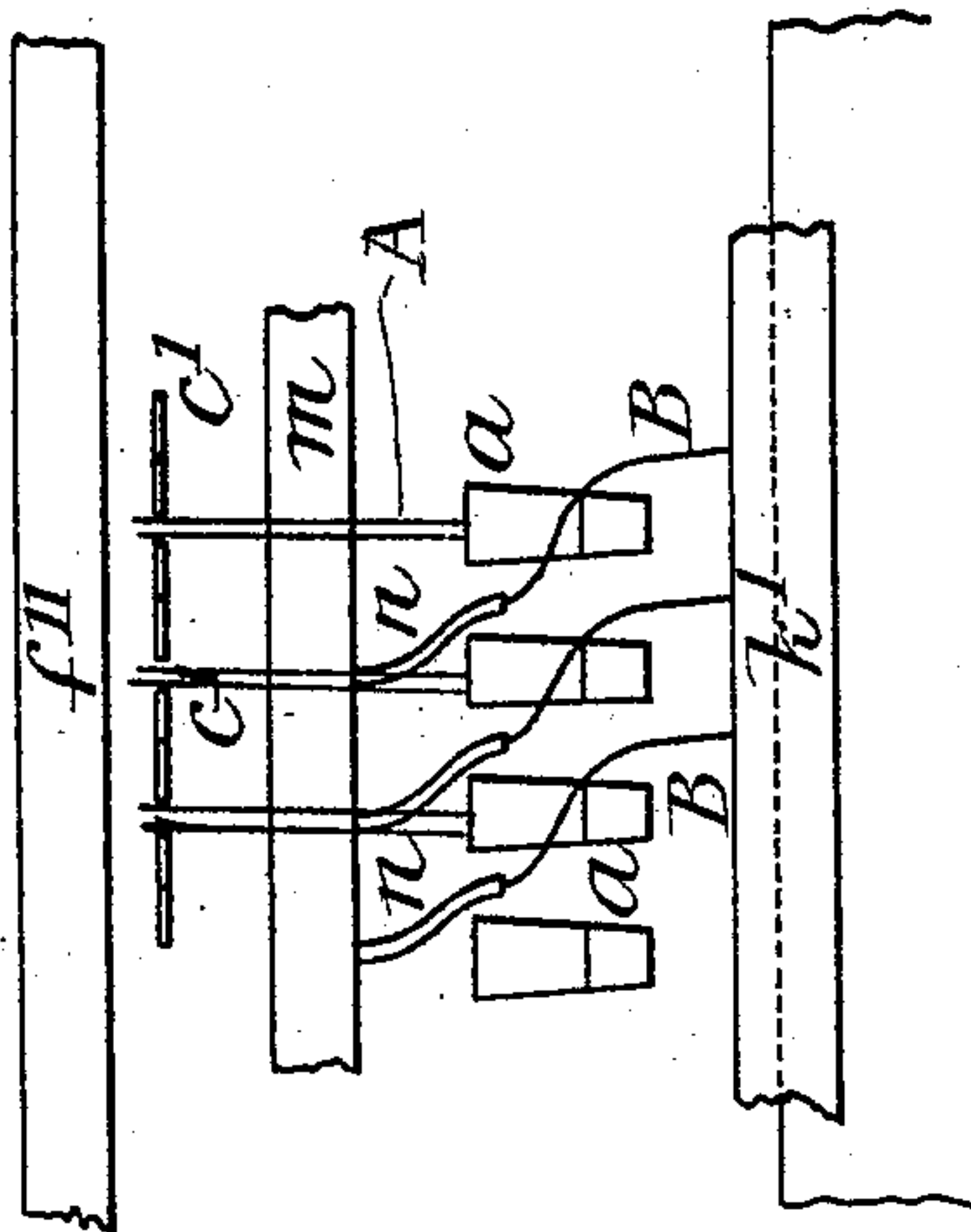


Fig. 29.



*Fig. 26.*

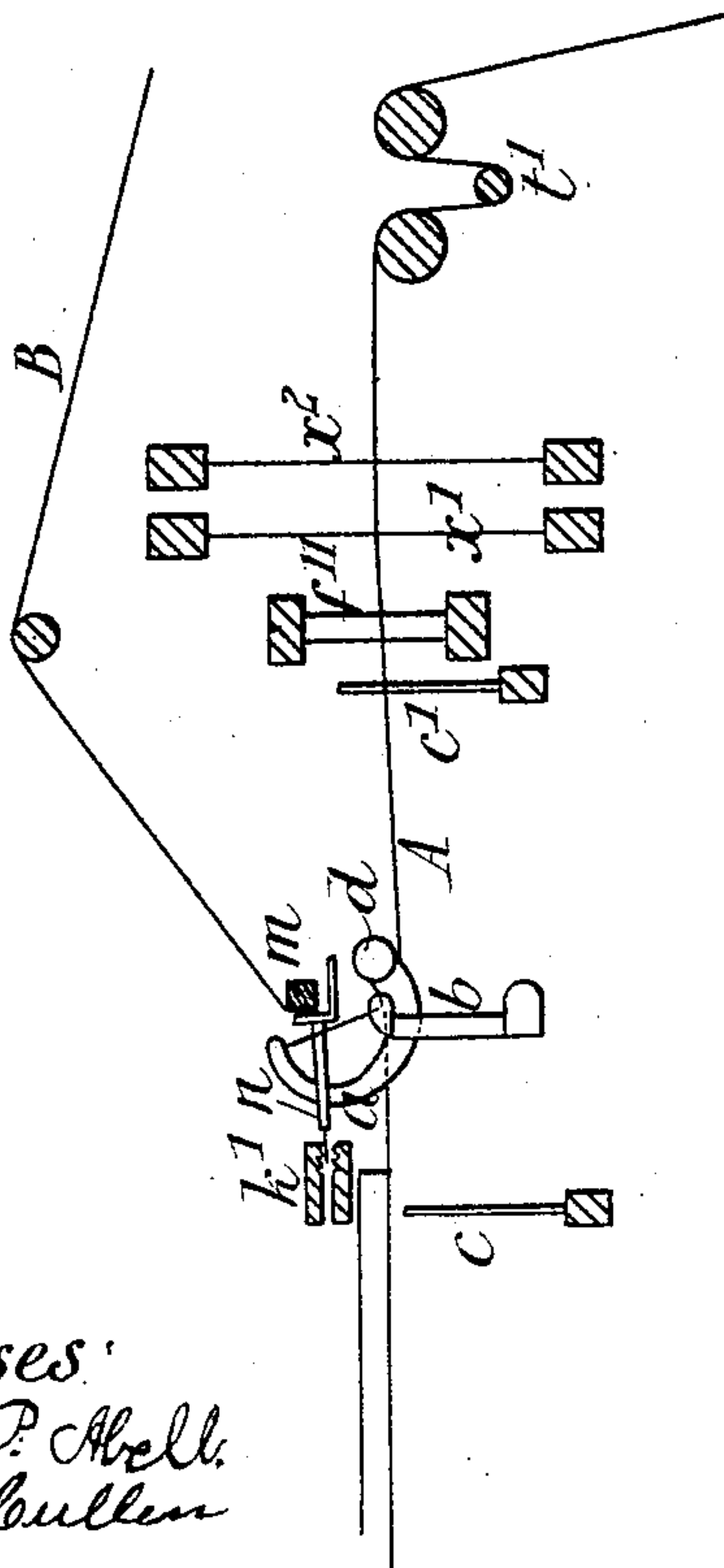
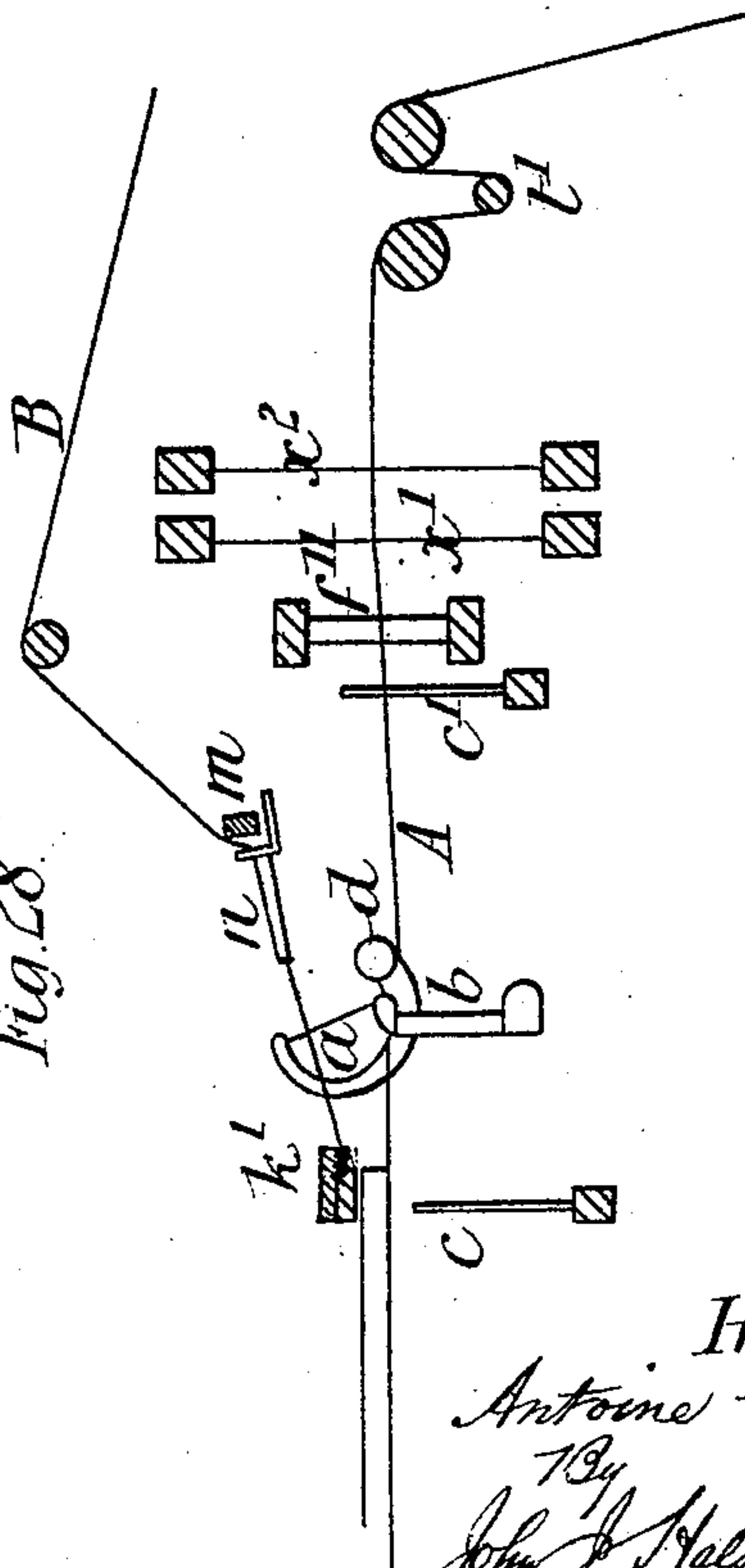


Fig. 28.



Witnesses:  
Walter P. Abell.  
John Cullen

Walter P. Abell.  
John Cullen

John Bullen

*Inventor.*

Antoine Siret

79.

John J. Halsted of son  
his City's

his Ellys

(No Model.)

26 Sheets—Sheet 12.

A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

Fig. 30.

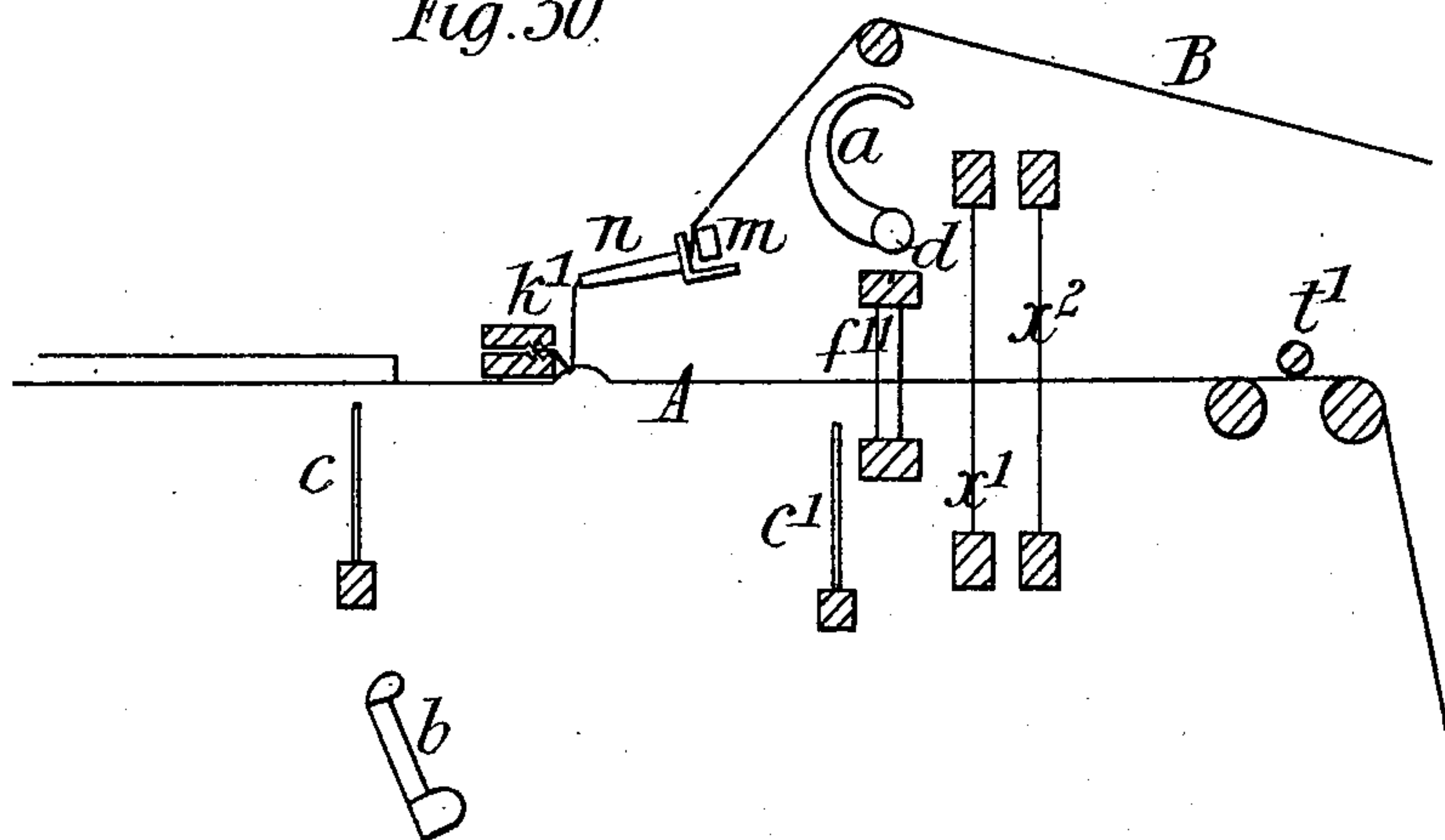


Fig. 31.

