

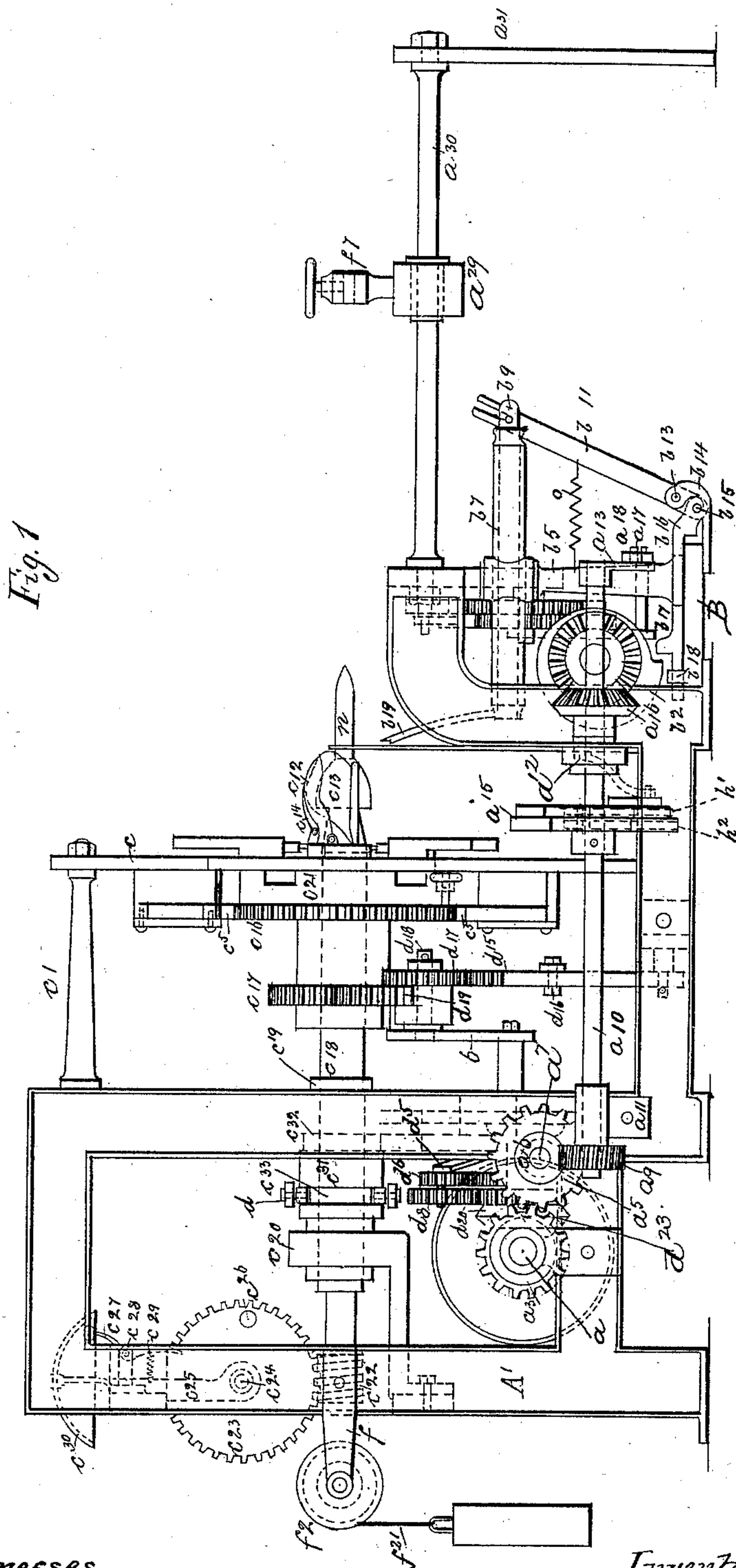
(No Model.)

9 Sheets—Sheet 1.

B. SANER.  
HEDDLE MACHINE.

No. 426,473.

Patented Apr. 29, 1890.



Witnesses  
Max Lehn  
Herman Gillman

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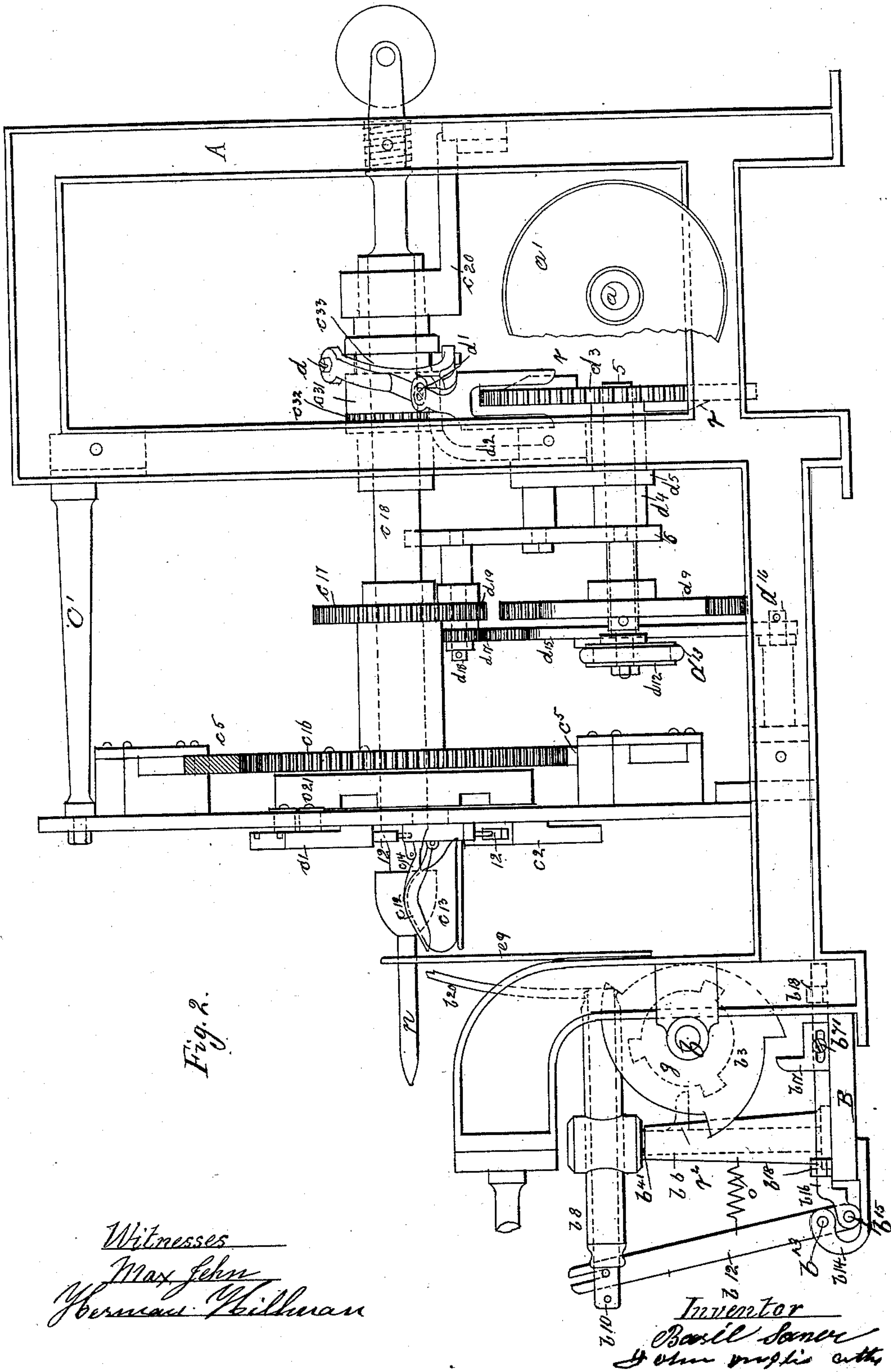
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9 Sheets—Sheet 2.