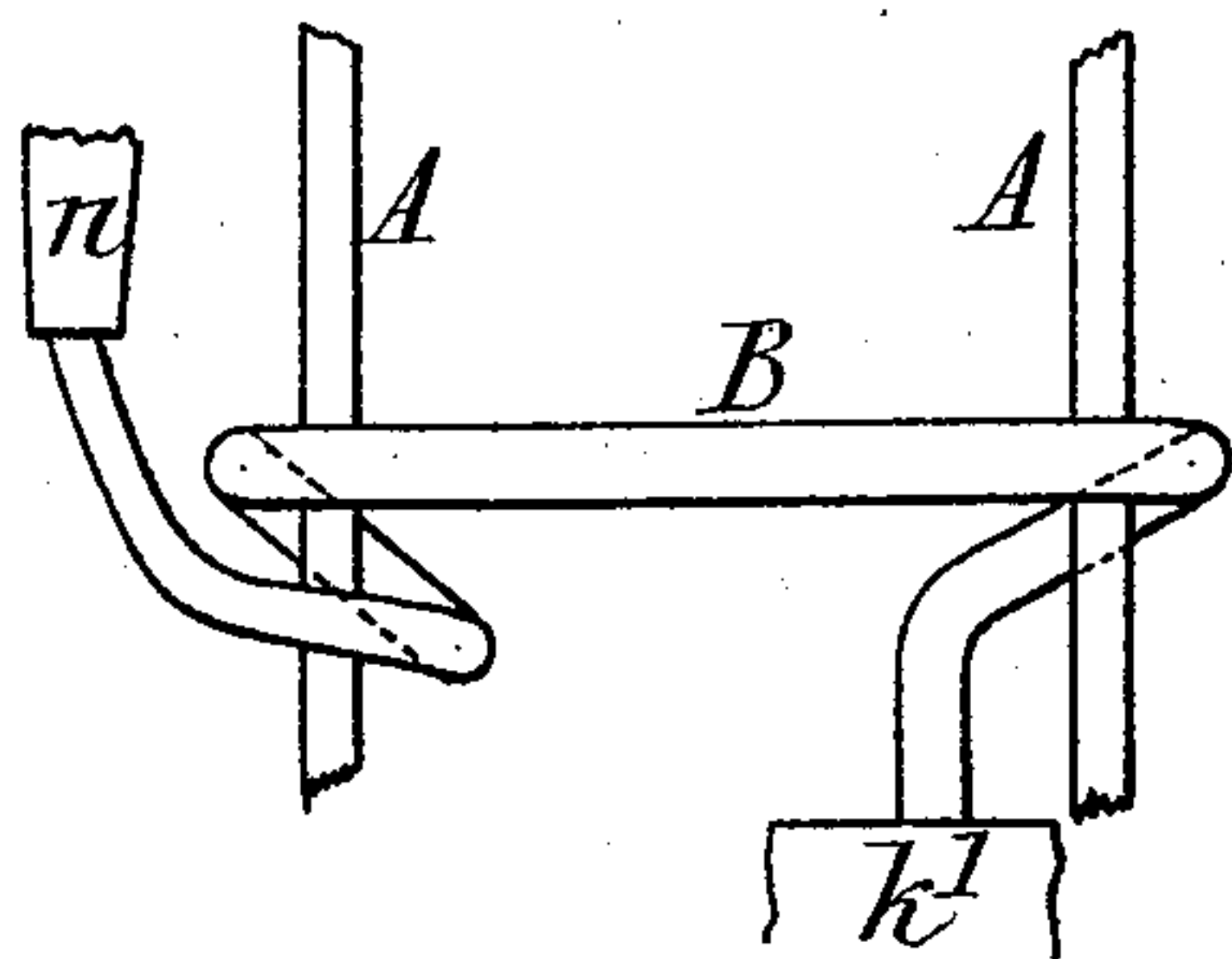
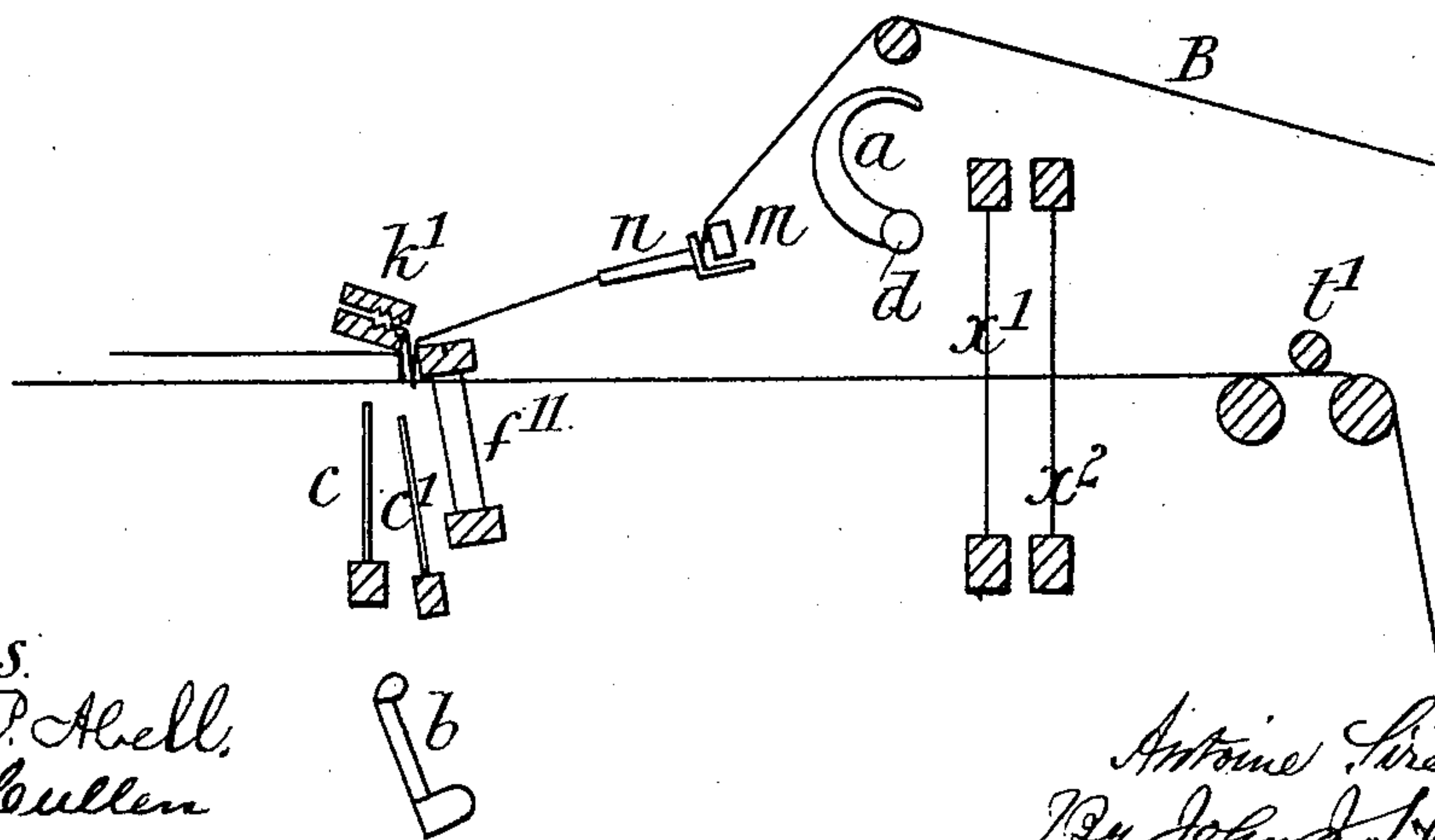


Fig. 32.



Witnesses:  
Walter P. Abell,  
John Cullen

Inventor:  
Antoine Siret.  
By John J. Husted for  
his Attys.



(No Model.)

26 Sheets—Sheet 13.

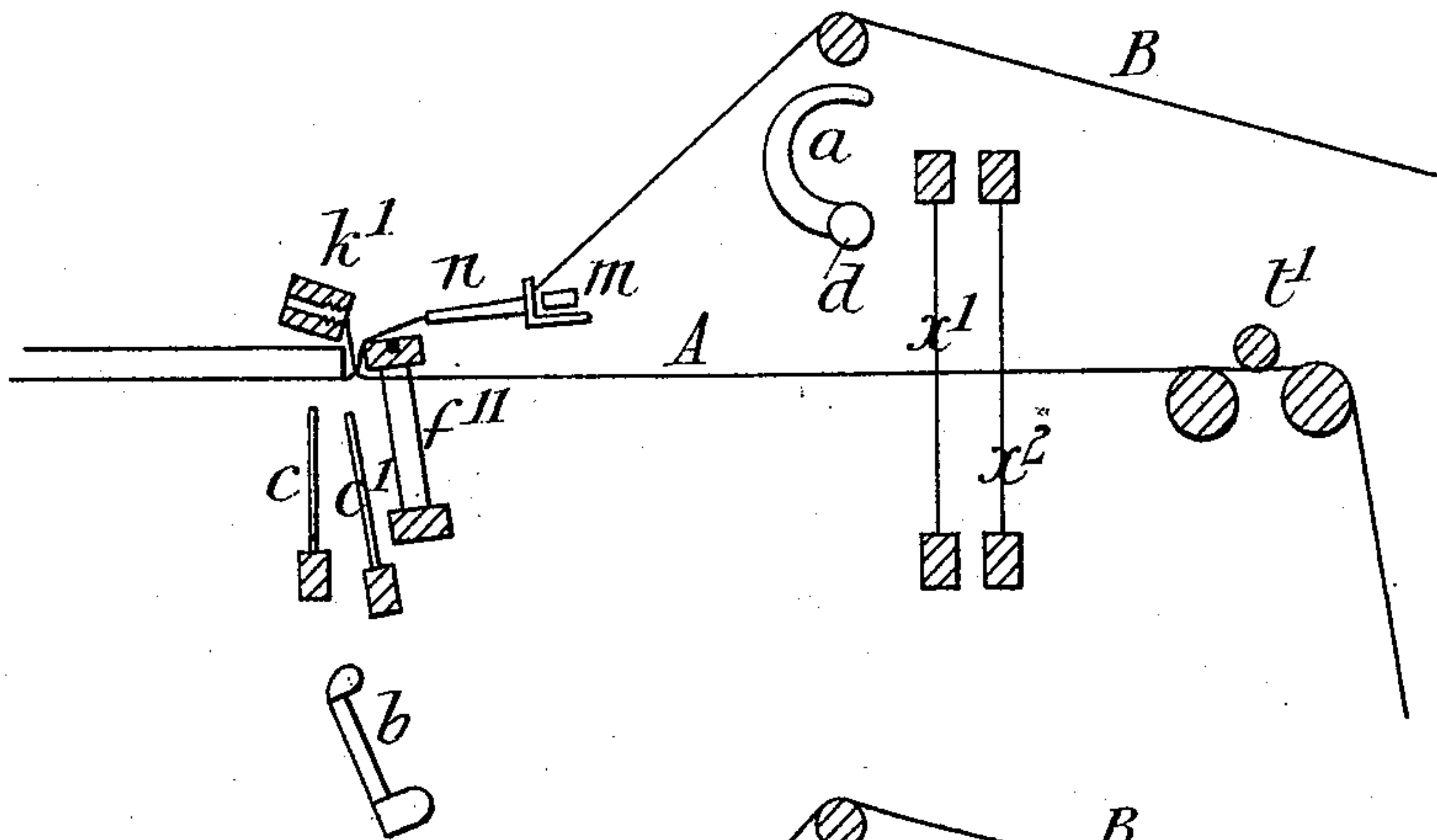
A. SIRET.

LOOM FOR WEAVING PILE FABRICS.

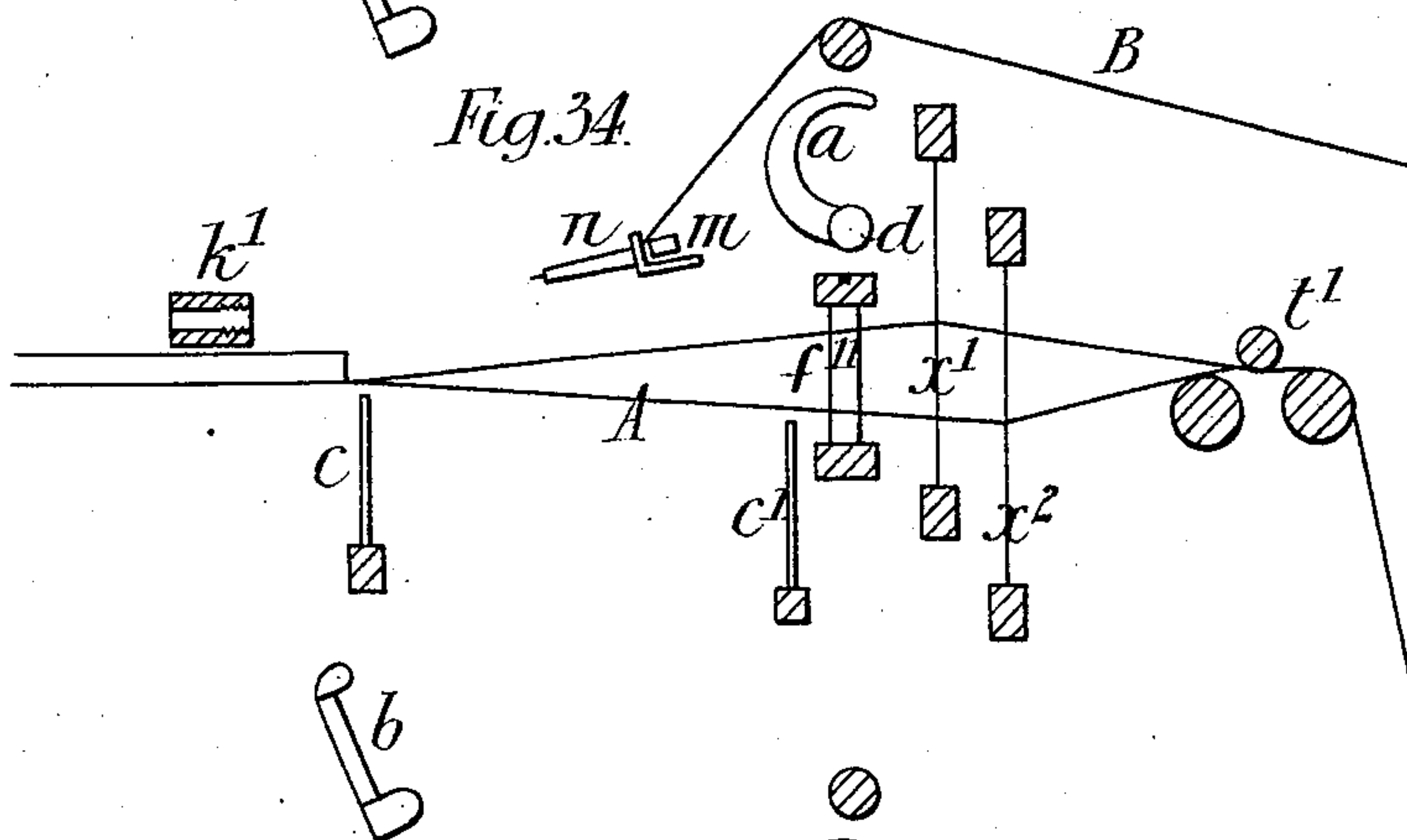
No. 582,398.

Patented May 11, 1897.

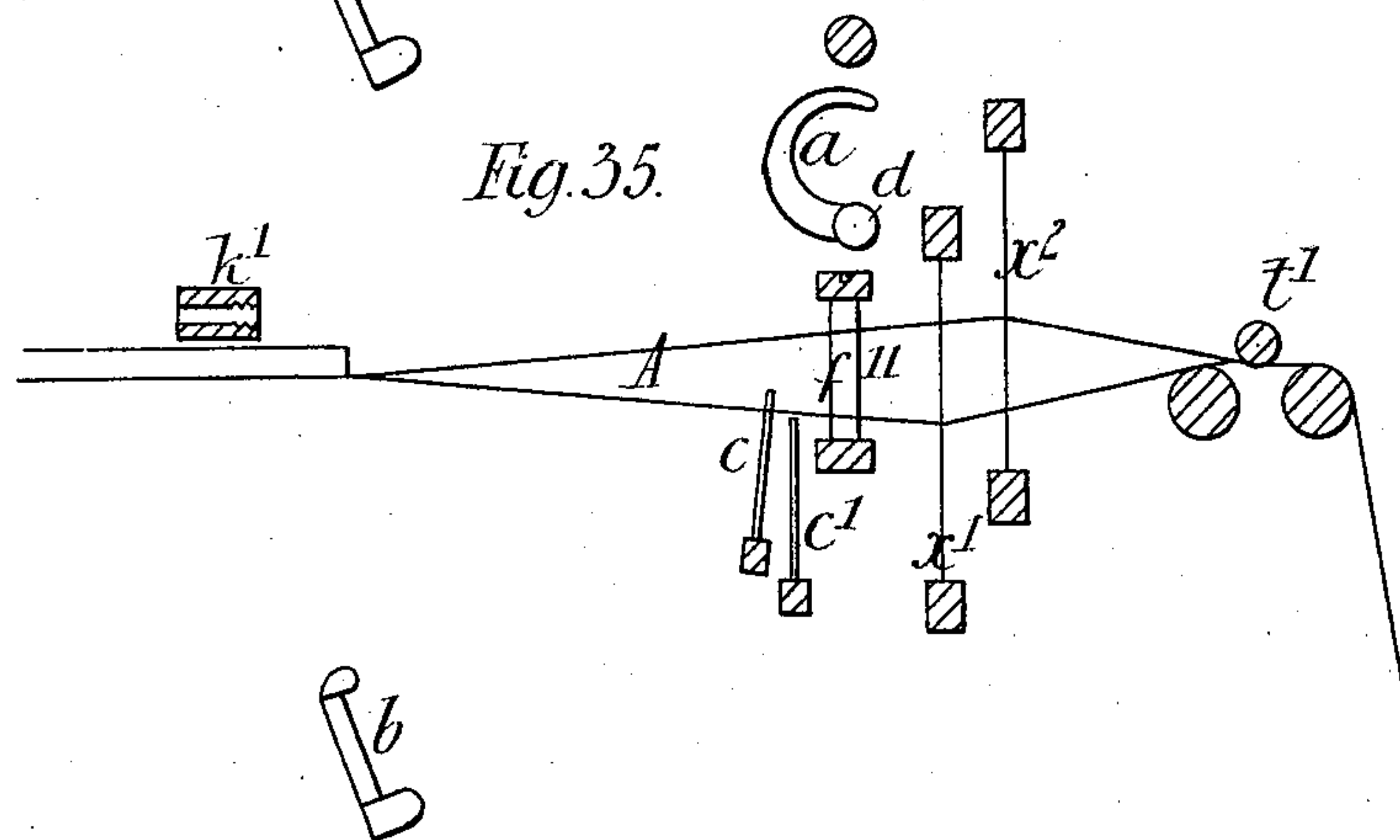
*Fig. 33.*



*Fig. 34.*



*Fig. 35.*



Witnesses:  
Walter O. Abell.  
John Keenan

Inventor:  
Antoine Siret  
By John J. Halsted for  
his attys



(No Model.)

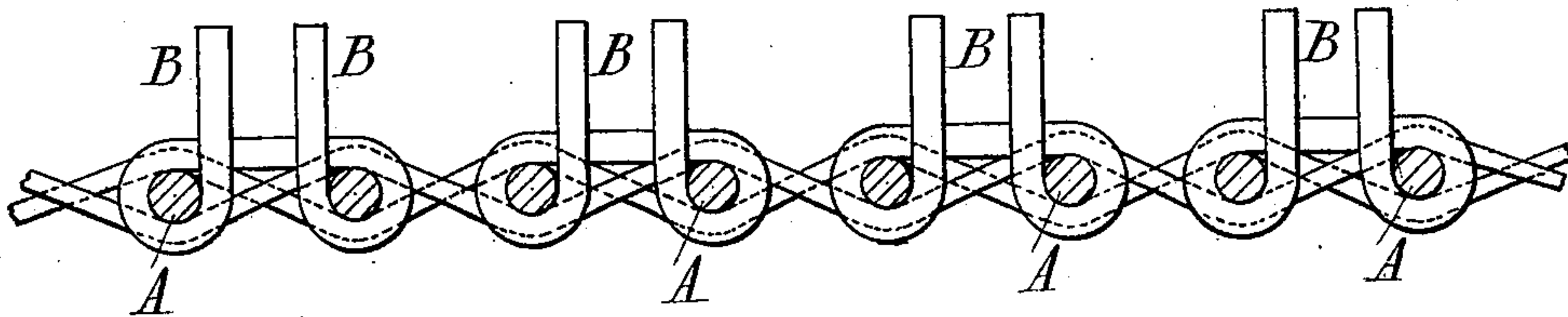
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LOOM FOR WEAVING PILE FABRICS.