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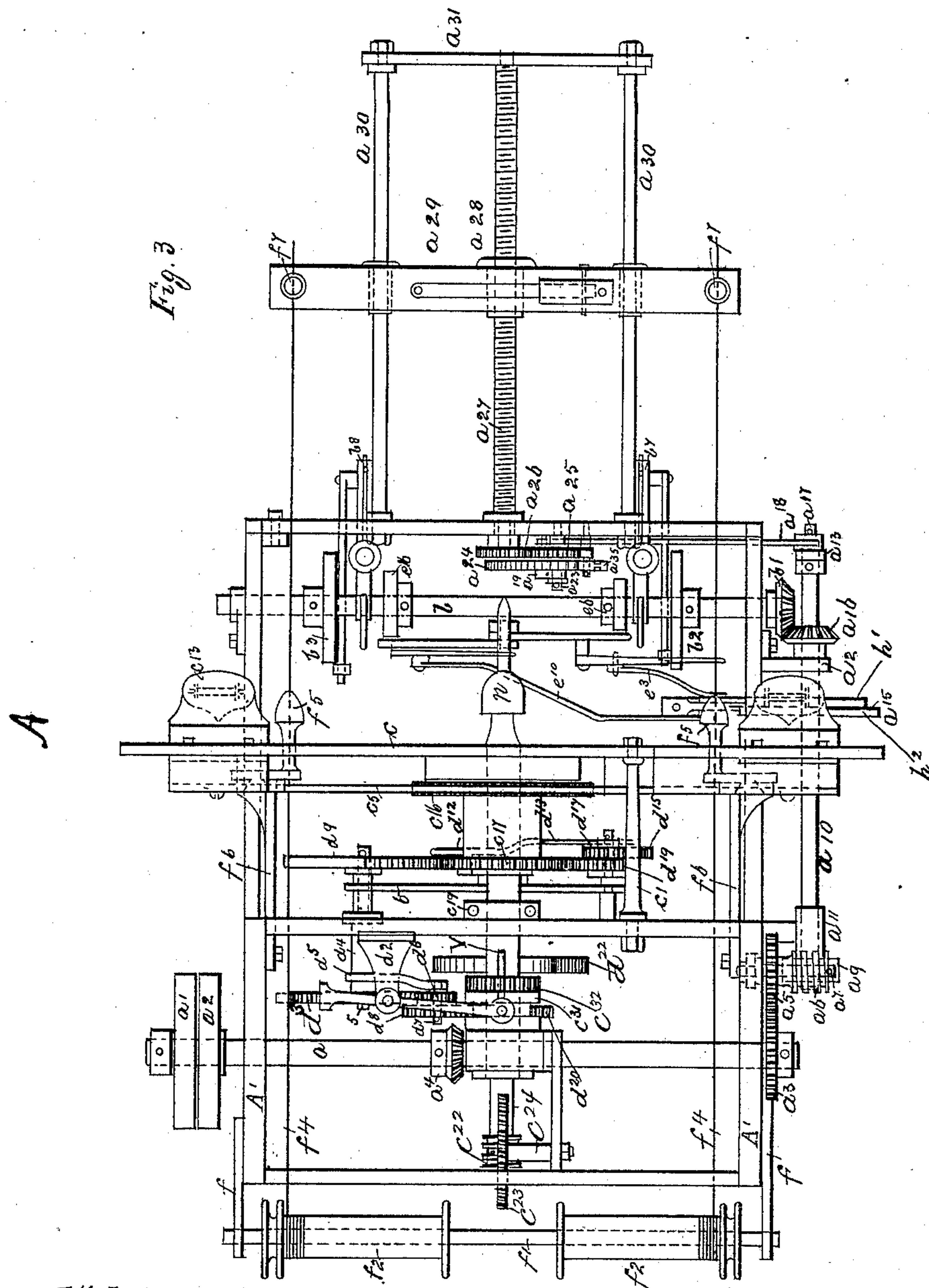
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9 Sheets—Sheet 3.

B. SANER.  
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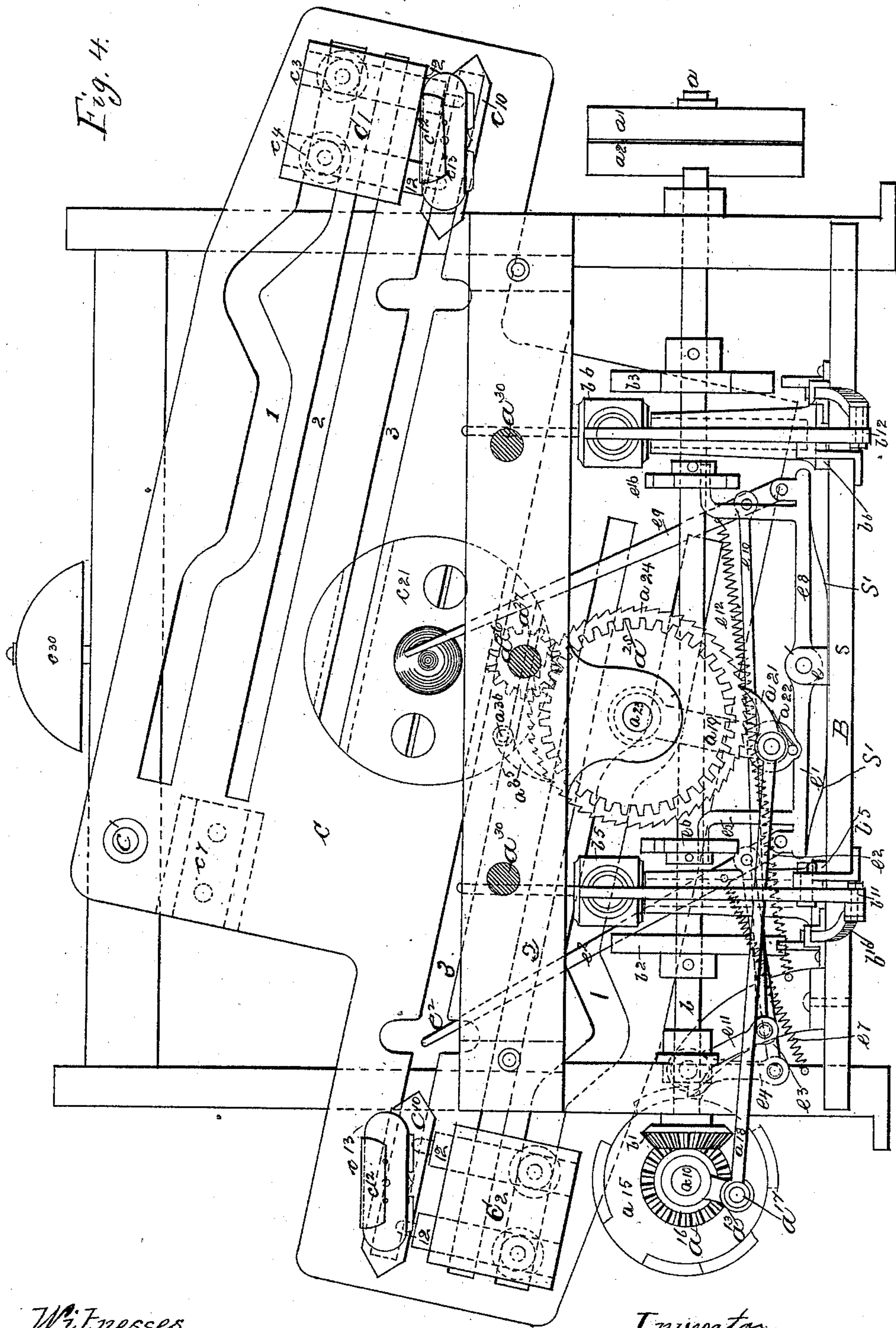
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9 Sheets—Sheet 4.

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Witnesses  
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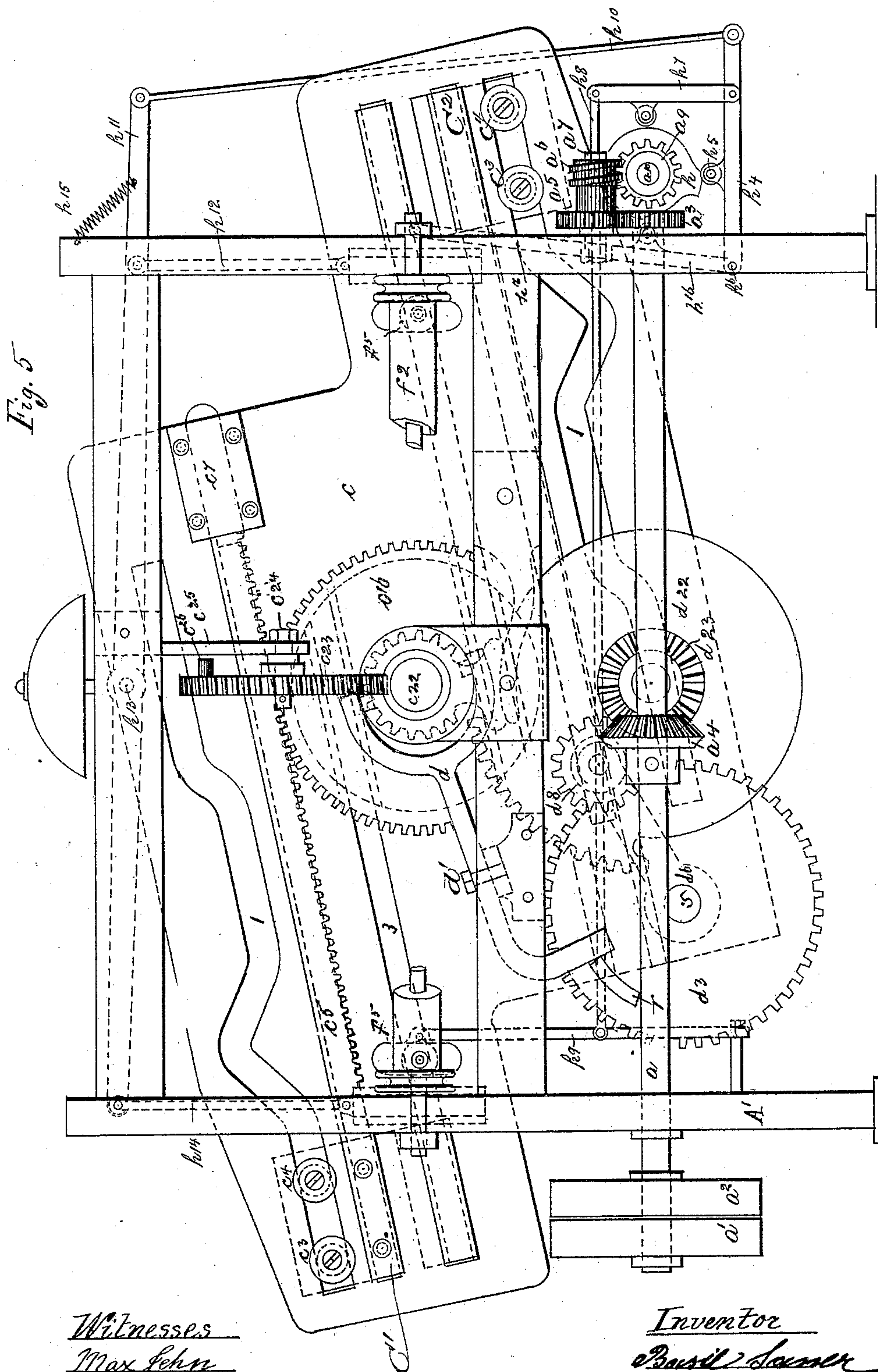
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9 Sheets—Sheet 5.

B. SANER.  
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No. 426,473.

Patented Apr. 29, 1890.



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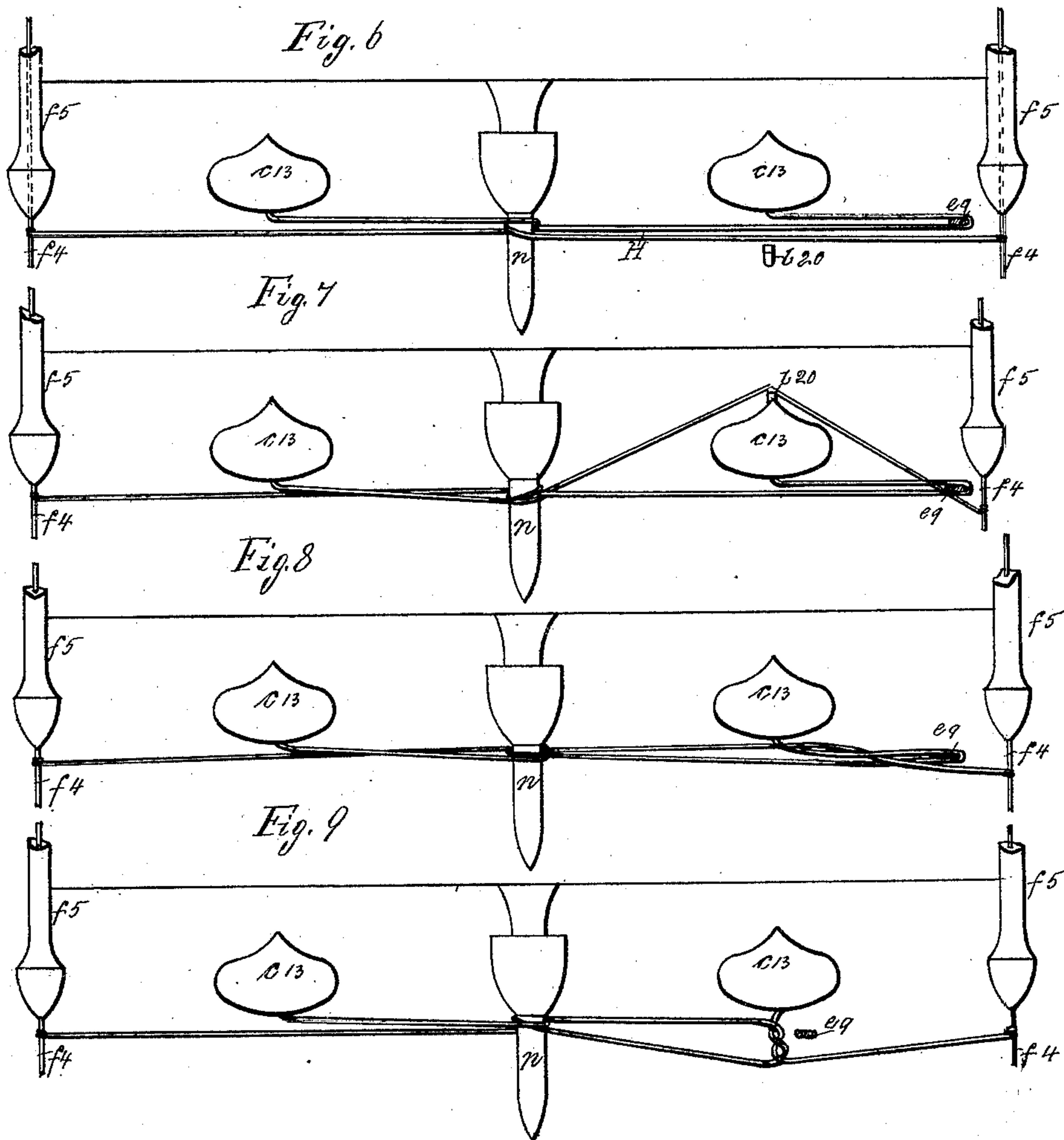
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9 Sheets—Sheet 6.

B. SANER.  
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No. 426,473.

Patented Apr. 29, 1890.