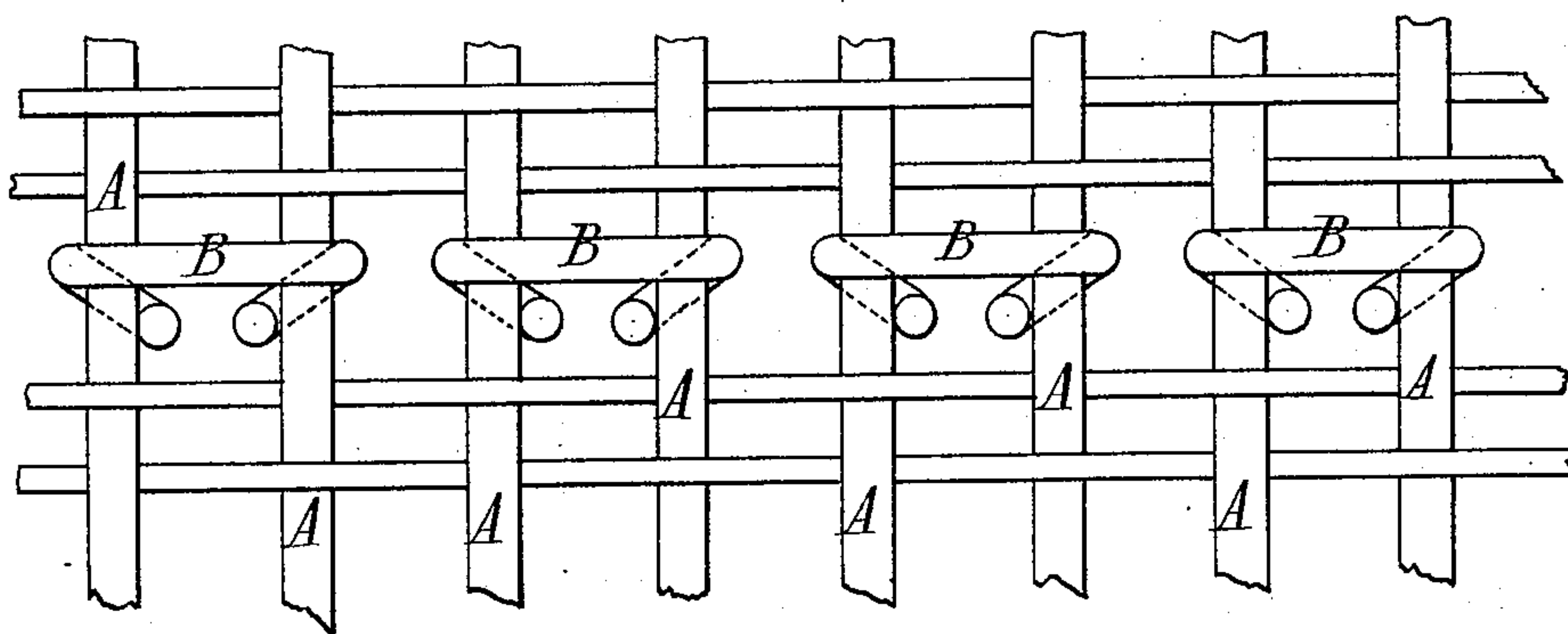
No. 582,398.

Patented May 11, 1897.

*Fig. 36.*



*Fig. 37.*



Witnesses.  
Walter P. Abell.  
John Cullen

Inventor.  
Antoine Siret.  
By John J. Macleod for  
his Attys

(No Model.)

26 Sheets—Sheet 15.

A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

Fig. 39.

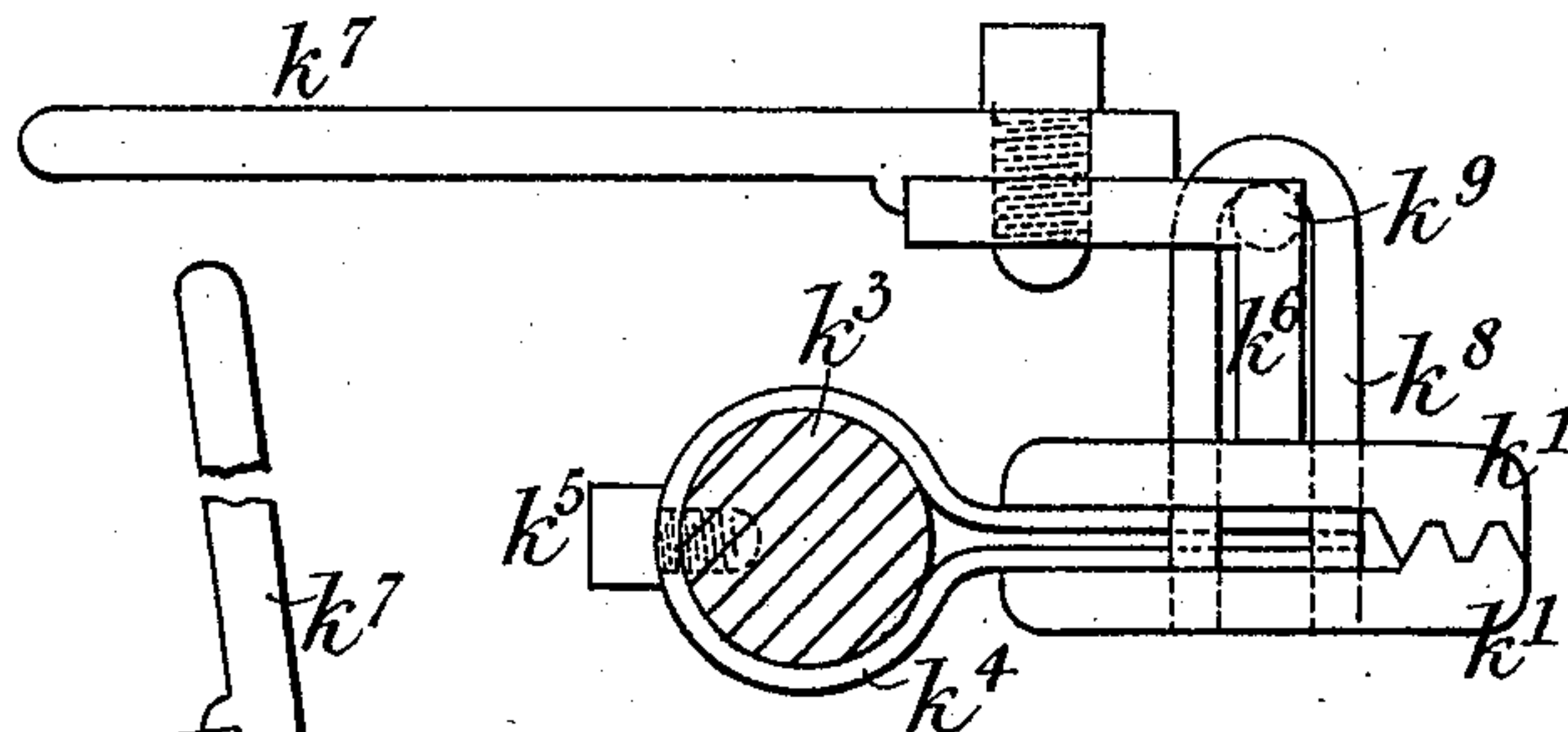


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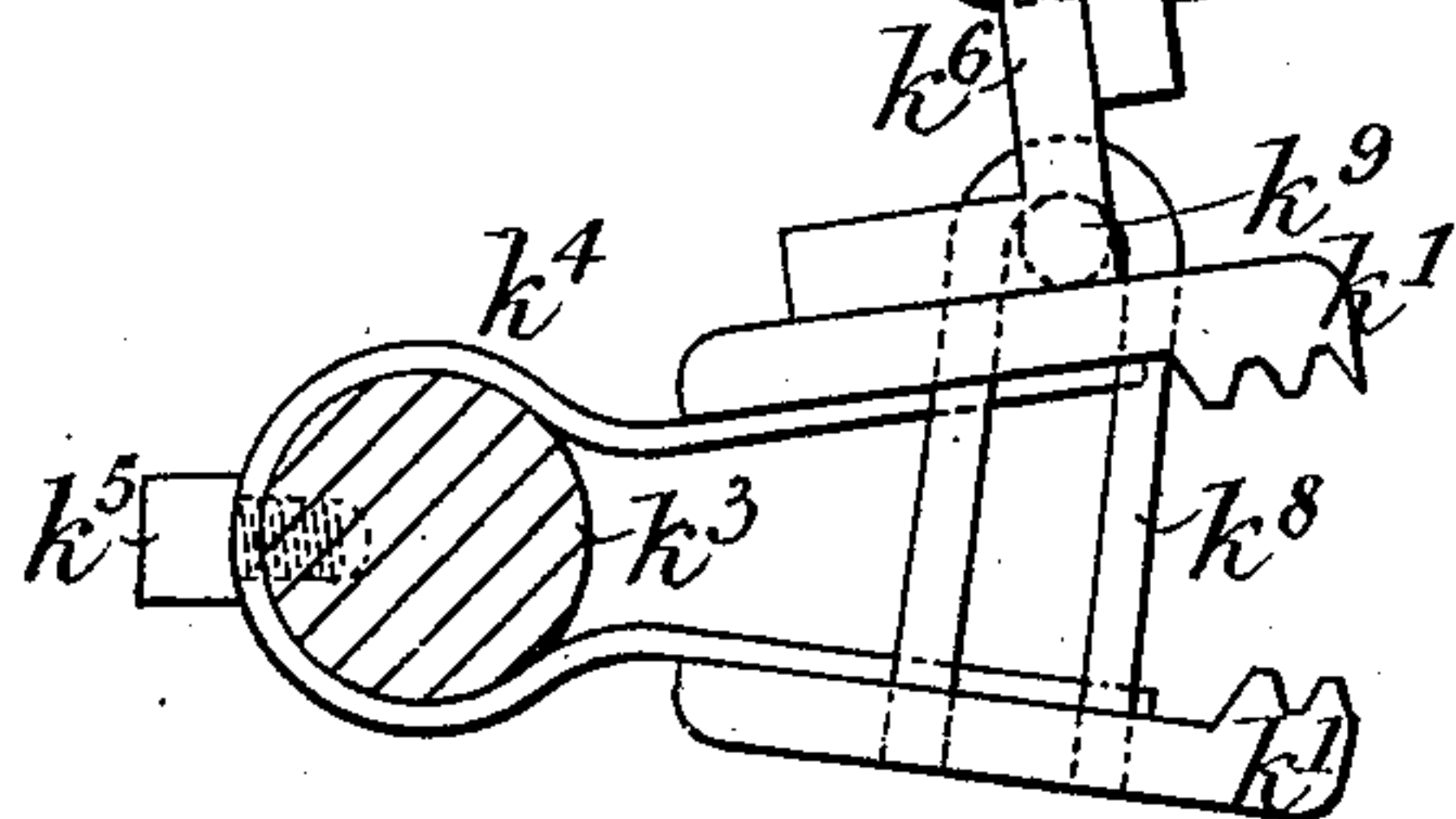
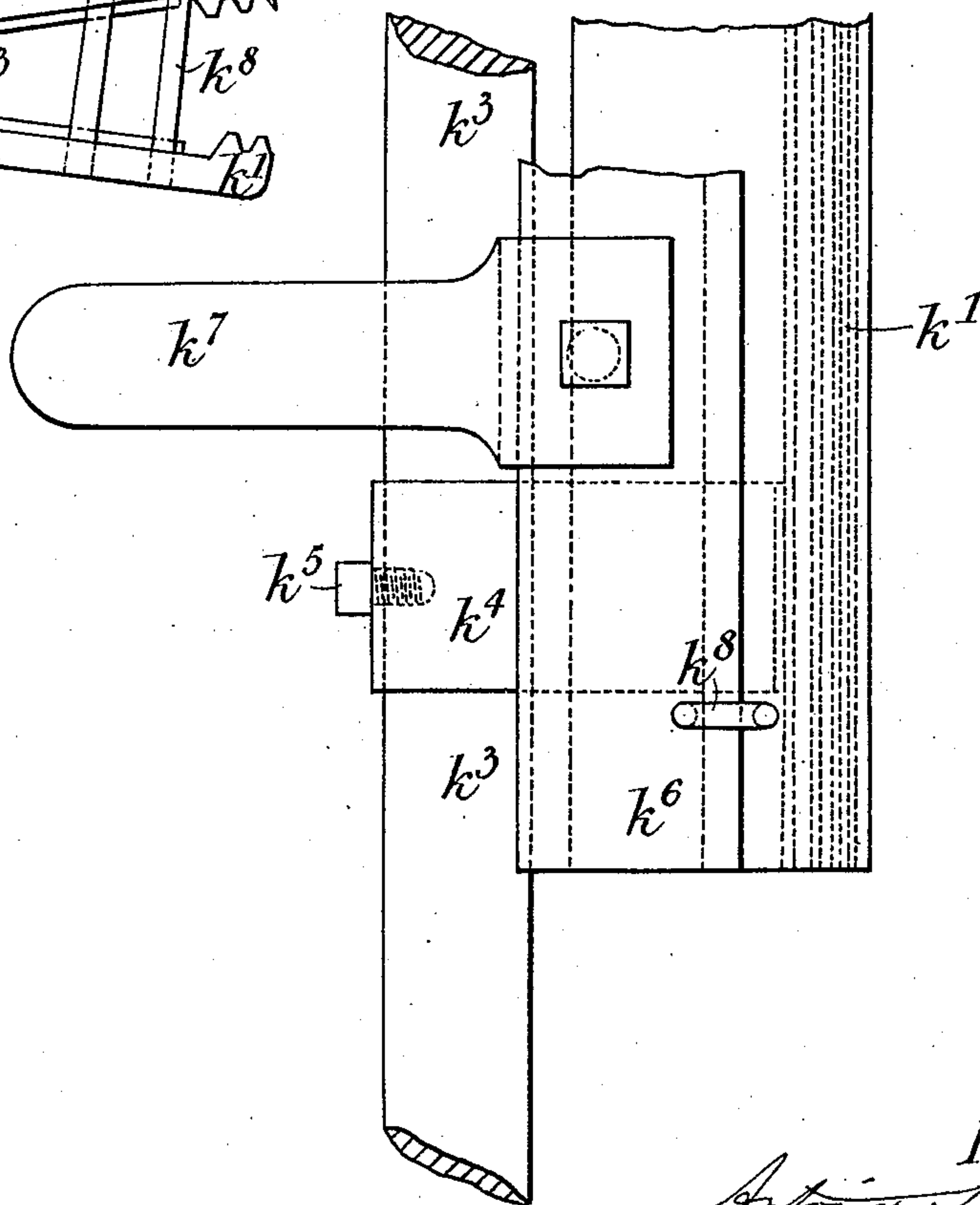


Fig. 40.



Witnesses.  
Walter P. Abell,  
John Bullen

Inventor.  
Antoine Siret.  
By John J. Macleod, for  
his attys





(No Model.)