Witnesses  
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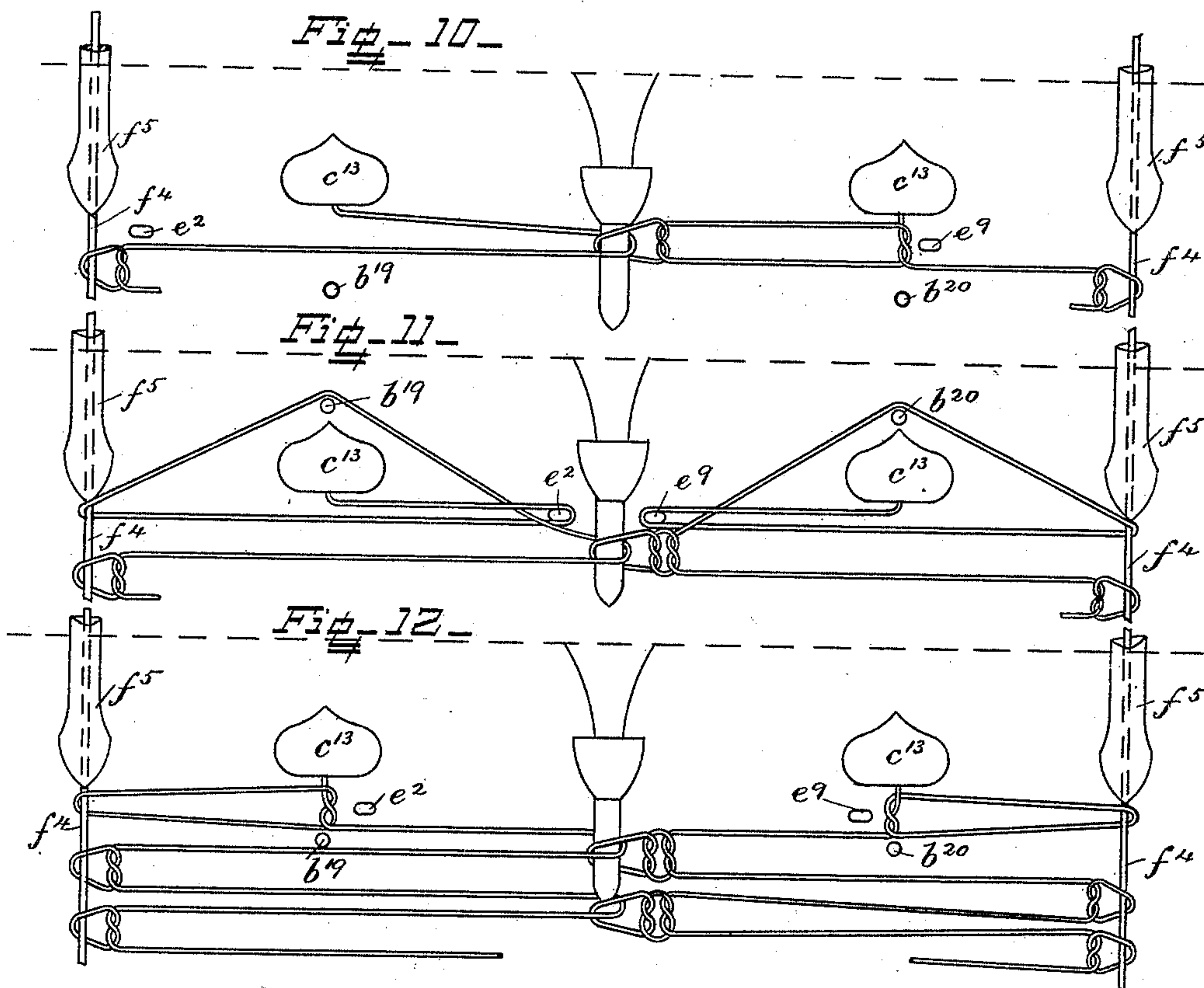
(No Model.)

9 Sheets—Sheet 7.

B. SANER.  
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No. 426,473.

Patented Apr. 29, 1890.



Witnesses

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(No Model.)

9 Sheets—Sheet 8.

B. SANER.  
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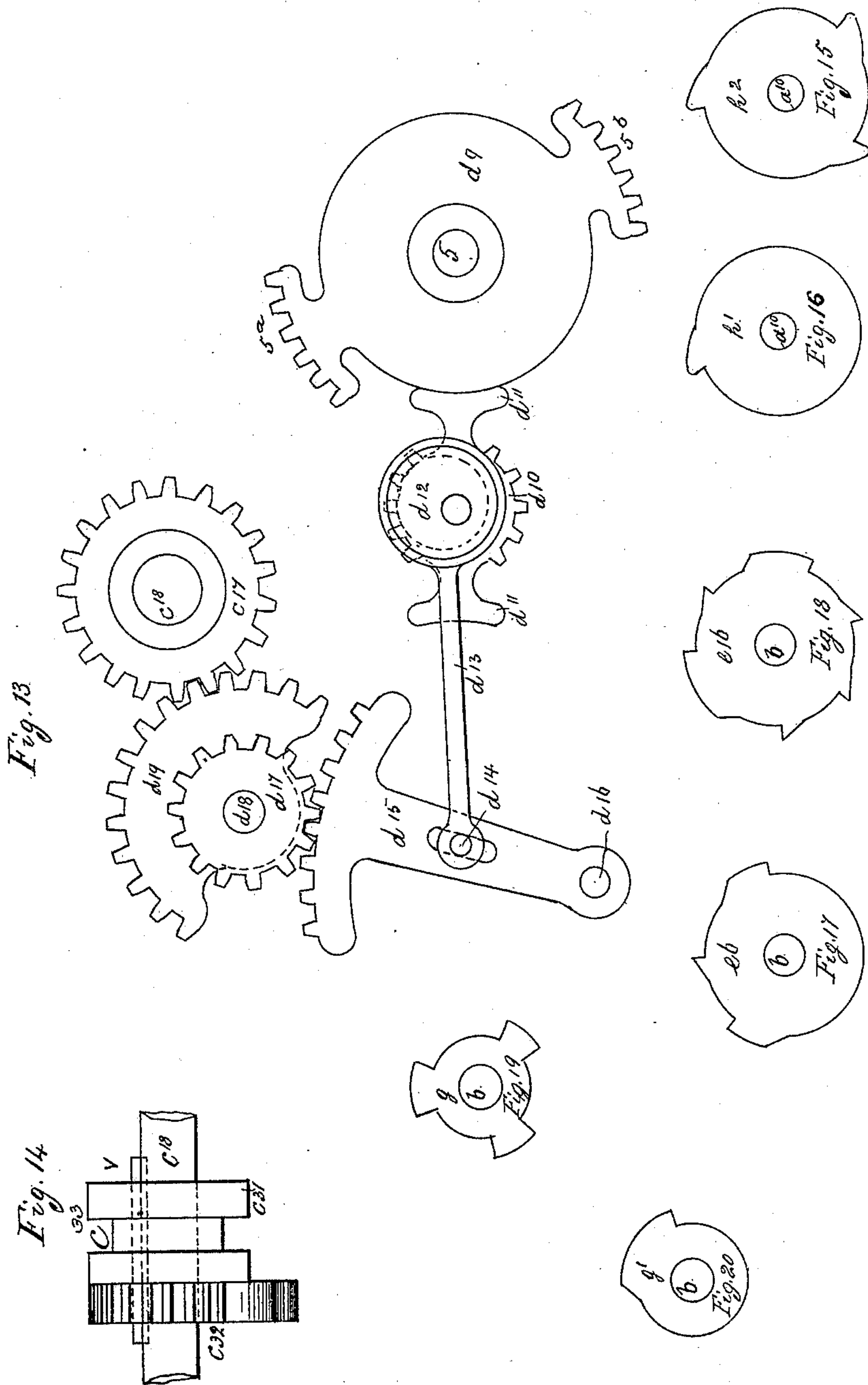


Fig. 14

Witnesses  
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(No Model.)