26 Sheets—Sheet 17.

A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

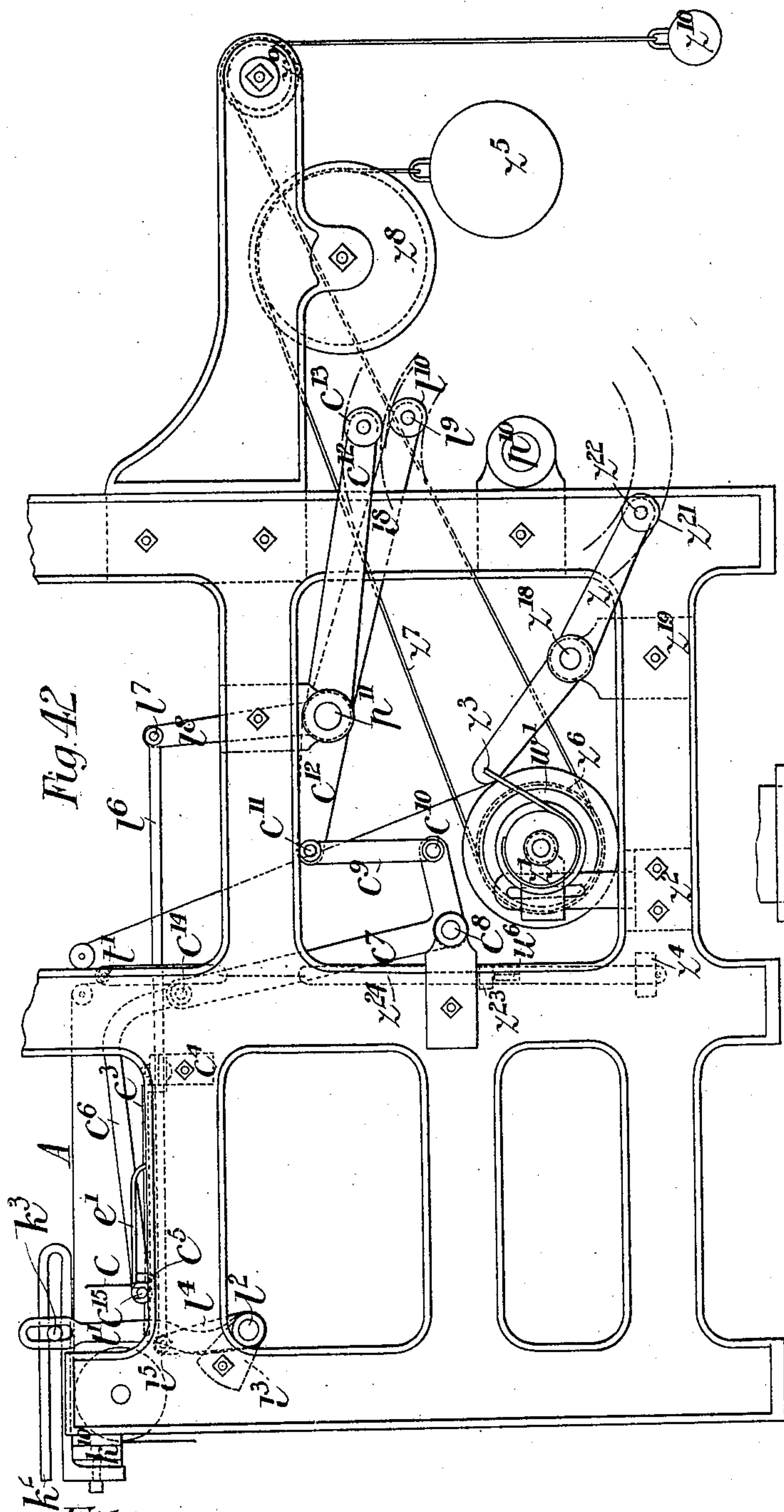


Fig. 42

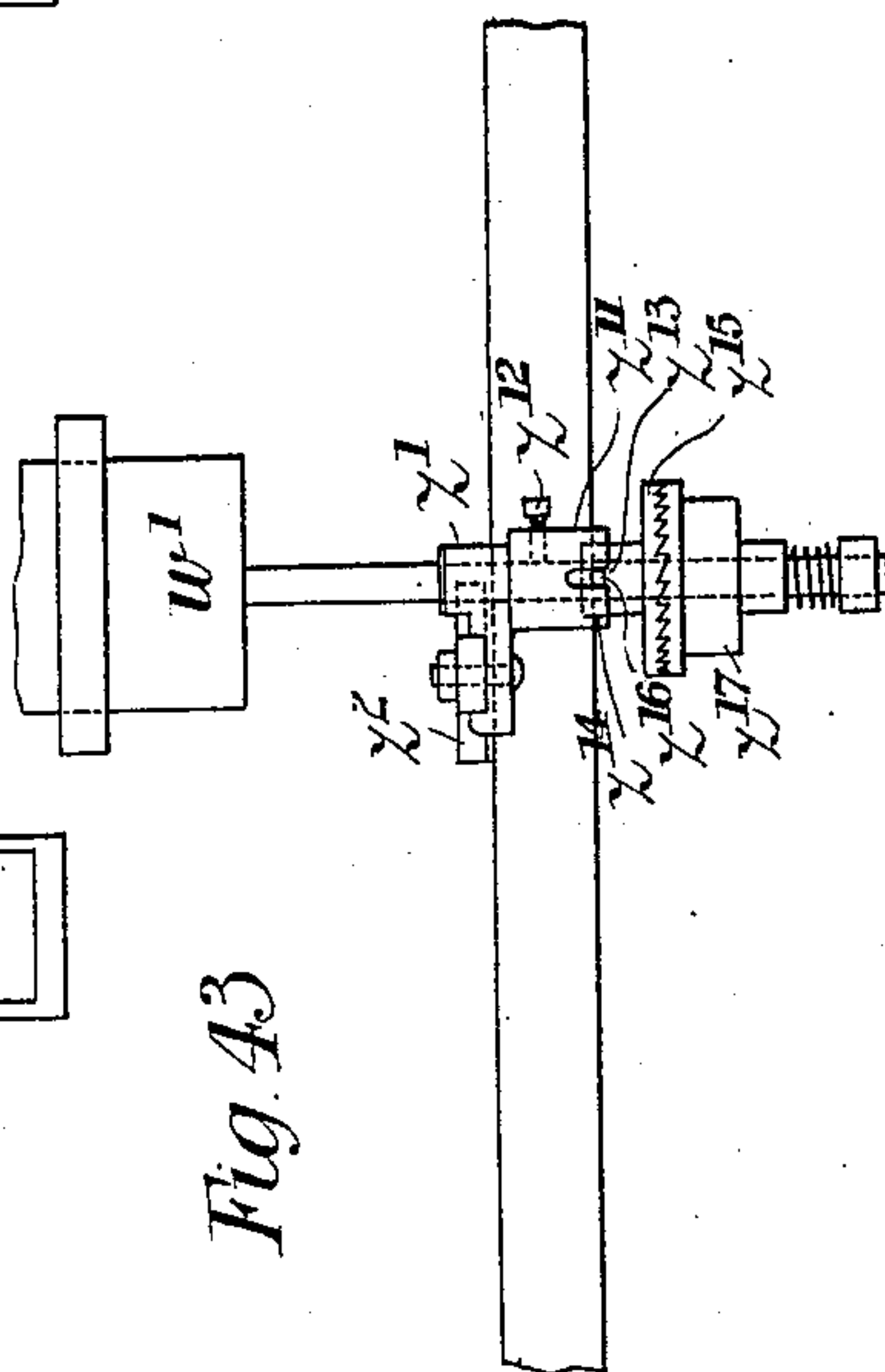


Fig. 43

Witnesses.

Wm. S. Rohrer.  
J. F. Beale.

Inventor.

Antoine Siret.  
By  
John J. Halsted & Son,  
his attorneys

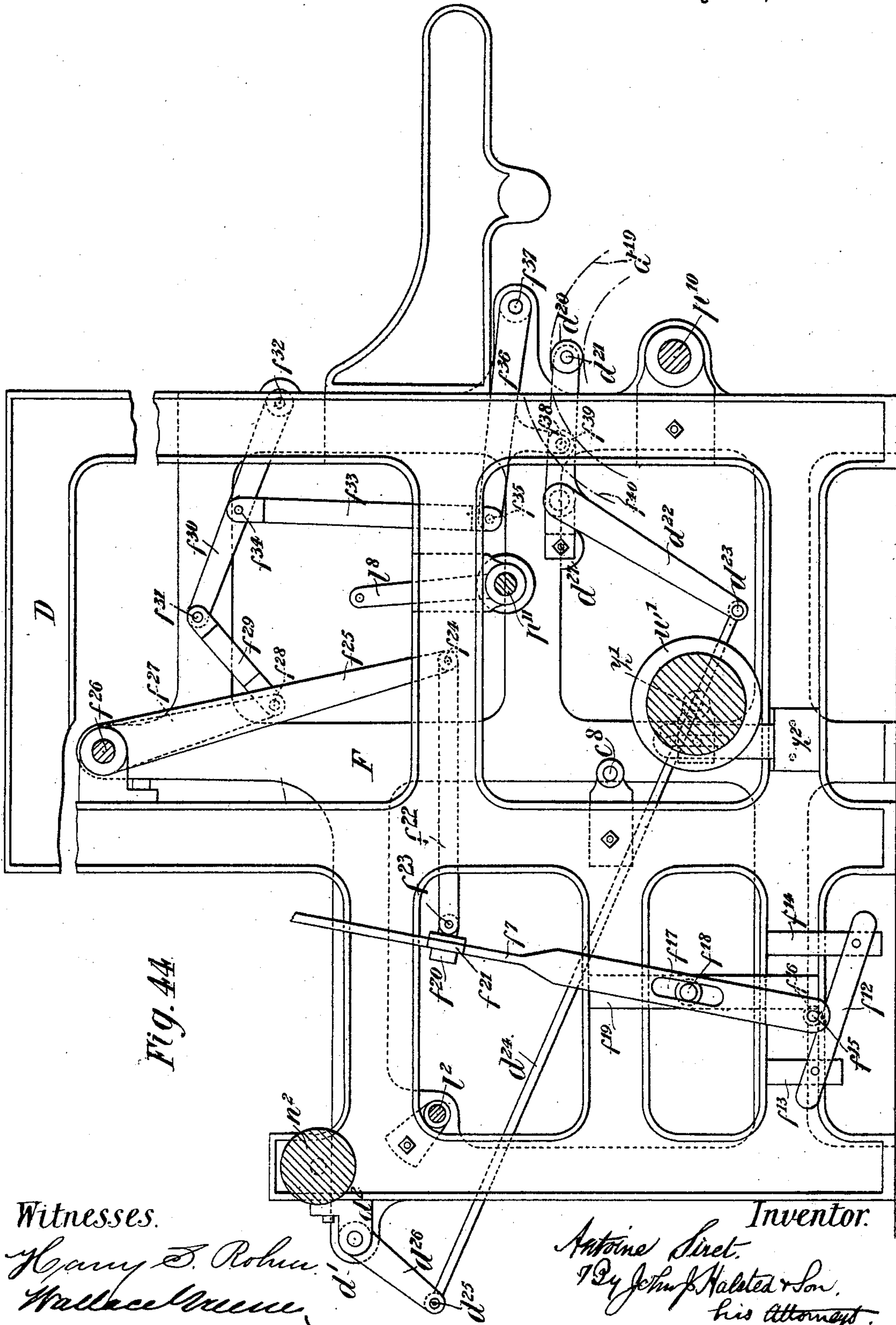
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26 Sheets—Sheet 18.

A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.



Witnesses.

Harry D. Rohrer.  
Wallace Munn.

Inventor.

Antoine Siret.  
By John F. Halsted & Son,  
his attorneys.



(No Model.)

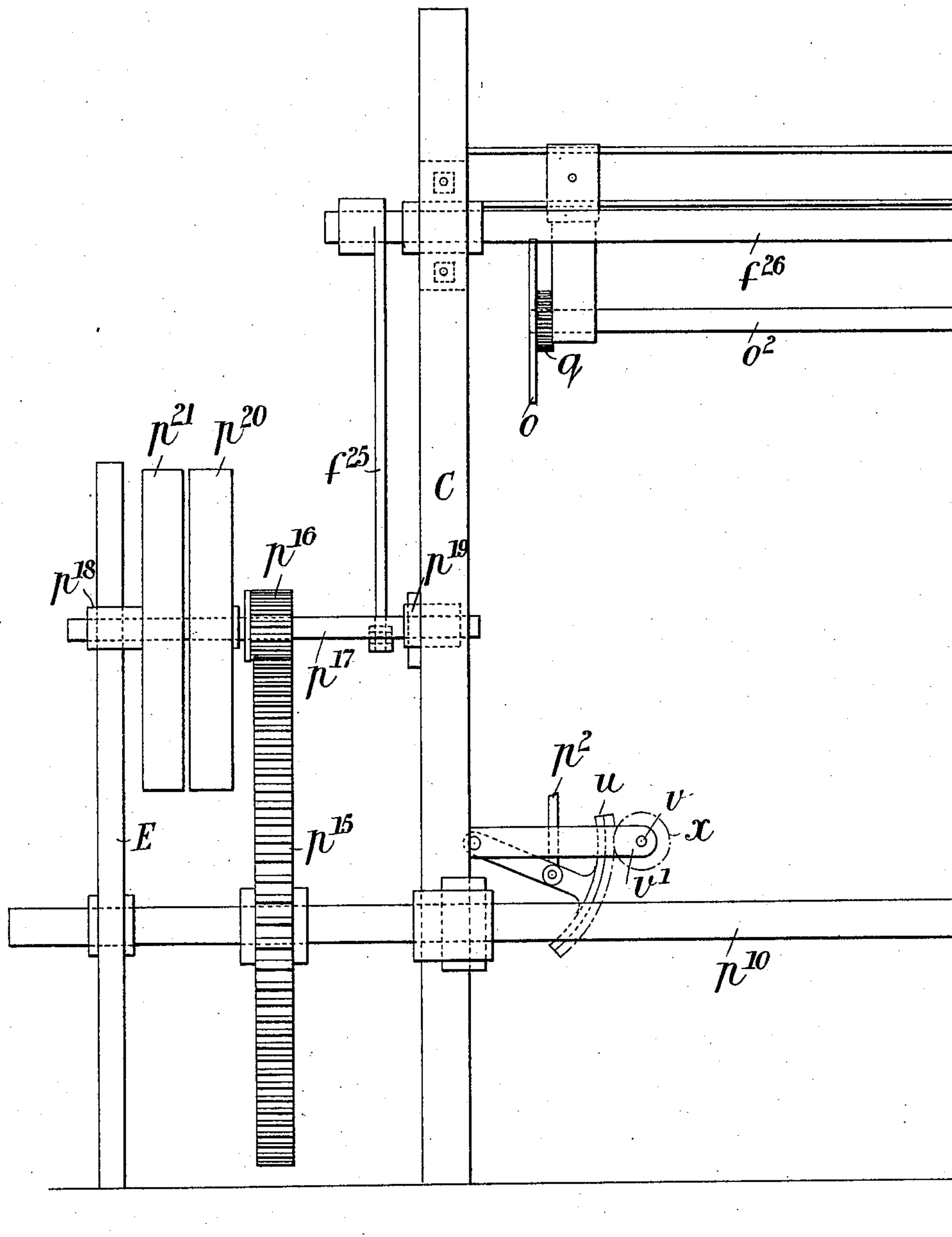
26 Sheets—Sheet 19.

A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

Fig. 45.



Witnesses.

Harry D. Rohrer.  
Wallace Greene,

Inventor.

Antoine Siret.  
By John J. Halsted & Son,  
his Attys

(No Model.)

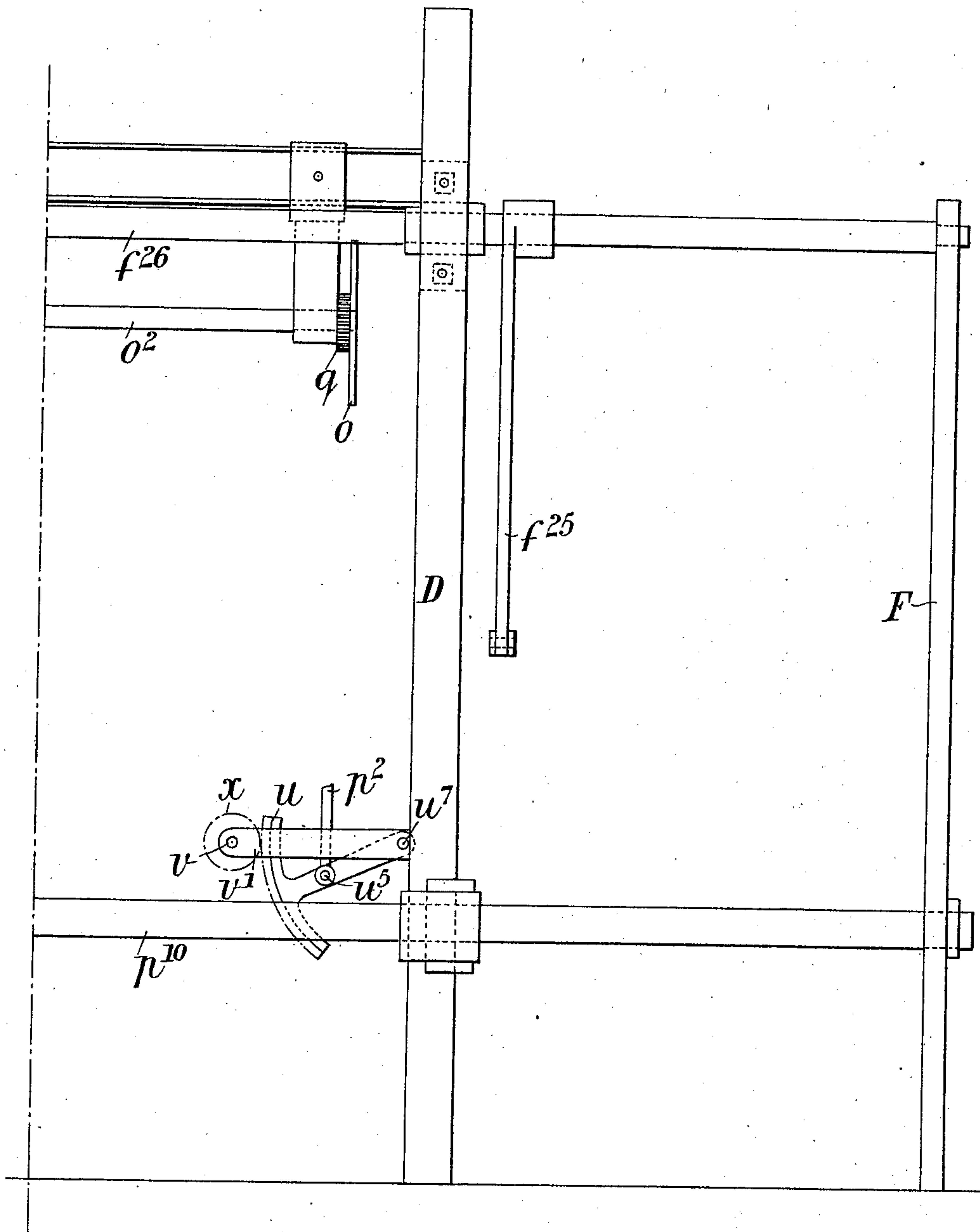
26 Sheets—Sheet 20.

A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

Fig. 45.\*



Witnesses.  
Harry D. Rohrer  
Wallace Greene

Inventor.  
Antoine Siret  
By John J. Halsted for  
his Attys

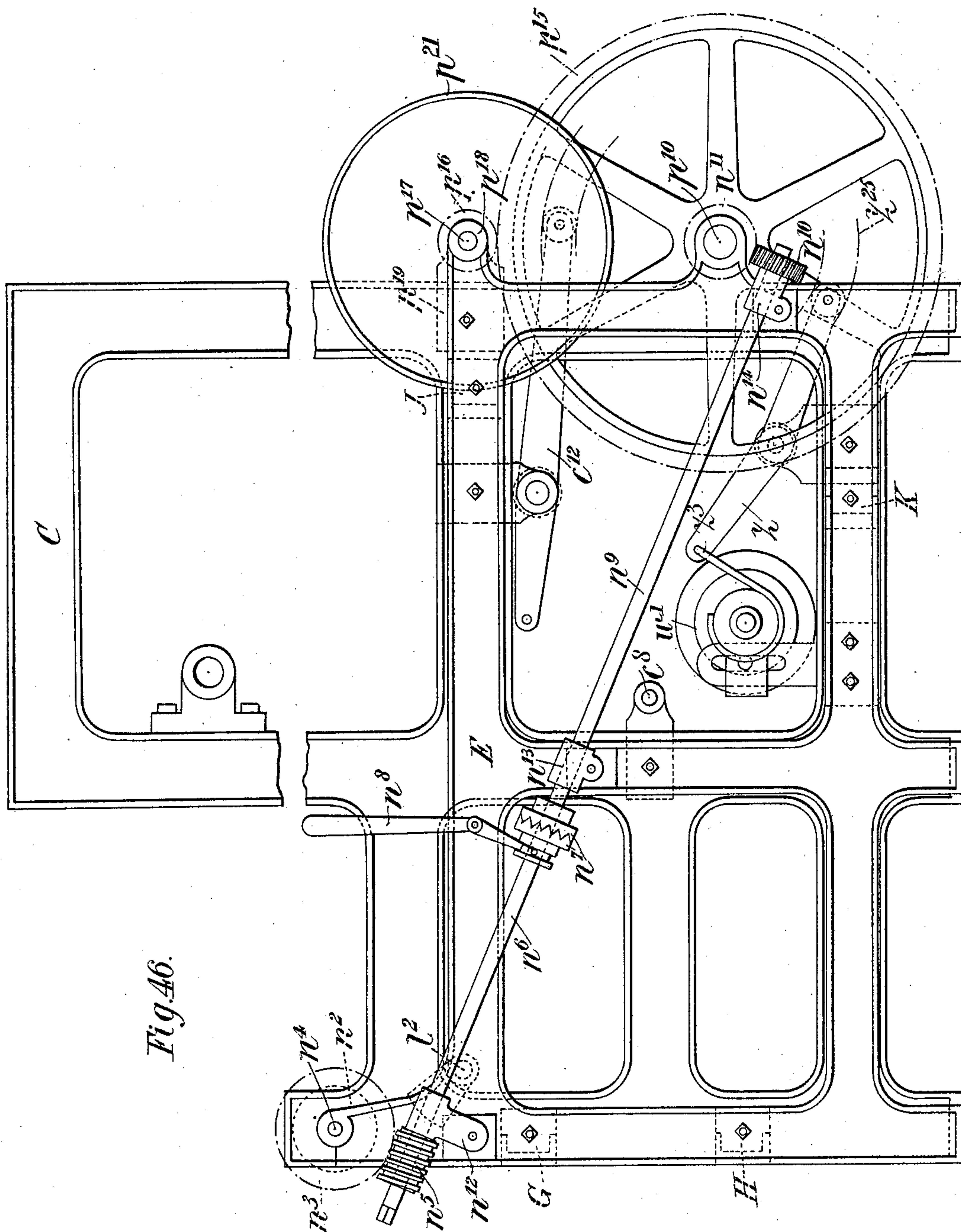
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A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.



*Witnesses.*

Henry S. Polner.  
Mallard Greene,

*Inventor:*

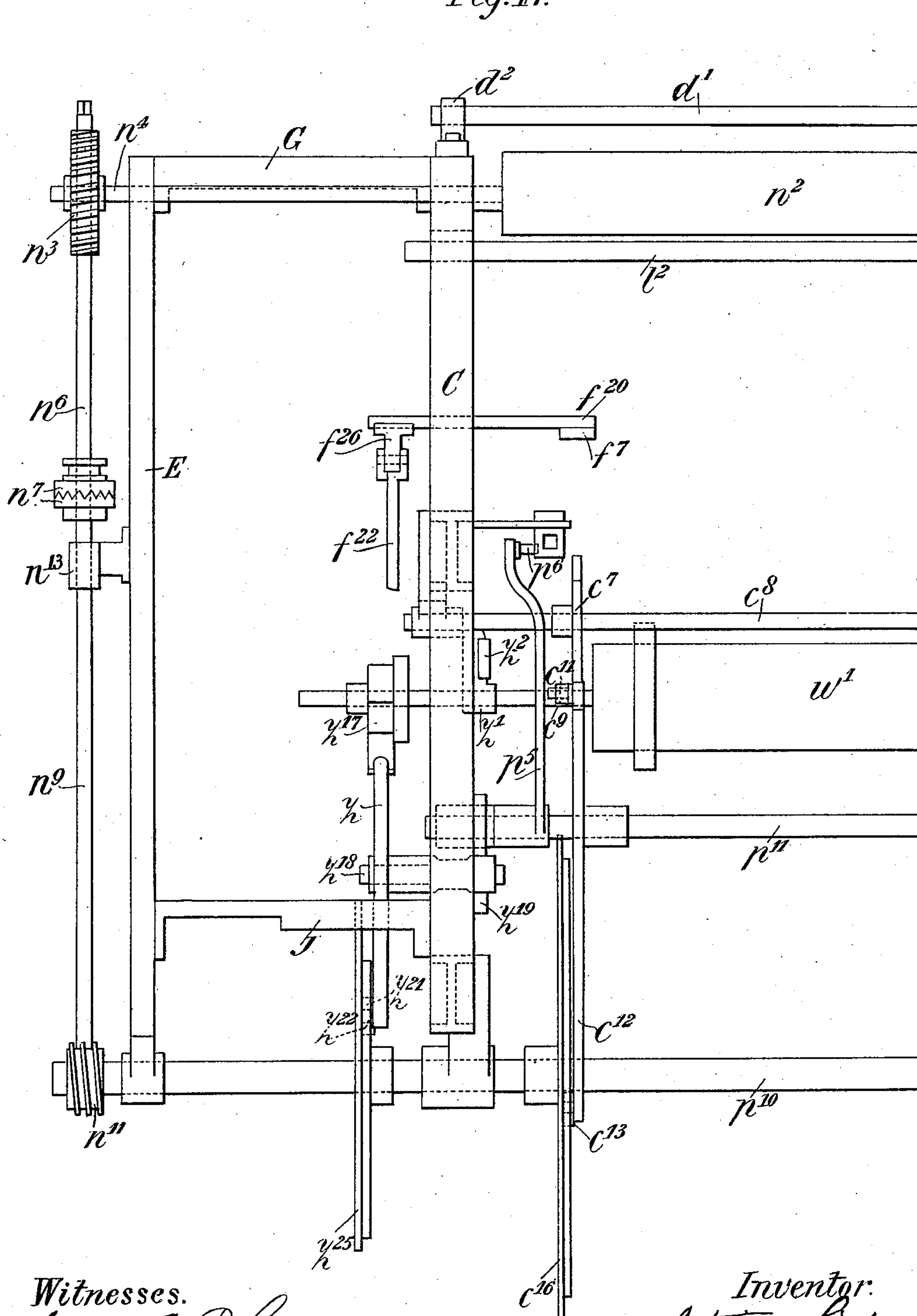
Antoine Siret.  
By John J. Halsted for  
his Atty's

26 Sheets—Sheet 22.

No. 582,398.

Patented May 11, 1897.

*Fig. 47.*



*Witnesses.*

Witnesses.  
 Mary E. Rohm  
 Wallace Greene,

*Inventor:*

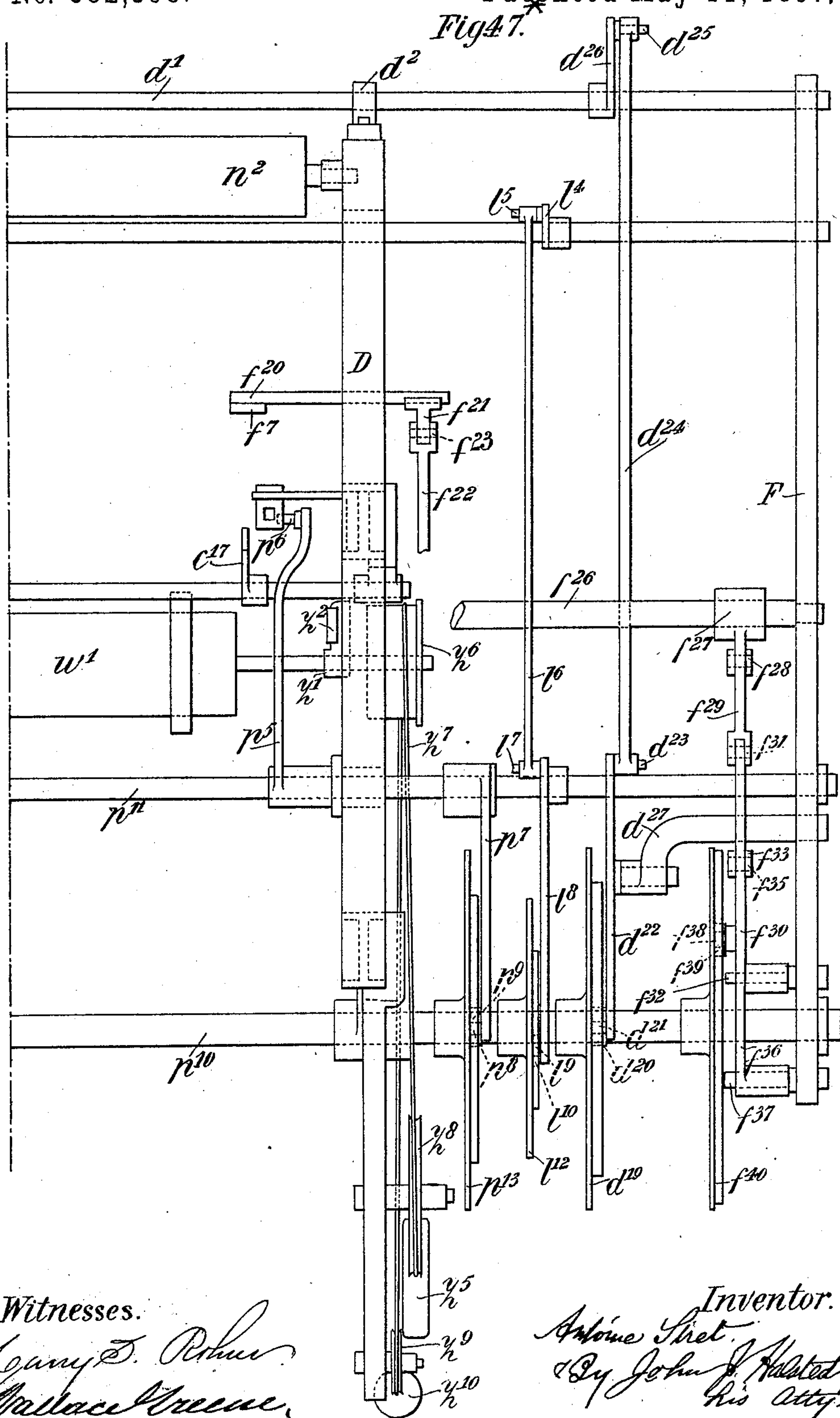
Antoine Suet.  
By John J. Halsted & Son  
his Attys



A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.





A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

No. 582,398.

Patented May 11, 1897.

Fig. 48.

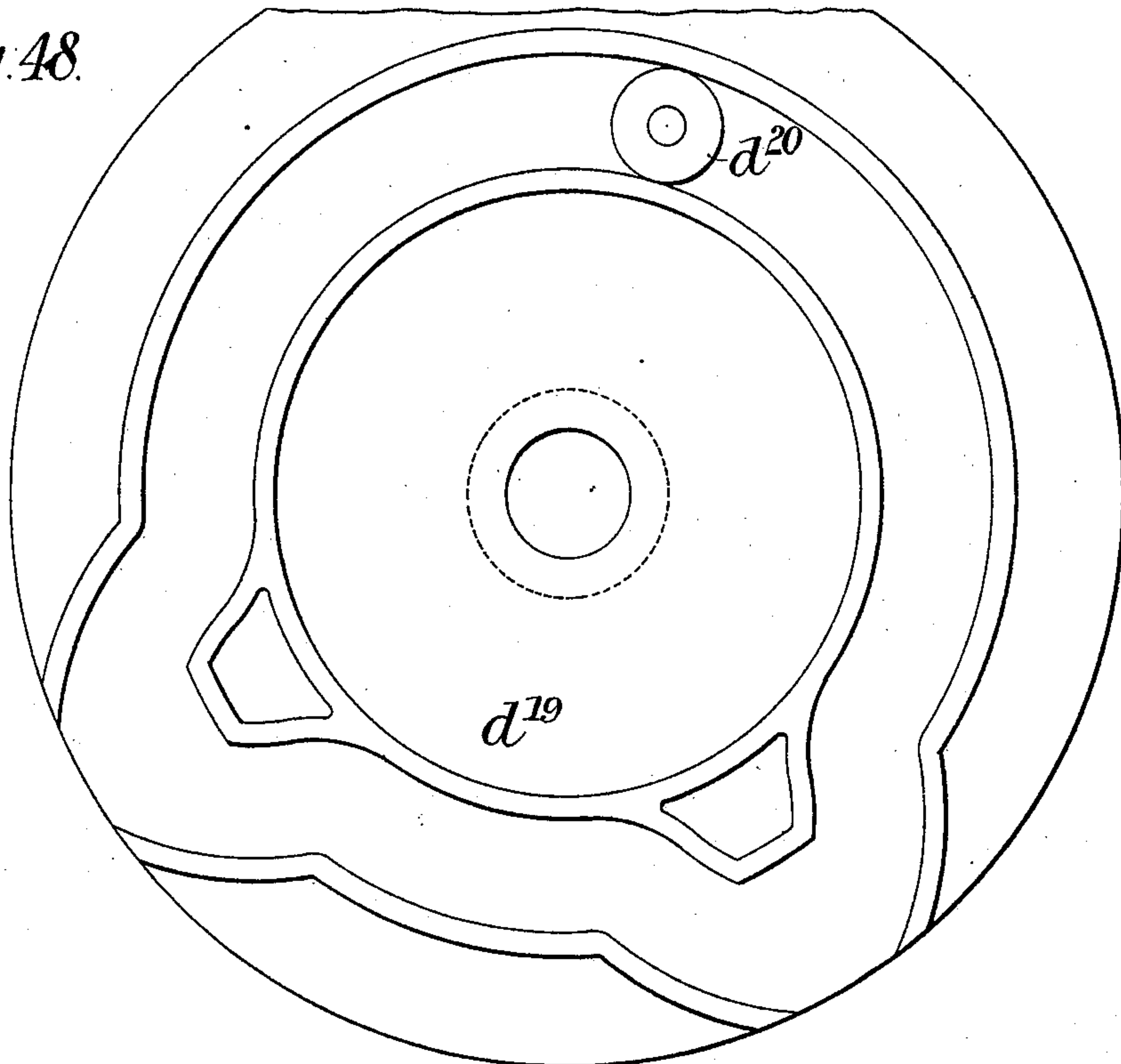
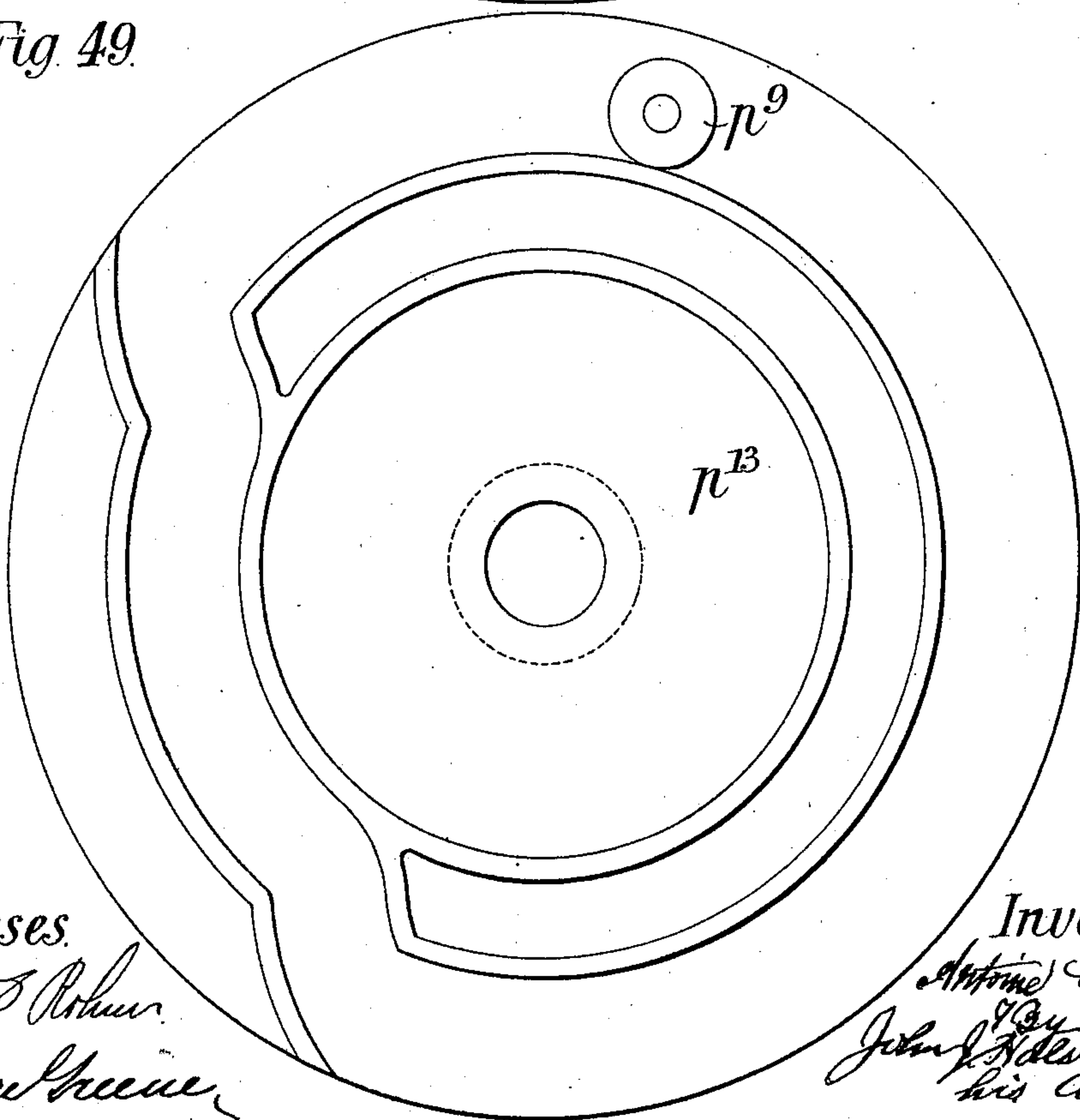


Fig. 49.



Witnesses.

Harry S. Parker  
Wallace Greene

Inventor.

Antoine Siret  
John F. Hildesheim & Son  
his Attys

(No Model.)