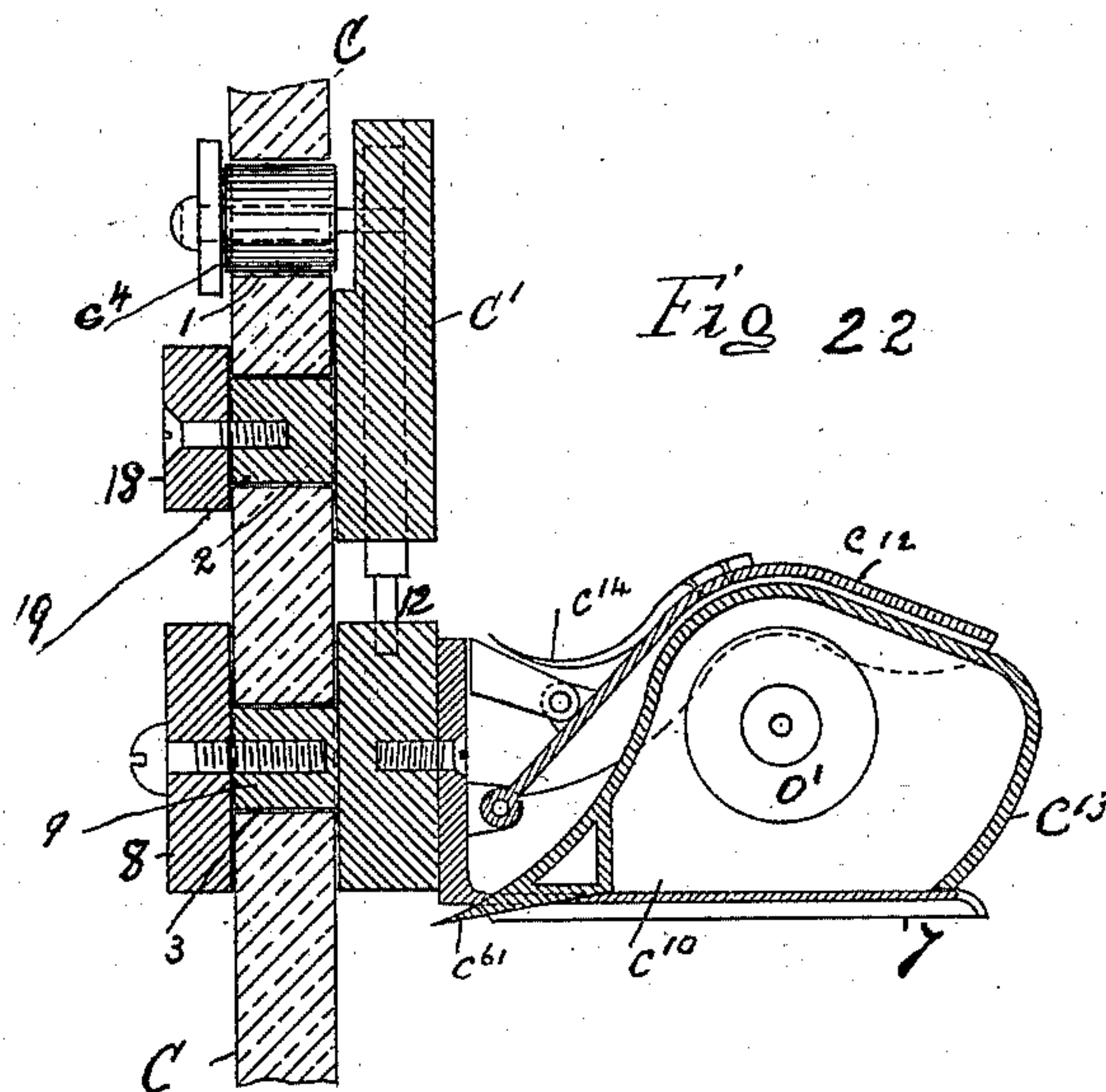
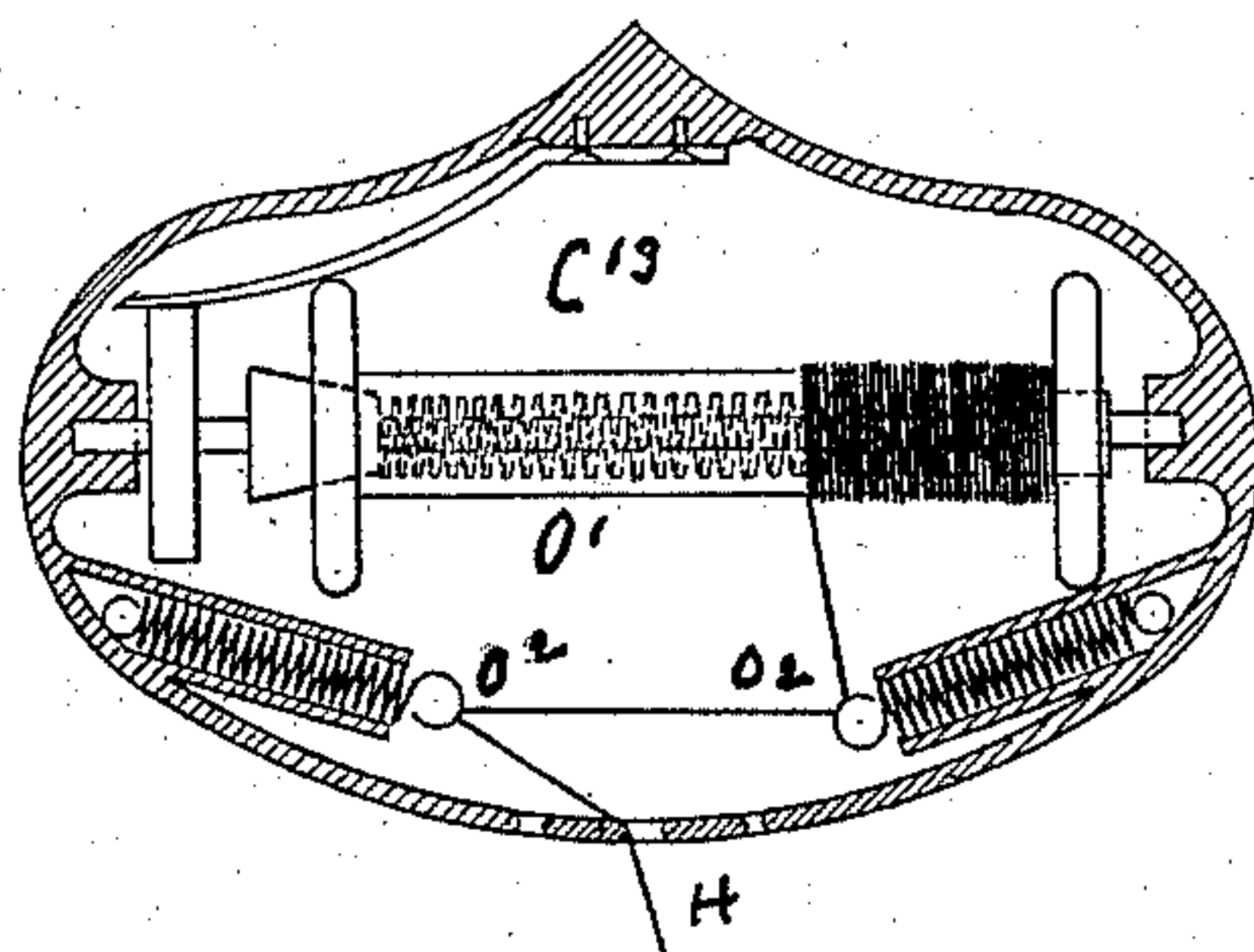
9 Sheets—Sheet 9.

B. SANER.  
HEDDLE MACHINE.

No. 426,473.

Patented Apr. 29, 1890.

Fig 21



Witnesses

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Fred L. Warner

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# UNITED STATES PATENT OFFICE.

BASIL SANER, OF PATERSON, NEW JERSEY.

## HEDDLE-MACHINE.

SPECIFICATION forming part of Letters Patent No. 426,473, dated April 29, 1890.

Application filed January 28, 1886. Serial No. 190,040. (No model.)

*To all whom it may concern:*

Be it known that I, BASIL SANER, a citizen of the United States, residing at Paterson, Passaic county, State of New Jersey, have invented a new and useful Improvement in Machines for Making Loom-Harness, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

10 A represents a machine for making loom-harness, having the usual supporting-frame A', on and to which frame are arranged and secured various devices, which will be hereinafter explained and claimed.