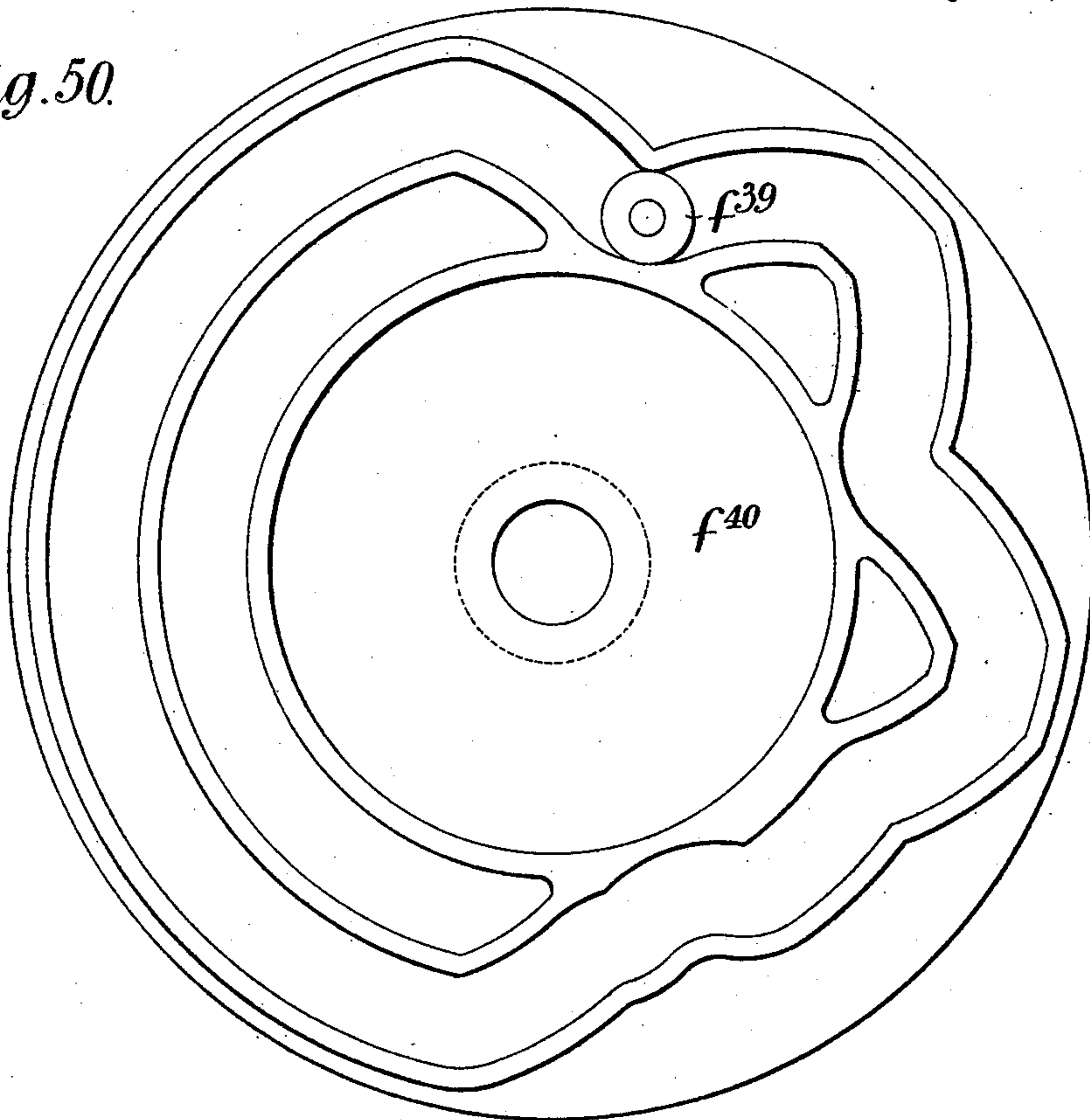
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A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

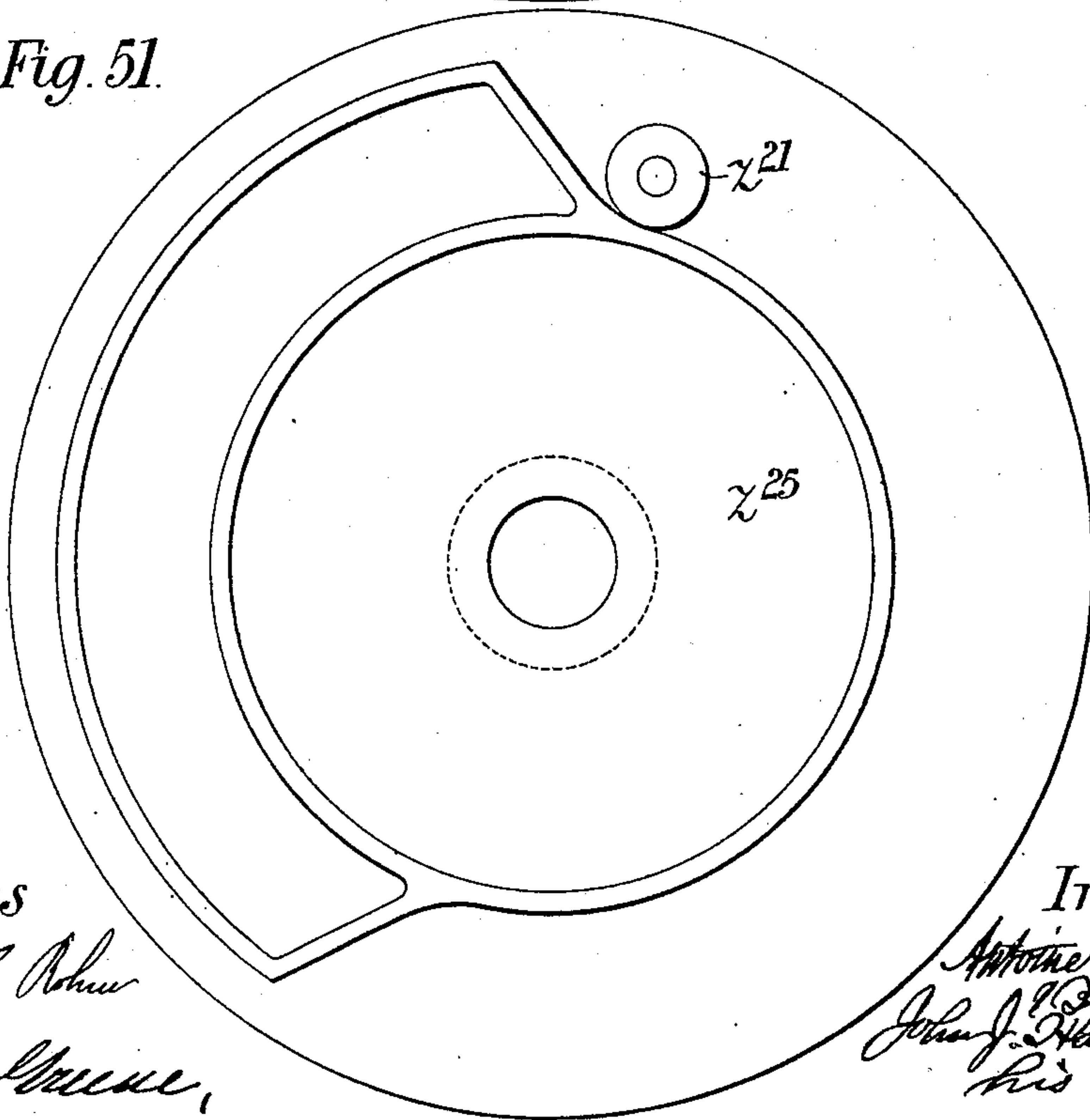
No. 582,398.

Patented May 11, 1897.

*Fig. 50.*



*Fig. 51.*



Witnesses

*Henry J. Brown*  
*Wallace Brown*

Inventor.

*Antoine Siret*  
*John J. Walsted & Son*  
*his Attys.*

(No Model.)

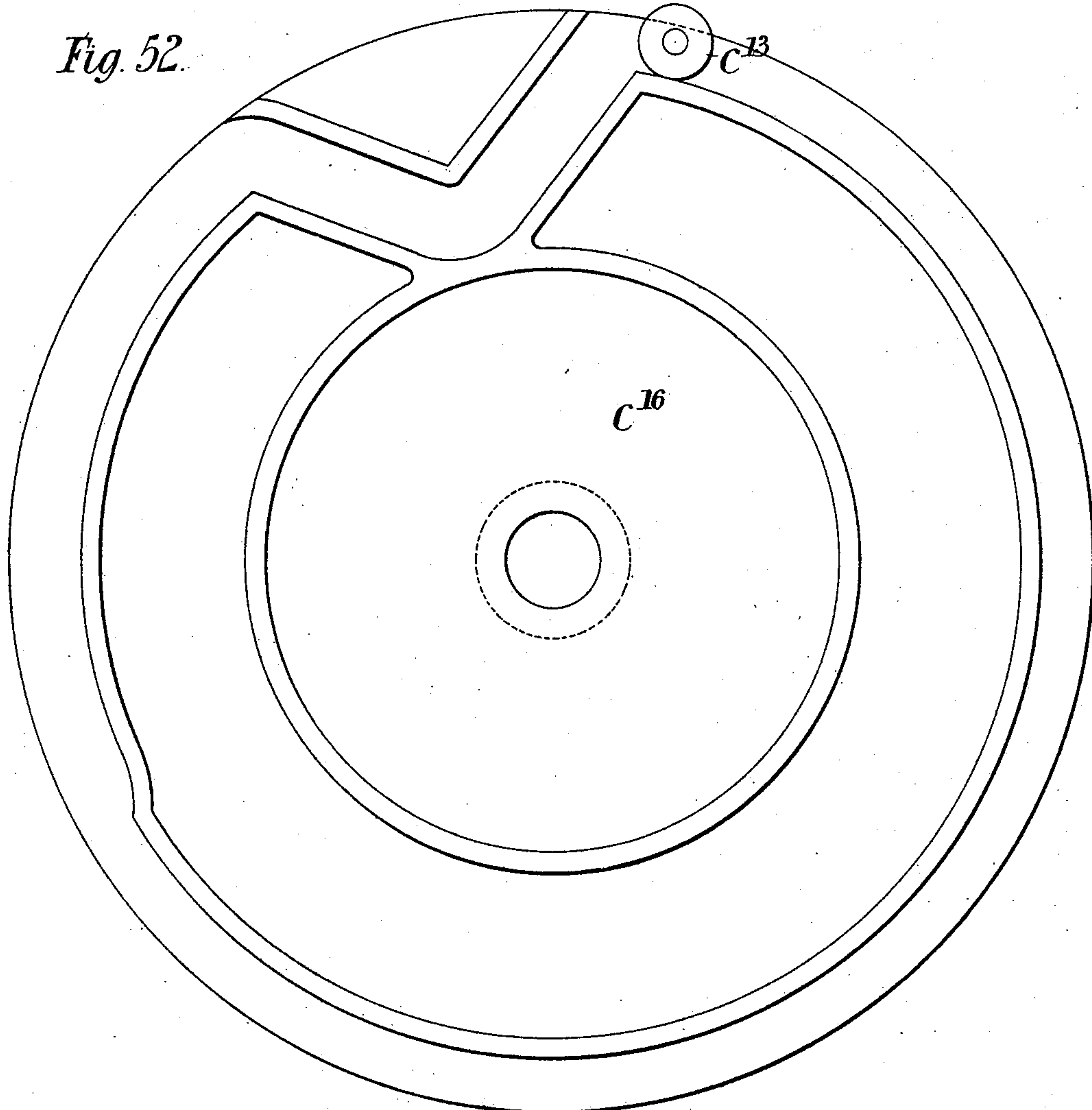
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A. SIRET.  
LOOM FOR WEAVING PILE FABRICS.

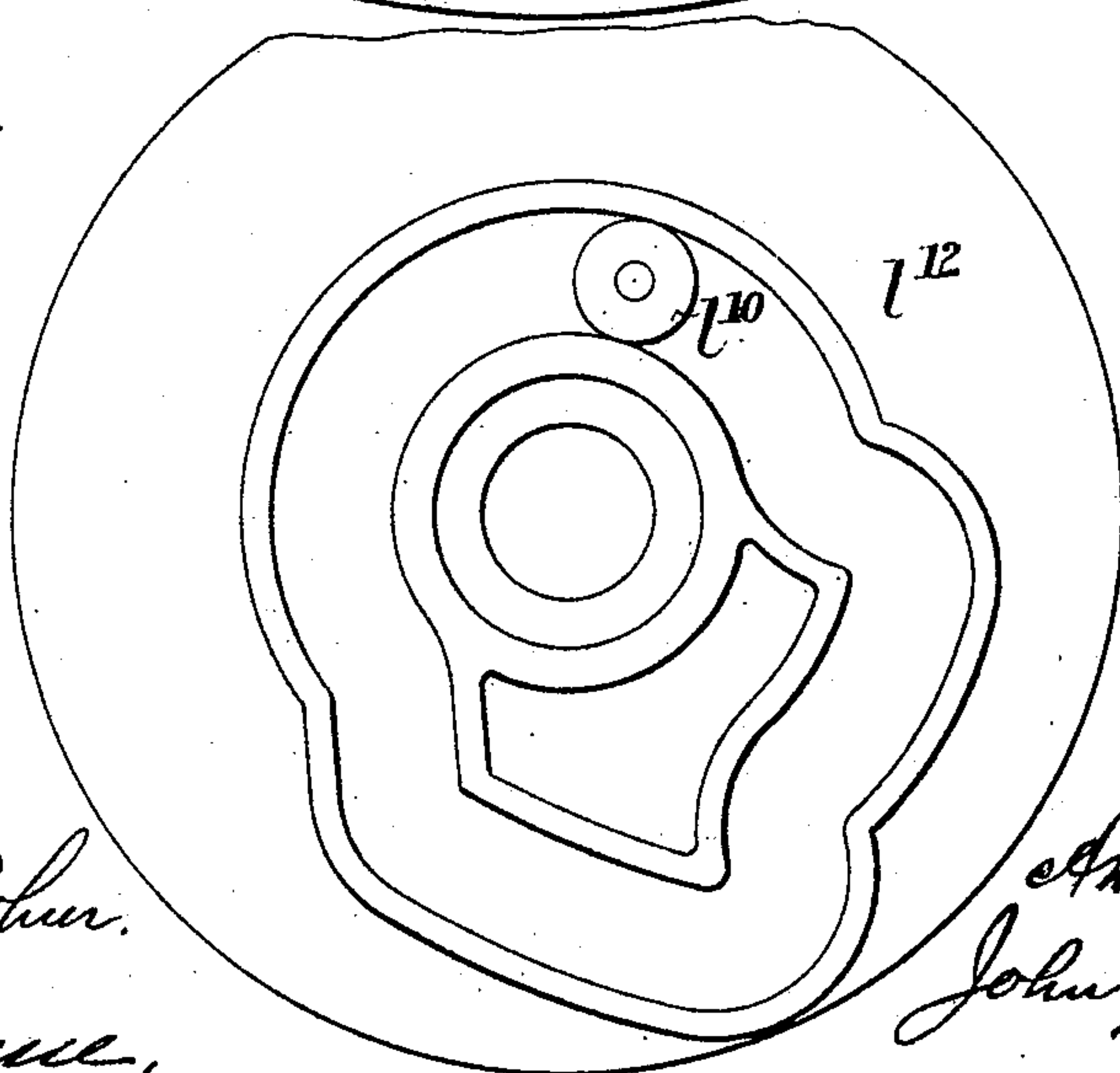
No. 582,398.

Patented May 11, 1897.

*Fig. 52.*



*Fig. 53.*



Witnesses.

*Harry B. Rohrer.*  
*Malcolm Greene,*

Inventor.

*Antoine Siret.*  
*John P. Halstead & Son*  
*his Attys*



# UNITED STATES PATENT OFFICE.

ANTOINE SIRET, OF PARIS, FRANCE.

## LOOM FOR WEAVING PILE FABRICS.

SPECIFICATION forming part of Letters Patent No. 582,398, dated May 11, 1897.

Application filed July 14, 1891. Serial No. 399,450. (No model.) Patented in France May 3, 1890, No. 205,428; in Belgium May 19, 1890, No. 90,610; in Germany May 23, 1890, No. 57,708; in England June 4, 1890, No. 8,659, and in Austria-Hungary October 11, 1890, No. 22,704 and No. 42,592.

*To all whom it may concern:*

Be it known that I, ANTOINE SIRET, a subject of the Queen of Great Britain, residing at Paris, France, have invented new and useful Improvements in Looms for Weaving Pile Fabrics, (patented in France, No. 205,428, dated May 3, 1890; in Belgium, No. 90,610, dated May 19, 1890; in Germany, No. 57,708, dated May 23, 1890; in Great Britain, No. 8,659, dated June 4, 1890, and in Austria-Hungary, No. 22,704 and No. 42,592, dated October 11, 1890,) of which the following is a specification.

This invention relates to the manufacture of carpets, rugs, and other pile fabrics, such as are known as "oriental" carpets or fabrics—that is to say, of carpets or fabrics in which the pile is tied in the body of the fabric by means of the true Persian or oriental knot, which has hitherto been produced or formed by hand in the case of the manufacture of oriental carpets in the looms of the East.

According to my invention I arrange and interweave the ground-warps or binding-threads with the pile-threads by automatic or mechanical means in such a manner as to cause ground-warps or binding-threads to produce the true Persian or oriental knot, and I thereby produce a new manufacture of carpets and fabrics. For this purpose in arranging the ground-warps or binding-threads I separate them into groups of two, alternately in front and behind the point where the knot is to be formed, by means of dividing-combs adapted to be moved up and down and to and fro. In order to form the knot, I make use of what I term "thread-turners" or "loopers." These thread-turners or loopers are made somewhat in the form of small crescents and are provided on their peripheries with grooves adapted to receive the ground-warp or binding-threads. Backward-and-forward and rotary motions are communicated to the loopers by suitable means, and the loopers, acting in combination with the forked teeth of a comb adapted to take hold of the ground-warp threads, form or twist the ground-warp threads into loops, the tension of these threads being slackened for this purpose. Through

the loops thus formed tubes or guides or carriers carrying the pile-threads are now passed in a slanting direction, the pile-threads being held by suitable nippers or holders. The free ends of the pile-threads when they have been passed through the loops are laid hold of by suitable nippers, and the tubes having been withdrawn from the loops and the ground-warp threads having been released by the loopers and forked comb and the tension of or upon the ground-warp threads being renewed, the knot is formed and the pile-thread is cut by a suitable knife or cutting instrument, the top of the batten having a groove to allow of this being done.

Modifications of the mechanism above referred to may be employed for producing true knots, such as are above mentioned, by substituting parts that will act similarly to those I have indicated as being suitable.

In order to enable the invention to be fully understood, I will describe how it can be carried into practice by reference to the accompanying drawings, which illustrate in detail the different parts of apparatus or mechanism suitable for the manufacture of pile-carpets and other like fabrics according to my invention.

Figure 1 is a longitudinal section showing more particularly the general construction of the mechanism for operating the forked comb and one of the dividing-combs. Fig. 2 is a sectional elevation of the mechanism for giving the necessary direction to the pile-thread tubes or carriers. Fig. 2<sup>a</sup> is a plan of part of Fig. 2. Fig. 3 is a sectional elevation of the mechanism for regulating the inclination of the pile-thread nippers and for imparting a lateral motion to the pile-thread tubes or carriers. Figs. 4, 4<sup>a</sup>, 4<sup>b</sup>, and 5 are plans of parts of Fig. 3. Fig. 5<sup>a</sup> is a perspective view of the device shown in Fig. 4<sup>a</sup>. Fig. 6 is an elevation, and Fig. 7 is a plan, of part of the mechanism for operating the thread-turners or loopers. Fig. 8 is an elevation of part of the mechanism employed for giving motion to a cam-shaft hereinafter described. Figs. 9 and 10 are side and edge views, respectively, of one of the thread-turners or loopers. Figs. 11 and 12 are side and edge views, respectively,



of one of the teeth of the dividing-combs. Figs. 13, 14, and 15 are side, edge, and plan views, respectively, of one of the teeth of the forked comb. Figs. 16, 16<sup>a</sup>, and 16<sup>b</sup> are sectional side elevations, and Fig. 17 is a plan, of the pile-thread tubes, guides, or carriers with their nippers or holders. Figs. 18, 20, 22, 24, 26, 28, 30, 32, 33, 34, and 35 are sectional elevations, and Figs. 19, 21, 23, 25, 27, 29, and 31 are plan views, illustrating the various stages of the manufacture. Figs. 36 and 37 are diagrams illustrating the formation of the fabric obtained. Figs. 38 and 39 are side sectional elevations, and Fig. 40 is a plan of the mechanism for nipping the pile-threads. Fig. 41 is a side elevation, partly in section, showing the whole of the mechanism for operating the loopers. Figs. 42 and 42\* combined show an elevation of the mechanism for imparting motion to the pile-thread nippers and to one of the dividing-combs and for producing tension on and slackening the warp-threads. Fig. 43 is a plan of part of Fig. 42\*. Fig. 44 is a sectional side elevation showing the mechanism for imparting motion to the lathe-swords and the mechanism for imparting motion to the mechanism shown in Fig. 2. Figs. 45 and 45\* combined represent a rear elevation showing the driving-pulleys of the loom and the mechanism for imparting motion to the main driving-shaft. Fig. 46 is a side elevation showing the taking-up motion, the letting-off motion, a portion of the mechanism for imparting motion to one of the dividing-combs, the driving-pulleys, and mechanism for imparting motion to the main driving-shaft. Figs. 47 and 47\* combined show a plan showing part of the mechanism for operating the loopers, the forked comb, and one of the dividing-combs, part of the mechanism for operating the nippers, part of the mechanism for operating the pile tubes or carriers, part of the mechanism for operating the lathe-swords, part of the mechanism for operating the other dividing-comb, the mechanism for operating the taking-up motion, and the mechanism for operating the letting-off motion. Figs. 48 to 53 are views of cams hereinafter described.

Similar letters in all the figures indicate similar parts.

The side framing of the loom is indicated by the letters C D E F, and the cross-rails by the letters G H J K.

A A represent the ground-warps or binding-threads, and B B the pile-threads.

*a a*, Figs. 1, 6, 9, 10, and 41, are the thread-turners or loopers; *b*, Figs. 1, 13, 14, and 15, is the forked comb, and *c c'*, Figs. 1, 11, 12, and 42\*, are the dividing-combs. The thread-turners or loopers are constructed somewhat in the form of crescents, as shown clearly in Figs. 9 and 10. They are fixed side by side upon a shaft *d*, whereby they are all caused to rotate together. They are each formed with a groove *e*, which increases in width from the point *f* to the shaft *d*. The motion

of the thread-turners or loopers causes two of the warp-threads to enter this groove before being turned or twisted to form loops.

The forked comb, Figs. 13, 14, and 15, is made by providing the free end of each of its teeth *b* with two lugs *g*, notched at *h* and having small bosses *i*. The two warp-threads which are caused to enter the fork are kept separate and in their place by a central pointed projection *j*.

During the operation of the thread-turners or loopers *a* the warp-threads A are caused to twine around the lugs *g* and are held in the notches *h*. The teeth of the dividing-combs *c c'* are, as shown at Figs. 11 and 12, advantageously formed of flat strips terminating in a point *k*.

The pile-threads B are wound upon rollers or bobbins, the colors of the pile-threads being arranged in accordance with the required design. These rollers or bobbins are each accompanied by a tube-carrier and nipper. (Shown in Figs. 16, 16<sup>a</sup>, 16<sup>b</sup>, and 17.) The rollers or bobbins are successively brought into position by any suitable means—such, for example, as by the use of a revolving drum similar to that described in the specification of United States Patent No. 411,067 of 1889, for carrying the pile bobbins or rollers. The necessary tension may also be given to the pile warp-threads by means of the devices described in the above-mentioned specification or by other suitable means.

The tubes *n*, carrying the pile-threads B, are fixed to an angular carrying-bar *l* and are bent or curved, as shown in Fig. 17. The nippers *m* of the tubes *n* for nipping or holding the pile-threads or tufts B are mounted on the bar *l* and are adapted to oscillate thereon.

Fig. 16<sup>a</sup> shows one of the nippers *m* raised so as to allow the threads B to pass freely through the tube *n*, and in Fig. 16 the nipper *m* is shown in section in the position it occupies when closed and gripping the thread B.

The nipper *m* is held in position by the pegs *m'* and the bands *m''* and can be opened and closed by means of the handle *m'''*, which is not illustrated in Figs. 16 and 16<sup>b</sup>.

Toward each extremity of the carrying-bar *l* is fixed a hammer *i'*, which protects the tubes *n* and prevents their coming in contact with the upper portion of the batten prior to and during the operation of cutting the pile.

The required tube-carrier and nipper can be advantageously brought into the jaws formed by latches *d<sup>12</sup>* and bars *d<sup>6</sup>*, Fig. 2, by means of levers similar to those employed for operating the pile-thread-nipping bars in the specification of the said former United States patent and suitable connections actuated by a cam on the main driving-shaft *p<sup>10</sup>*, Figs. 44, 45, 45\*, and 46, the said levers being provided toward one of their extremities with links *o'*, Figs. 2 and 2<sup>a</sup>. Each link *o'* is pivoted on a stud *o<sup>3</sup>*, the said link carrying toward its other extremity a pin *o<sup>4</sup>*, which



pin  $o^4$  slides upon the bracket  $u^2$ , the said bracket  $u^2$  communicating the required direction to the pin  $o^4$ . The link  $o'$  carries the jaw  $o^5$ , the said jaw  $o^5$  engaging the tube-carrier  $l$ . The jaw  $o^5$  is provided with a spring  $o^6$ , which serves to maintain the tube-carrier  $l$  in its required position.

I have not illustrated the method of inserting the weft, which may be accomplished in any well-known manner, such as by means of shuttles or carriers, and the healds may be operated in any well-known manner, such as by an arrangement of levers deriving their motions from cams on the shaft  $p^{10}$ .  $d'$ , Figs. 2, 44, 47, and 47\*, is a shaft supported by brackets  $d^2$ , attached to the framing of the loom and receiving its motion from a cam  $d^{19}$  on the shaft  $p^{10}$  by means of the roller  $d^{20}$ , revolving on the stud  $d^{21}$ , attached to the bell-crank lever  $d^{22}$ , pivoted on the bracket  $d^{27}$ . The lever  $d^{22}$  carries toward its other extremity the stud  $d^{23}$ , upon which the connecting-rod  $d^{24}$  works freely. The connecting-rod  $d^{24}$ , toward its other extremity, works freely on the stud  $d^{25}$ , mounted on the lever  $d^{26}$ , attached to the shaft  $d'$ . The cam  $d^{19}$  is shown detached in Fig. 48.

Toward each end of the shaft  $d'$  is attached a lever  $d^3$ , and at the upper end of the lever  $d^3$  one end of a connecting-rod  $s^{17}$  is attached by means of a stud  $d^4$ . The other end of the connecting-rod  $s^{17}$  is attached by means of a stud  $d^5$  to the double slotted bent bar  $d^6$ . The slot  $d^8$  at one end of the bar  $d^6$  slides freely upon a stud  $d^7$ , secured to a guide  $k^2$ . The slot  $d^{10}$  at the other end of the bar  $d^6$  slides freely upon a stud  $d^{11}$ , attached to the guide  $k^2$  by means of a bracket. On the outer part of the bar  $d^6$  is pivoted the latch  $d^{12}$ , which, as it approaches the back of the loom, is raised by means of an adjustable stud  $d^{13}$ , and is prevented from being raised too far by means of a stud  $d^{14}$ , the studs  $d^{13}$  and  $d^{14}$  being supported by a bracket  $d^{15}$ , attached to the guide  $k^2$ . As the latch  $d^{12}$  advances toward the front of the loom it is closed by means of a guide-rod  $d^{16}$ , one end of which is secured to the latch  $d^{12}$  by means of a stud  $d^{17}$  and the other end to the bar  $d^6$  by means of a stud  $d^{18}$ . When the latch  $d^{12}$  is lowered, it embraces the tube-carrier  $l$ , and the required direction is imparted to the latch  $d^{12}$  and tube-carrier  $l$  by means of the slots  $d^8$  and  $d^{10}$  in the bar  $d^6$ .

The necessary movements of the tube-carrier from right to left and from left to right are effected by means of guides  $f'$ , Figs. 3 and 4, attached to the brackets  $u^2$ , the said guides  $f'$  coming into contact with the extremities of the tube-carrier  $l$  and giving the required lateral movement as the tube-carrier advances to or retires from the front of the loom. The tube-carrier is advanced and retired by means of the latch  $d^{12}$ , actuated by the cam  $d^{19}$  on the shaft  $p^{10}$ , and the connections hereinbefore described.

To-and-fro and rotary movements are imparted to the shaft  $d$  of the thread-turners or loopers. For this purpose I advantageously employ the following means, videlicet: On each side of the loom a plate or disk  $o$  is provided, Figs. 1, 6, 7, and 41, the said plate being secured to a shaft  $o^2$ , which shaft is carried by brackets suitably attached to the framing of the loom. Motion is communicated to the shaft  $o^2$  on each side of the loom by means of a rack-rod  $p$ , carrying the rack  $p'$ , engaging a pinion  $q$ , fixed to the disk  $o$ . On each disk  $o$  is pivoted one end of a jointed connecting-rod  $r$ , the opposite end of which carries the shaft  $d$  of the thread-turners or loopers  $a$ , so that as the disks  $o$  partially revolve the loopers are caused to advance and retire, the required direction being imparted to the shaft  $d$  by means of the guide-slot  $w'$ , formed in the bracket  $u^2$ , as shown in Figs. 2, 3, and 41, attached to the framing at each side of the loom by means of the bracket  $w^3$ . At each end of the shaft  $d$  is attached a pinion  $t$ , the teeth of the said pinion gearing into the teeth of the rack  $s'$ , the said rack being attached to the connecting-rod  $s$ . Each pinion  $t$  is kept in gear with its rack  $s'$  by means of a plate  $s^2$ , the said plate being provided with a slot  $s^3$ , in which the shaft  $d$  is free to move as required.

The necessary rotary motion is communicated to the shaft  $d$  by means of the connecting-rods  $s$ , operating through the medium of the racks  $s'$  and pinions  $t$ . Toward the other extremity of each connecting-rod  $s$  is fixed an adjusting-block  $s^4$ , Fig. 41, each said adjusting-block being fixed to a bell-crank lever  $s^5$  by means of a stud  $s^6$ . The bell-crank lever  $s^5$  is pivoted on a stud  $s^7$ , attached to the framing of the loom. To the other arm of each bell-crank lever  $s^5$  is attached a stud  $s^8$ . The said stud carries a roller  $s^9$ . This roller works freely in a slot  $s^{10}$ , formed in a swing-lever  $s^{11}$ . The swing-lever  $s^{11}$  is pivoted on a stud  $s^{12}$ , suitably attached by means of a supporting-brackets  $s^{13}$  to the framing of the loom. Toward the other extremity of the swing-lever  $s^{11}$  is attached by means of a stud  $s^{14}$  a jointed connecting-rod  $s^{15}$ . The other extremity of the jointed connecting-rod  $s^{15}$  is attached to the disks  $o$  by means of studs  $s^{16}$  and receives motion from the movement of the disks  $o$ .

To the lower end of each rod  $p$  is hinged a connecting-rod  $p^2$ , operating a toothed sector  $u$ , Fig. 8, the said sector being pivoted on the stud  $u^7$ , attached to the framing of the loom by means of a bracket  $u^4$ .

The necessary up-and-down motion is communicated to the rack-rod  $p$  by means of a link  $p^3$ , attached thereto by a stud  $p^4$ . The other extremity of the link  $p^3$  is attached to a lever  $p^5$  by means of a stud  $p^6$ . The lever  $p^5$  is attached to a shaft  $p^{11}$ . To the shaft  $p^{11}$  is attached a lever  $p^7$ , carrying a stud  $p^8$  and a roller  $p^9$ . The said roller  $p^9$  works on a



cam  $p^{13}$ , (part of which is shown by dotted lines in Fig. 41,) mounted on the shaft  $p^{10}$ . The cam  $p^{13}$  is also shown detached in Fig. 49.

Each toothed sector  $u$  rotates a cam-shaft  $v$ , Figs. 1 and 8, through the medium of a pinion  $x$ , the cam-shaft  $v$  being supported by brackets  $v'$ , attached to the framing of the loom. The cams mounted on the cam-shaft  $v$  actuate the forked comb  $b$  and the dividing-combs  $c$  and  $c'$ . The forked comb  $b$  has an oscillating movement, as well as a rising-and-falling movement, communicated to it. The forked comb  $b$  is attached to a shaft  $b'$ , which works freely in bearings toward the upper extremity of the connecting-rods  $y$ , one of which is situated toward each extremity of the shaft  $b'$ . At the lower extremity of each connecting-rod  $y$  is a slotted bar  $b^2$ , the slot working freely over the shaft  $v$ . To each said slotted bar is secured a stud  $b^{11}$ , carrying a roller  $b^{12}$ , actuated by means of a cam  $y'$  on the shaft  $v$ , whereby a rising-and-falling motion is imparted to the connecting-rod  $y$ . In order to communicate the necessary oscillating motion to the comb  $b$ , I attach a lever  $b^3$  toward each extremity of the shaft  $b'$ , the other extremity of the said lever carrying a stud  $b^4$ , on which is pivoted the upper extremity of the connecting-rod  $a'$ . The lower extremity of the connecting-rod  $a'$  is connected by means of a stud  $b^5$  to one end of a lever  $b^6$ , the other end of the lever  $b^6$  being pivoted on a stud mounted on a bracket attached to the framing of the loom. The lever  $b^6$  comes into contact with a cam  $a^2$  on the shaft  $v$  and by this means transmits the necessary oscillating motion to the comb  $b$ . Toward one extremity of the shaft  $b'$  is attached a cranked lever  $b^9$ , actuated by means of a spiral spring  $b^{10}$  and a cord  $b^{14}$  passing over a pulley  $b^{15}$ , which serve to bring back the comb  $b$  to its position of rest.

Toward each end of the batten  $f^{11}$  are attached guides  $c^2$ , upon which the comb  $c'$  is free to slide up and down. The dividing-comb  $c'$  is supported by projections on the upper extremities of each of the comb-holders  $w$ . The comb-holders  $w$  work freely in guides  $g'$ , attached to the lathe-swords  $f^7$ .

The comb-holders  $w$  carry a pin  $i'$ , which, as the batten  $f^{11}$  advances and retires, rides over an inclined plane  $j'$ , thereby preventing the comb  $c'$  from striking the comb  $b$ , the inclined plane being attached to the framing of the loom by means of the bracket  $j^2$ . A rod  $h'$  is provided, having at its upper end a projection  $h^6$ , which comes in contact with the dividing-comb  $c'$  when the rod  $h'$  is moved upward. A forked guide  $h^2$  is attached to the lower end of the rod  $h'$  and slides over the shaft  $v'$ . To the forked guide  $h^2$  is attached a stud  $h^3$ , carrying a roller  $h^4$ , which is operated by a cam  $h^5$ , thus giving an up-and-down motion to the rod  $h'$  and thereby imparting the necessary upward movement of the dividing-comb  $c'$  for effecting the separation of the ground warp-threads A.