15 Figure 1 of the drawings shows one side of the machine in elevation. Fig. 2 shows in elevation the opposite side of the machine, (certain parts of the machine.) Fig. 3 is a plan of the machine, certain parts being omitted.

20 Fig. 4 is a front elevation of the same, the rods  $a^{27}$  and  $a^{30}$ , hereinafter described, being shown in section. Fig. 5 is a rear elevation of the same, in which figure the bobbins and shaft are partly removed. Figs. 6 to 12, in-

25 clusive, show the effects produced by the devices in their different movements when forming the harness. Fig. 13 is a detail view of a portion of one combination of devices. Fig. 14 is a detached view of the sliding gear

30  $c^{32}$  and a portion of the supporting-shaft thereof, hereinafter described. Figs. 15 and 16 are detached views of cams on shaft  $a^{10}$ . Figs. 17 and 18 are views of cams on shaft  $b$  to operate the swinging needles. Figs. 19 and 20 are views of inside cams on shaft  $b$ . Fig. 21 is a longitudinal section through the shuttle; and Fig. 22 is a cross-section through the same, the shuttle-carrier, and the adjacent co-operating parts.

40 In suitable bearings arranged in the lower part of the frame A' is journaled a transverse driving-shaft  $a$ , having on one end of the same fast and loose pulleys  $a'$   $a^2$ . On the opposite end of the said shaft is fixed a gear-wheel  $a^3$ , and near the middle of its length said shaft has fixed thereon a bevel gear-wheel  $a^4$ . Wheel  $a^3$  gears with a like wheel  $a^5$ , that is integral with a worm  $a^6$ , the said wheel  $a^5$  and worm  $a^6$  being journaled on a stud  $a^7$ , secured in the frame A'. Worm  $a^6$  engages a worm-wheel  $a^9$  on one end of a shaft  $a^{10}$ , journaled in bracket-bearings  $a^{11}$   $a^{12}$  and carrying

a cam  $h$ , a double cam  $a^{15}$ , bevel gear-wheel  $a^{16}$ , and a crank-arm  $a^{13}$ . The stud  $a^{17}$  on the said crank-arm has connected thereto one end 55 of a link  $a^{18}$ , (see Fig. 4,) the opposite end of which is connected to a pawl-arm  $a^{19}$ , pivoted upon a stud  $a^{23}$ , secured in a depending portion of frame A', said arm carrying a pawl  $a^{21}$  and a spring  $a^{22}$ , which act against the pawl 60 to press it into engagement with the teeth of a ratchet-wheel  $a^{24}$ , mounted upon the stud  $a^{23}$ . A retaining-pawl  $a^{35}$ , provided on pin  $a^{36}$ , holds ratchet-wheel  $a^{24}$  from back movement.

65 Connected with the ratchet-wheel  $a^{24}$  is a wheel  $a^{25}$ , gearing with a pinion  $a^{26}$ , fixed on a rod  $a^{27}$ , journaled at one end in frame A' and at the other in plate  $d^{31}$ . On each side of rod  $a^{27}$  is a guide-rod  $a^{30}$ , each secured at one end 70 to frame A' and at the other to the plate  $a^{31}$ . On the rods  $a^{27}$   $a^{30}$  is placed a bar or frame  $a^{29}$ , having in the middle of the same a split nut  $a^{28}$  to engage with the threaded portion of the rod  $a^{27}$ . Near the ends of frame or bar 75  $a^{29}$  are pins  $f^7$ , to which are attached the ends of cords or rig-bands  $f^4$ , to which the heddles are connected at their ends. By the slow intermittent movement of the said bar or frame 80 occasioned by the intermittent rotation of the threaded rod  $a^{27}$ , the said cords or bands are gradually moved along the machine as the heddles are successively formed by the operations hereinafter described and united to the said cords or bands. 85

On one end of a transversely - arranged shaft  $b$  (see Fig. 4) is a bevel gear-wheel  $b'$ , meshing with wheel  $a^{16}$  on shaft  $a^{10}$ . Said shaft  $b$  has mounted thereon the cams  $b^2$ ,  $b^3$ ,  $e^6$ , and  $e^{16}$ . 90

On the front bottom plate B, secured to the frame, are placed hollow standards  $b^5$   $b^6$ , (see Fig. 4,) in which are received the depending stems  $b^4$  of slotted horizontal sleeves  $b^7$   $b^8$ . Passing through the said sleeves are rods  $b^9$  95  $b^{10}$ , (see Figs. 1 and 2,) the inner or left-hand ends of which in Fig. 1 (right-hand ends in Fig. 2) carry fingers  $b^{19}$   $b^{20}$ , and the outer or right-hand ends of which in Fig. 1 (left-hand ends in Fig. 2) are slotted. Across the slot 100 in each rod extends a pin, which is received in a slot at the upper end of a vertical lever  $b^{11}$  or  $b^{12}$ . Levers  $b^{11}$   $b^{12}$  are fulcrumed on pins  $b^{13}$ , secured in curved brackets  $b^{14}$ , se-



cured to plate B, and are connected at their lower ends to slides  $b^{16}$ , arranged in guides  $b^{18}$  upon the plate B and carrying projections  $b^{17}$ , which, if desired, may be slotted as shown in Fig. 2, and adjustably held to the slides by screws  $b^{11}$ , said projections being disposed in position to be engaged by the projections of the cams  $b^2 b^3$  on the shaft  $b$ .

On plate B, near the middle of the machine, is a lug  $e$ , to which are pivoted levers  $e' e^8$ , extending in opposite directions toward the sides of the machine, said levers being formed with projections, as shown, adapted to be engaged by the cams  $e^6 e^{16}$  upon shaft  $b$  to depress the same, and being pressed upward by the spring  $S'$  beneath the same.

On the free ends of the levers  $e' e^8$  are pivoted the swinging needles  $e^2 e^9$ . Needle  $e^9$  is connected by a rod  $e^{10}$  to a lever  $e^{11}$ , which is arranged to engage the part  $h^2$  of the cam  $a^{15}$  on shaft  $a^{10}$ , and a spring  $e^{12}$ , connected at one end to the machine-frame and at the other to the needle  $e^9$ , serves to move the latter in opposition to the cam. Needle  $e^2$  is connected by a rod  $e^3$  to the lever  $e^4$ , which is acted upon by the part  $h'$  of cam  $a^{15}$  and moved in opposition to the cam by spring  $e^7$ , attached at one end to the needle and at the other to the machine-frame.

The two parts  $h' h^2$  composing cam  $a^{15}$  are shown, respectively, in Figs. 15 and 16.

The vertical transverse plate  $c$  is secured to the machine-frame in an inclined or oblique position and is formed with two sets of slots, each set comprising three slots 1, 2, and 3. The slots 3 and 2 respectively serve for the reception and guidance of the shuttle-holders  $c^{10}$  and shuttle-operating slide-frames  $c' c^2$ . Each shuttle-holder  $c^{10}$  (see Fig. 22) has a lug 9 fitting in the slot 3 of one of the sets of slots, and a retaining-plate 8 is fastened to the said lug back of the plate  $c$ . The front portion of the holder is bifurcated (see Fig. 4) and has arranged above the divided parts, on which the shuttle rests, a curved cover or guard  $c^{12}$ , caused by a spring  $c^{14}$  to bear upon the top of the shuttle  $c^{13}$ , to hold the latter in position.

Each slide-frame  $c'$  or  $c^2$  is provided with a lug 19, fitting one of the slots 2, and a retaining-plate 18 at the back of the plate  $c$ , and carries two pointed slides or pins 12, provided with pins or studs upon which are mounted the rollers  $c^3 c^4$ , which latter move in the slot 1. The pointed ends of the slides or pins 12 engage with the shuttle-holders to cause the latter to move with slide-frames  $c' c^2$ , and slots 1 are curved, as shown, to provide for the disengagement and re-engagement of the slides or pins successively with the shuttle-holders as the latter pass into the slots of the disk  $c^{21}$ , hereinafter described, and subsequently above and below the cords or rig-bands  $f^4$ , in the manner hereinafter described.