The required direction is imparted to the lathe-swords  $f^7$  by means of inclined planes  $f^{12}$ , Fig. 44, secured to the framing by brackets  $f^{13}$  and  $f^{14}$  toward their lower extremities, the said lathe-swords  $f^7$  carrying studs  $f^{15}$ , upon which rollers  $f^{16}$  revolve freely in contact with the inclined planes  $f^{12}$ . The lathe-swords are provided with slots  $f^{17}$ , in which studs  $f^{18}$  work freely, the said studs being supported by brackets  $f^{19}$ , attached to the framing of the loom. To the lathe-swords  $f^7$  plates  $f^{20}$ , Figs. 47 and 47\*, are attached toward one extremity, and toward the other extremity of the plates are attached brackets  $f^{21}$ , which are connected to connecting-rods  $f^{22}$  by means of pins  $f^{23}$ . The connecting-rods  $f^{22}$  carry toward their other extremities pins  $f^{24}$ , by which they are connected to arms  $f^{25}$ , Figs. 44, 45, and 45\*. The arms  $f^{25}$  are attached to a shaft  $f^{26}$ , to which is attached a lever  $f^{27}$ , which lever is connected toward its lower extremity by means of a pin  $f^{28}$  to a connecting-rod  $f^{29}$ . The connecting-rod  $f^{29}$  is connected to a lever  $f^{30}$  by a pin  $f^{31}$ , the lever  $f^{30}$  being pivoted on a stud  $f^{32}$ , attached to the framing F. The lever  $f^{30}$  is connected toward its center to a connecting-rod  $f^{33}$  by means of a pin  $f^{34}$ , the said connecting-rod being connected by means of a pin  $f^{35}$  to a two-armed lever  $f^{36}$ , which lever  $f^{36}$  is pivoted on a stud  $f^{37}$ , attached to the framing F. To the second arm of the lever  $f^{36}$  is attached a stud  $f^{38}$ , carrying a roller  $f^{39}$ , the said roller being operated by a cam  $f^{40}$ . The cam  $f^{40}$  is shown detached in Fig. 50.

$w'$ , Figs. 41, 42, 43, 47, and 47\*, is the warp-beam carrying the ground warp-threads, the said beam being mounted in brackets  $z'$ , carried by supports  $z^2$ , secured to the framing of the loom. Toward one extremity of the beam-shaft, Figs. 46 and 47\*, is attached a pulley  $z^6$ , round which is passed a rope  $z^7$ , the said rope passing over pulleys  $z^8$  and  $z^9$  and carrying weights  $z^5$  and  $z^{10}$ . Toward the other extremity of the beam-shaft a collar  $z^{11}$ , Fig. 43, is fixed by means of a set-screw  $z^{12}$ . The collar  $z^{11}$  has two recesses  $z^{13}$  opposite each other and is provided with a circular recess  $z^{14}$ .

$z^{15}$  is a portion of a clutch-box carrying a boss and two pins  $z^{16}$ , the said boss sliding freely in the circular recess  $z^{14}$ , the two pins  $z^{16}$  entering the recesses  $z^{13}$ . The other portion of the clutch-box carries a pulley  $z^{17}$ , to which is secured a strap or band  $z^3$ , Fig. 42, attached to a lever  $z$ , pivoted on a stud  $z^{18}$ , supported by a bracket  $z^{19}$ , the said lever  $z$  receiving its motion from a cam  $z^{25}$  (partly shown in dotted lines) on the shaft  $p^{10}$  through a roller  $z^{21}$ , carried by a stud  $z^{22}$  on the lever  $z$ . The cam  $z^{25}$  is shown detached in Fig. 51.

The necessary amount of slack for the action of the loopers is let off the beam  $w'$  by the action of the lever  $z$  and a strap or band  $z^3$  and is temporarily taken up by the tension-rod  $t'$ . When the beam  $w'$  is released by the strap or band  $z^3$ , the warp-threads are instantly drawn tight by the action of the weight



5  $z^5$ . The required tension is communicated to the tension-rod  $t'$  by means of weights  $z^4$  at each side of the loom. The tension is relieved by means of the bar  $u^6$ , attached to the studs  $u^5$ , Figs. 1 and 8, mounted on the sectors  $u$ , which bar in its upward motion comes in contact with blocks  $z^{23}$ , secured to rods  $z^{24}$ , and lifts the weights  $z^4$ , thereby releasing the tension-rod  $t'$ .

10 The dividing-comb  $c$  is mounted upon a shaft  $c^{15}$ , Figs. 1 and 42, the said shaft being supported at each end by a horizontal guide-bar  $c^3$ , secured to the framing of the loom by a bracket  $c^4$ . To the horizontal guide-bar  $c^3$ 
 15 is attached a stud  $c^5$ , upon which is pivoted a curved guide-bar  $e'$  in such a position that the shaft  $c^{15}$  is free to slide backward from the front of the loom and to pass under the pivoted end of the curved guide-bar  $e'$ . As
 20 the shaft  $c^{15}$  approaches the other end of the horizontal guide-bar  $c^3$  it raises the free end of the curved guide-bar  $e'$  and passes under it, the curved guide-bar  $e'$  then resuming its former position, so that its end again rests upon
 25 the horizontal guide-bar.

When the shaft  $c^{15}$ , in its motion toward the front of the loom, comes in contact with the extremity of the curved end of the guide-bar  $e'$ , which rests upon the horizontal guide-bar  $c^3$ ,
 30 it rides up and passes over it until it again reaches the opposite end of the curved guide-bar, when it falls onto the horizontal guide-bar and is again in position to move backward from the front of the loom.

35 To each end of the shaft  $c^{15}$  is attached one end of a connecting-rod  $c^6$ . The other end of the connecting-rod  $c^6$  is attached to one arm of a bell-crank lever  $c^7$  by means of a stud  $c^{14}$ , the said bell-crank lever being attached to a
 40 shaft  $c^8$ , near one extremity thereof, the said shaft carrying toward its other extremity a lever  $c^{17}$ , Fig. 47, for actuating the connections for controlling the comb  $c$  at the other side of the loom. On the other arm of the
 45 bell-crank lever  $c^7$  is pivoted a link  $c^9$  by means of a stud  $c^{10}$ . The other end of the link  $c^9$  is pivoted on a stud  $c^{11}$ , attached to one end of a lever  $c^{12}$ , working freely on the shaft  $p^{11}$ . At the other end of the lever  $c^{12}$  is
 50 attached a roller  $c^{13}$ , actuated by a cam  $c^{16}$  (partly shown in dotted lines in Fig. 42) on the shaft  $p^{10}$ . The cam  $c^{16}$  is shown detached in Fig. 52.

At each side of the loom the guide  $k^2$  is suitably secured to a cross-rail  $k^{10}$ , the said cross-rail being attached to the framing of the loom. The ends of a shaft  $k^3$  move backward and forward in the guide  $k^2$  when actuated by a lever  $l'$ , situated at each side of the loom.

60 The shaft  $k^3$  carries the nippers  $k'$ , as shown in Figs. 38, 39, and 40, which lay hold of the free ends of the pile-threads  $B$  when they have passed through the loops formed by the loopers  $a$ . In Fig. 38 the jaws of the nippers  $k'$ 
 65 are shown open and in Fig. 39 they are shown closed. The said jaws of the nippers  $k'$  are

mounted on a spring  $k^4$ , secured to the shaft  $k^3$  by means of set-screws  $k^5$ . The two jaws are brought together by means of an angle-bar  $k^6$ , pivoted at  $k^9$  in a staple  $k^8$ . To the
 70 angle-bar  $k^6$  are secured handles  $k^7$  to facilitate the opening and closing of the jaws  $k'$  by hand, or, as will be obvious, the jaws may be opened and closed by mechanical means. The nippers  $k'$  are moved backward and forward
 75 toward the back and front of the loom by means of the levers  $l'$ , Figs. 1 and 42, which embrace the shaft  $k^3$  in slots at their upper ends. At their lower ends the levers  $l'$  are attached to a cross-shaft  $l^2$ , supported by
 80 brackets  $l^3$ , attached to the framing of the loom.

To the shaft  $l^2$ , Fig. 42, is secured a lever  $l^4$ , the upper end of which carries a stud  $l^5$ , upon which is pivoted one end of a connecting-rod  $l^6$ , Figs. 42 and 47. The other end of the connecting-rod  $l^6$  is pivoted on a stud  $l^7$ ,
 85 carried by the end of one arm of a bell-crank lever  $l^8$ , pivoted on the shaft  $p^{11}$ . To the end of the other arm of the said bell-crank lever
 90 is attached a stud  $l^9$ , carrying a roller  $l^{10}$ , actuated by a cam  $l^{12}$  (partly shown in dotted lines) on the shaft  $p^{10}$ . The cam  $l^{12}$  is shown detached in Fig. 53.

On one end of the shaft  $k^3$ , Figs. 1, 3, 4<sup>a</sup>,
 95 38, 39, 40, and 42, is a lever  $f^2$ , Figs. 3, 4<sup>a</sup>, and 5<sup>a</sup>, which is provided on its free end with a pin  $f^3$ , parallel to the said shaft. To one of the guides  $k^2$  is attached what I term a "switch-guide"  $f^4$ , which is provided with a spring
 100  $f^5$  and a pivoted guide  $f^6$ , the said spring and guide being also shown in detached plan views at Figs. 4<sup>b</sup> and 5, respectively. When the nippers  $k'$  are at the front of the loom, the pin  $f^3$  is underneath both the spring  $f^5$  and
 105 guide  $f^6$ , and as the nippers pass toward the back of the loom the pin  $f^3$  passes along the inclined guide  $f^4$  and lifts the pivoted guide  $f^6$  as it passes under it. After the passage of the pin  $f^3$  the pivoted guide  $f^6$  resumes its position, and when the nippers return toward
 110 the front of the loom the pin  $f^3$  passes over the pivoted guide  $f^6$  and under the spring  $f^5$  until it reaches the point at which the spring  $f^5$  and guide  $f^6$  are partially cut away and
 115 cross one another, when it lifts the spring  $f^5$  and passes through the space where the pivoted guide  $f^6$  is cut out and falls upon the fixed guide  $f^4$ .

The above-described movements of the pin
 120  $f^3$  and lever  $f^2$  regulate the inclination of the nippers.

After weaving the cloth is drawn off by the breast-roller  $n^2$ , mounted on the shaft  $n^4$ , the said shaft  $n^4$  carrying toward one extremity
 125 the worm-wheel  $n^3$ , Figs. 46 and 47. Motion is imparted to the worm-wheel  $n^3$  by means of a worm  $n^5$ , attached to a shaft  $n^6$ , the said shaft  $n^6$  carrying the sliding portion of a toothed clutch  $n^7$ , which is thrown into and
 130 out of gear by means of the handle  $n^8$ , the other portion of the clutch-box  $n^7$  being at-



tached to a shaft  $n^9$ , which carries toward its lower extremity a worm-wheel  $n^{10}$ . The shafts  $n^6$  and  $n^9$  are supported by brackets  $n^{12}$ ,  $n^{13}$ , and  $n^{14}$ , attached to the framing E. The worm-wheel  $n^{10}$  engages with a worm  $n^{11}$ , carried by the main driving-shaft  $p^{10}$ .

To the main driving-shaft  $p^{10}$  is attached a spur-wheel  $p^{15}$ , Figs. 45 and 46, engaging with a pinion  $p^{16}$ , attached to the shaft  $p^{17}$ , the said shaft being supported by the bearing  $p^{18}$  in the framing E and the bracket  $p^{19}$ , attached to the framing C. The shaft  $p^{17}$  carries a fast pulley  $p^{20}$  for driving the loom and a loose pulley  $p^{21}$ .

The operation of the mechanism is as follows: When the machine is at rest, the warp-threads A are parallel and the parts are in the position shown in Fig. 1.

First position, Figs. 18 and 19: The links  $o'$ , Figs. 2 and 2<sup>a</sup>, in their jaws  $o^5$  draw along the bar  $l$  with the tubes  $n$ , containing the woolen or pile threads B, the comb  $c$  advances and rises and divides the warp-threads A into groups of two. The beam  $w'$ , Fig. 42, on which the warp-threads A are wound, is slackened and a certain length of the warp-threads is unwound by the action of the bent lever  $z$  and strap or band  $z^3$ , the tension-rod  $t'$  taking up the slack and assuming the position shown in Fig. 18.

Second position, first stage, Figs. 20 and 21: The thread-turner or looper  $a$  advances and commences to turn. The comb  $b$  rises and oscillates and each tooth thereof takes hold of a group of two of the threads, which have been prepared, as above stated, by the dividing-comb  $c$ . A little before the thread-turner or looper reaches the warps A the dividing-comb  $c'$  rises and separates the threads into groups of two, but in an opposite manner to the first comb  $c$ , as shown in Fig. 21.

Second position, second stage, Figs. 22 and 23: The warp-threads A are completely looped or turned by the thread-turners or loopers  $a$ , the tension on the warp-threads A being reduced by the lifting of the weights  $z^4$  by means of the bar  $u^6$  and sector  $u$ , and the threads pass into and are held in the notches  $h$  of the comb  $b$ . The combs  $c$ ,  $c'$ , and  $b$  remain in the position which they previously occupied. Fig. 23 clearly shows how the warp-threads are looped around the thread-turners or loopers and the comb with the forked teeth.

Third position, first stage, Figs. 24 and 25: The tubes  $n$  advance and enter the loops formed by the thread-turners or loopers and comb with forked teeth, both of which remain stationary. The dividing-comb  $c$  is lowered beneath the fabric and the comb  $c'$  remains stationary.

Third position, second stage, Figs. 26 and 27: The tubes  $n$  completely pass through the loops formed by the thread-turners or loopers and are moved toward the right hand a distance proportionate to the quality of fabric

which is to be produced, the wool or pile threads B entering at one side of the thread-turners or loopers and leaving at the other side, thus traversing in a slanting direction the loops formed by the warp-threads. The ends of the woolen or pile threads which project from the tubes are nipped in the jaws of the nipper  $k'$ . The combs  $b$   $c$   $c'$ , as well as the thread-turners or loopers, remain stationary, as before—that is to say, the warp-threads A do not move.

Third position, third stage, Figs. 28 and 29: The nipper or holder  $m$  is opened and the tubes  $n$  move back, thus presenting a length of wool.

Fourth position, first stage, Figs. 30 and 31: The nipper  $k'$  advances over the front of the fabric, the tubes  $n$  also advance, and the wool or pile thread is thereby slackened. The comb  $c'$  descends, the warp-threads A are again tightened by means of the weight  $z^5$ , the lever  $z$  having slackened the belt  $z^3$  to enable this to take place, and the thread-turner or looper  $a$  and comb  $b$  return to their first position. As shown in Fig. 31, the result of the tension of the warp-threads A is to form the knot in the woolen or pile threads B around the said warp-threads.

Fourth position, second stage, Fig. 32: The tubes  $n$  are drawn back while the nipper  $m$  is still open. The batten  $f^{11}$  is moved forward against the fabric, and during this time the nipper  $k'$  is inclined in order to regulate the height of the woolen threads or pile.

Fourth position, third stage, Fig. 33: The nipper  $m$  of the tubes  $n$  is again closed. The knife or cutting instrument (not shown in the drawings) is passed, by hand or by mechanical means, over the part of the pile-threads which is immediately over the groove on the top of the batten  $f^{11}$ , so as to sever the said threads, and the nipper  $k'$  is then opened.

Fifth position, first stage, Fig. 34: The tubes  $n$  move back, the nipper  $k'$  passes back over the front of the fabric, the heald  $x'$  rises while the heald  $x^2$  falls, and the weft-thread is passed in.

Fifth position, second stage, Fig. 35: The heald  $x'$  falls while the heald  $x^2$  rises and another weft-thread is passed in. The comb  $c$  then comes back near to the batten and the hereinbefore-described operations are repeated, and so on, the kind of weaving produced being illustrated on an enlarged scale in Figs. 36 and 37.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim in the manufacture of pile fabrics of the kind known as "oriental" carpets or fabrics is—

1. In a loom for weaving pile fabrics of the kind specified, the combination of dividing-combs disposed relatively to each other as set forth, mechanism as described serving to impart to the combs a horizontal and a vertical



movement, devices for looping the ground warp-threads of the fabric, devices for inserting the tuft, and means for actuating said devices, all substantially as and for the purposes set forth.

2. In a loom for weaving pile carpets and other like fabrics of the kind specified, the combination with the described dividing-combs, of devices for operating said combs as set forth, crescent-shaped thread-turners or loopers having on their peripheries grooves for receiving the ground warp-threads to be converted into loops, tuft-inserting devices, and devices substantially as described for imparting to said loopers forward-and-backward and rotary movements to form loops in said warp-threads, all substantially as set forth.

3. In a loom for weaving pile carpets and other like fabrics, the combination with the thread-turners and means for actuating the same, and with the dividing-combs and means for actuating the same, of a comb having teeth provided with forked ends adapted to hold the ground-warps separately as described while they are being twisted or formed into loops, and tuft-inserting devices and means for actuating the same, all substantially as above set forth.

4. In a loom for weaving pile carpets and other like fabrics of the kind herein specified, the means for forming the loops, the tubes for inserting the tufts in the ground-warps and the described means for releasing the ground-warps, in order to allow of slackening the threads to the required extent for the formation of loops and for placing them in tension after the passage of the tubes carrying the pile-threads, consisting in the combination with the warp-beam, of lever  $z$ , strap

$z^3$  attached thereto, pulleys  $z^6$   $z^8$  and  $z^9$ , rope  $z^7$  passing around said pulleys, weights  $z^5$  and  $z^{10}$  carried by said rope, and tension-rod  $t'$  to take up the slack, all substantially as hereinbefore described.

5. In a loom for weaving pile carpets and other like fabrics of the kind herein specified, the tuft-inserting mechanism, and the herein-described mechanism for imparting to-and-fro and rotary movements to the thread-turners or loopers, consisting in the combination of looper-shaft  $d$ , shaft  $o^2$  carrying the disks  $o$ , pinion  $q$  fixed to disk  $o$ , rack-rod  $p$ , carrying a rack  $p'$  engaging said pinion, connecting-rods  $r$  pivoted respectively on the disks  $o'$ , pinions  $t$  on shaft  $d$ , rack  $s'$ , rod  $s$  to which said rack is attached, and slotted plate  $s^2$  in which shaft  $d$  is free to move and serving to keep pinion  $t$  in gear with rack  $s'$ , all substantially as shown and described.

6. In a loom for weaving pile carpets and other like fabrics of the kind herein specified, the herein-described mechanism for actuating the pile-thread tubes or carriers and causing them to pass in a slanting direction through the loops of the warp-threads, consisting in the combination with said tubes, of the thread-turners and their actuating mechanism, and with the dividing-combs and their actuating mechanism, of means as described for advancing the tubes to enter and pass through the loops, and means as described for moving them sidewise while the thread-turners and the dividing-combs remain stationary.

ANTOINE SIRET.

Witnesses:

ROBT. M. HOOPER,  
MISHEL COQUARO.