To the slide-frames  $c' c^2$  are attached racks  $c^5 c^5$ , one of which is shown in full lines in

Fig. 5, these racks engaging the gear-wheel  $c^{16}$  on opposite sides of the center of the wheel. Said gear-wheel  $c^{16}$  is placed loosely upon a spindle  $c^{18}$ , and the sleeve or hub of said wheel carries a pinion  $c^{17}$ , (see Fig. 3,) engaged by a gear-segment  $d^{19}$ , Figs. 2 and 13, which is fast to a pinion  $d^{17}$ , engaged by a sector  $d^{15}$ , pivoted at  $d^{16}$ , and having connected thereto by the pin  $d^{14}$  the strap  $d^{13}$  of the eccentric  $d^{12}$ , which eccentric is secured at the side of a wheel  $d^{10}$ , having oppositely-placed teeth, as shown, and arms  $d^{11}$ , curved on their outer sides to fit the plain portion of the wheel  $d^9$ . Wheel  $d^9$  has opposite toothed segments  $5^a 5^b$ , for engagement with the toothed portions of wheel  $d^{10}$ . After engagement of one of the toothed segments  $5^a 5^b$  with the latter wheel the concave surface of one of the arms  $d^{11}$ , coming in contact with the smooth circumference of wheel  $d^9$ , locks wheel  $d^{10}$  from further movement until in the rotation of wheel  $d^9$  the other segment thereon strikes the said arm  $d^{11}$  and rotates wheel  $d^{10}$  far enough to provide for the engagement of such segment with the teeth of wheel  $d^{10}$ , when the segment acts to impart a partial rotation to wheel  $d^{10}$  and its attached eccentric. After each partial rotation of wheel  $d^{10}$  and eccentric  $d^{12}$ , occasioned by the engagement of one of the segment-arms  $5^a 5^b$  with one of the toothed portions of wheel  $d^{10}$ , the concave face of the other one of the arms  $d^{11}$  comes in contact with a plain portion of the circumference of wheel  $d^9$ , and locks the wheel  $d^{10}$  and eccentric  $d^{12}$  against further rotation until the next arm  $5^a$  or  $5^b$  strikes the arm  $d^{11}$  and communicates movement thereto. Wheel  $d^9$  is mounted on one end of a shaft 5, the opposite end of which carries a gear-wheel  $d^8$  in engagement with a pinion  $d^6$  at the side of and fast to a larger pinion  $d^8$ , which gears with a wheel  $d^{20}$ , mounted on a stud fixed to the machine-frame and made fast to the segment gear-wheel  $d^{22}$  and bevel-gear  $d^{23}$ , which latter gears with the bevel gear-wheel  $a^4$  on the shaft  $a$ .

On spindle  $c^{18}$  is a sleeve  $c^{31}$ , caused to turn therewith by a spline  $v$ , and carrying a wheel  $c^{32}$ , adapted to be engaged when in proper position upon the spindle  $c^{18}$  by the segment-gear  $d^{22}$ . Around the sleeve is a groove  $c^{33}$ , into which enter pins on the sleeve-shifter  $d$ , which is pivoted at  $d'$  to a bracket on the frame and has one end forked, as shown in Fig. 2, and receives between the branches thereof the wheel  $d^3$ . Upon the sides of the latter are lugs  $r$ , adapted to strike the branches of the forked end of shifter  $d$ , and thereby occasion the movement of the sleeve  $c^{31}$  along spindle  $c^{18}$  into position for the segment-gear  $d^{22}$  to engage the pinion  $c^{32}$ , and rotate spindle  $c^{18}$ , or to throw said pinion out of engagement with the said segment.

The cords or rig-bands  $f^1 f^1$  are wound upon spools  $f^2 f^2$ , placed at one end of the machine upon the rod  $f'$ , and having applied thereto



the weight-cords  $f^{21}$ . From the spools  $f^2 f^2$  the cords  $f^4 f^4$  are led forward through the guides  $f^5 f^5$  and the slots 3 3 in the plate  $c$  and are attached to the pins  $f^7 f^7$ .

5 Guides  $f^5 f^5$  are hung by rods  $h^{12} h^{14}$  from opposite ends of lever  $h^{11}$ , centrally pivoted at  $h^{13}$  upon the machine-frame, and having attached to it, near one extremity, one end of spring  $h^{15}$ , the other end of which is attached to the frame. The lever  $h^{11}$  is connected by  
10 rod  $h^{10}$  to lever  $h^4$ , pivoted at  $h^6$  to the frame and carrying the roller  $h^5$ , which is acted upon by cam  $h$  on shaft  $a^{10}$  to depress lever  $h^4$  and move lever  $h^{11}$  about its fulcrum, so as to raise  
15 one guide  $f^5$  and lower the other. Lever  $h^7$ , pivoted upon lever  $h^4$ , is connected by rod  $h^8$  to arm  $h^9$ , which is pivoted at the lower end to the frame and connected at its upper end to the left-hand guide  $f^5$  in Fig. 5. Arm  $h^{16}$   
20 is pivoted at its lower end at  $h^6$ , and at its upper end is connected with the right-hand guide  $f^5$  in Fig. 5. By the alternate engagement of cam  $h$  with levers  $h^7 h^{16}$  the guides  $f^5 f^5$  are alternately caused to move inwardly  
25 slightly toward the middle of the machine.

Spindle  $c^{18}$  at its rearward end is provided with a worm  $c^{22}$ , which engages and drives a worm-wheel  $c^{23}$ , carrying a pin  $c^{26}$ , adapted as the wheel rotates to engage lever  $c^{27}$ , which,  
30 when released, is caused by spring  $c^{29}$  to fly against the bell  $c^{30}$ .

The twines or threads H H, from which the heddles are formed, are wound on bobbins  $o'$ , mounted on the shuttles  $c^{13} c^{13}$ . From the bobbins the said twines or threads pass through  
35 eyes at the ends of spiral springs  $o^2 o^2$ , which serve to keep the twines or threads under proper tension and to take up any slack that may occur therein.

40 The operation of the parts in forming heddles is as follows, reference being had to Figs. 6 to 12: The twines H H being tied to the cords in rig-bands  $f^4 f^4$ , and the shuttles standing in positions intermediate the cords  $f^4 f^4$ , and  
45 the former  $n$  on the end of spindle  $c^{18}$ , the gear  $d^9$ , actuated from shaft  $a$  through the gearing described, in its rotation carries one of its gear-segments into engagement with one of the toothed portions of pinion  $d^{10}$ , the  
50 end of the said gear-segment first coming in contact with the arm  $d^{11}$ , resting against the plain portion of the circumference of wheel  $d^9$ , and thereby moving wheel  $d^{10}$  and the attached eccentric  $d^{12}$  until a toothed portion  
55 of wheel  $d^{10}$  is engaged by the segment, when the wheel is turned until the other arm  $d^{11}$  is brought into contact with the plain portion of wheel  $d^9$  at the opposite side of the gear-segment, again locking the wheel  $d^{10}$  and eccentric from movement. The semi-rotation  
60 thereby imparted to the wheel and eccentric causes sector  $d^{15}$  to be moved to one side, occasioning, through the pinions  $d^{17}$ , segment  $d^{19}$ , and wheels  $c^{17} c^{16}$ , a movement of the racks  
65  $c^5 c^5$  and connected slide-frames and shuttles inward toward the middle of the machine. The disk  $c^{21}$  at the end of the spindle  $c^{18}$  car-

ries the circular plate  $c^{21}$ , set in an opening in the plate  $c$ , and having slots formed therein coinciding with the slots 3 3 in the plate  $c$ .  
70 (See Fig. 4.) When the racks and slides are moved inward, as described, the holders  $c^{10}$  are carried into the slots in the plate  $c^{21}$ , the bolts or pins 12 12 being disengaged from the said holders  $c^{10}$  by bends in the slots 1 1 at  
75 points adjacent to the plate  $c^{21}$ , said bends acting upon rollers  $c^3 c^4$  as the said frames move to draw the bolts or pins out of the holders and leave the latter free to move with the plate  $c^{21}$ . While the holders are supported  
80 by the said plate  $c^{21}$  a complete revolution is imparted to the spindle  $c^{18}$  and plate through a lug  $r$  on wheel  $d^3$ , acting upon shifter  $d$  to move the sleeve  $c^{31}$  endwise into position for wheel  $c^{32}$  to be engaged by the gear-segment  
85 on wheel  $d^{22}$ , after which a reverse movement is imparted to said sleeve by another lug on wheel  $d^3$  to carry it out of position for engagement by the said gear-segment. By this rotation of plate  $c^{21}$  the cords H H are caused  
90 to wrap around the former-pin  $n$  and interlock, as shown in Fig. 6. The slots in plate  $c^{21}$ , having been brought in line with those of plate  $c$  again, the bolts or pins 2 2 again engage with the holders  $c^{10} c^{10}$  as the slide-frames  
95 and racks move outward and the shuttles are carried out to their intermediate positions, as in Fig. 6. Needle  $e^9$  is now operated from the part  $h^2$  of cam  $a^{15}$ , so as to cause the same to engage the twine from the right-hand shuttle  
100 and move outwardly therewith in the manner illustrated in Fig. 6. Next a projection on the cam  $g$  on shaft  $b$  engages lug  $r^2$  and raises sleeve  $b^8$ , so as to cause finger  $b^{20}$  to engage that portion of twine H which extends from  
105 cord  $f^4$  to the former  $n$ , and a projection on cam  $b^3$ , engaging projection  $b^{17}$  on slide  $b^{16}$ , rocks lever  $b^{12}$ , moving the rod  $b^{10}$  and attached finger  $b^{20}$ , so as to carry such portion to the opposite side thereof, as indicated in  
110 Fig. 7 at the right-hand side. Sleeve  $b^8$  and finger  $b^{20}$  now fall, releasing the loop of twine H, which as it moves to return to the original position catches upon the point of the shuttle and rides over the shuttle, thereby inter-  
115 locking the two portions of the twine in the manner indicated in Fig. 8. The slide  $b^{16}$ , rod  $b^{10}$ , and lever  $b^{12}$  are returned to their original outward position by a spring  $o$ . At the time twine H is moved into the position shown  
120 in Fig. 7 the cam  $h$  acts through lever  $h^7$ , link  $h^8$ , lever  $h^9$ , and guide  $f^5$  to move the cord  $f^4$  inward somewhat, as indicated in Fig. 7, to prevent strain on said cord H. The projection of cam  $h$  having passed the roller on  
125 lever  $h^7$ , the weighted cord applied to the spool  $f^2$  acts to tighten cord  $f^4$  and move the same and slide  $f^5$  outward to their first position. This outward movement of cord  $f^4$  draws the loops of twine H over the shuttle  
130 and into the position shown in Fig. 8. Cam  $e^{16}$  acts at this time to depress lever  $e^8$  and needle  $e^9$  to disengage the upper end of the latter from twine H, and the springs  $o^2 o^2$  in



the shuttle take up the slack in twine H. Needle  $e^9$ , having been permitted to rise again outside the half-knot formed in twine H, as shown in Fig. 9, is drawn toward the middle of the machine by the spring  $e^{12}$ , moving the half-knot inward next to the former  $n$ . By a repetition of the same operations a second half-knot is formed and carried inward to the former  $n$ , as indicated in Figs. 10 and 11.

Next cam  $h$  acts through lever  $h^4$ , rod  $h^{10}$ , lever  $h^{11}$ , and rod  $h^{14}$  to raise slightly the guide  $f^5$  and cord  $f^4$ . The slide-frame is then moved outwardly, said cord  $f^4$  passing between the shuttle-holder and the slide-frame as these latter pass the cord, the pins or bolts 2 being successively disengaged from the holder to permit the passage. Spring  $h^{15}$  now acts to depress guide  $f^5$  and the cord  $f^4$ , and the slide-frame and shuttle-holder move inward to their intermediate position, the shuttle-holder passing over the cord  $f^4$  in this movement. Needle  $e^9$  having been caused to rise into engagement with twine H and draw a loop of the same inward, as shown in Fig. 11, the finger  $b^{20}$  is actuated to engage the portion of said twine extending from the knot at the former to the cord  $f^4$  and place such portion in position, as shown in Fig. 11, to pass over the shuttle. Next a half-knot is formed by a repetition of operations, already described, and the needle  $e^9$  is actuated to force the said half-knot outward against the cord  $f^4$ . (See Fig. 12.) In Figs. 6, 7, 8, 9, and 10 the shuttle and other parts at the left-hand side of the machine are inactive; but Fig. 11 shows that while the parts on the right-hand side are being operated to form the half-knot, whereby the heddle is connected with the right-hand cord  $f^4$ , the parts on the left-hand side are similarly operated to form the half-knot, whereby the heddle is connected with the left-hand cord  $f^4$ . At the bottom of Fig. 12 is shown a completely-formed heddle. The rotation of rod

$a^{27}$  moves bar  $a^{29}$  along the rods  $a^{30}$  and serves to feed along the cords  $f^4$  as the heddles are formed thereon.

The wheel  $c^{23}$ , pin  $c^{26}$ , lever  $c^{27}$ , spring  $c^{29}$ , and bell or gong  $c^{30}$  serve to announce the completion of any given number of heddles.

Having described my invention, I claim—

1. The combination, with plate  $c$ , slotted as described, slide-frames  $c'$   $c^2$ , having racks  $c^5$ , pins 12 12, rollers  $c^3$   $c^4$ , holders  $c^{10}$ , the gear  $c^{16}$ , pinion  $c^{17}$ , segment  $d^{19}$ , and pinion  $d^{17}$ , segment  $d^{15}$ , strap  $d^{13}$ , eccentric  $d^{12}$ , wheels  $d^9$   $d^{10}$ , and shaft 5, of the disk  $c^{21}$ , spindle  $c^{18}$ , sleeve  $c^{31}$ , and gear  $c^{32}$ , segment-wheel  $d^{22}$ , shifter  $d$ , wheel  $d^3$ , having lug  $r$ , and means for rotating wheels  $d^3$  and  $d^{22}$ , all substantially as described.

2. The combination, with needle  $b^{20}$ , rod  $b^{10}$ , and sleeve  $b^8$ , stem  $b^{41}$ , lug  $r^2$ , standard  $b^6$ , lever  $b^{12}$ , the slide  $b^{16}$ , lug  $b^{17}$ , and spring  $o$ , of the cams  $g$  and  $b^3$ , the shaft  $b$ , and means for rotating said shaft, all substantially as described.

3. The combination, with the guides  $f^5$ , of the bar or lever  $h^7$ , the rod  $h^8$ , lever  $h^9$ , lever  $h^4$ , link  $h^{14}$ , link  $h^{12}$ , lever  $h^{11}$ , link  $h^{10}$ , spring  $h^{15}$ , cam  $h$ , lever  $h^{16}$ , frame  $A'$ , and shaft  $a^{10}$ , all substantially as described.

4. The combination, with needle  $e^9$  and lever  $e^8$ , of the link  $e^{10}$ , the lever  $e^{11}$ , the cams  $a^{15}$  and  $e^{16}$ , the revolving shaft  $a^{10}$ , the shaft  $b$ , the gear-wheels  $b'$  and  $a^{16}$ , the springs  $e^{12}$  and  $s'$ , and the frame  $A'$ , substantially as and for the purpose set forth.

5. The combination, with the crank-arm  $a^{13}$ , the link  $a^{18}$ , arm  $a^{19}$ , and pawl  $a^{21}$ , of the ratchet  $a^{24}$ , the gear-wheels  $a^{25}$  and  $a^{26}$ , the rod  $a^{27}$ , the frame  $a^{29}$ , the pins  $f^7$ , the slide-rods  $a^{30}$ , the shaft  $a^{10}$ , and the frame  $A'$ , substantially as and for the purpose set forth.

BASIL SANER.

Witnesses:

HERMAN HILLMAN,  
FRED I. WARNER.