

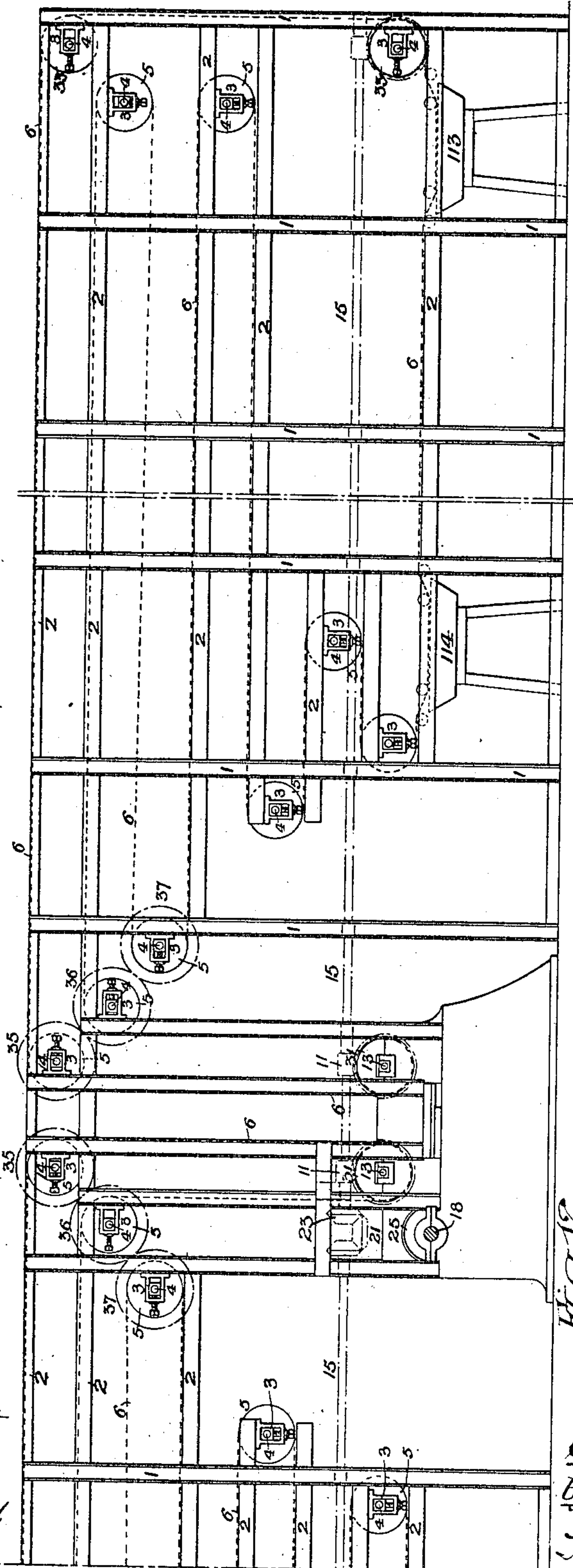
No. 837,694.

PATENTED DEC. 4, 1906.

C. M. LEWIS.
MATCH MAKING MACHINE.
APPLICATION FILED SEPT. 7, 1901.

8 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
Chas. D. Elton.
Frisco M. Whitehead.

Fig. 11.

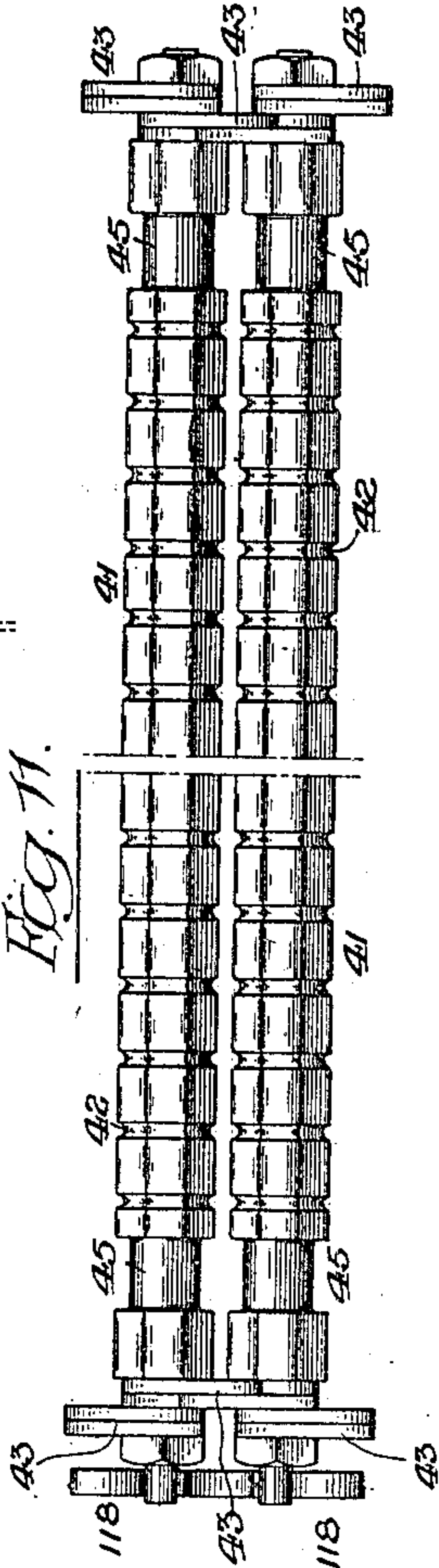
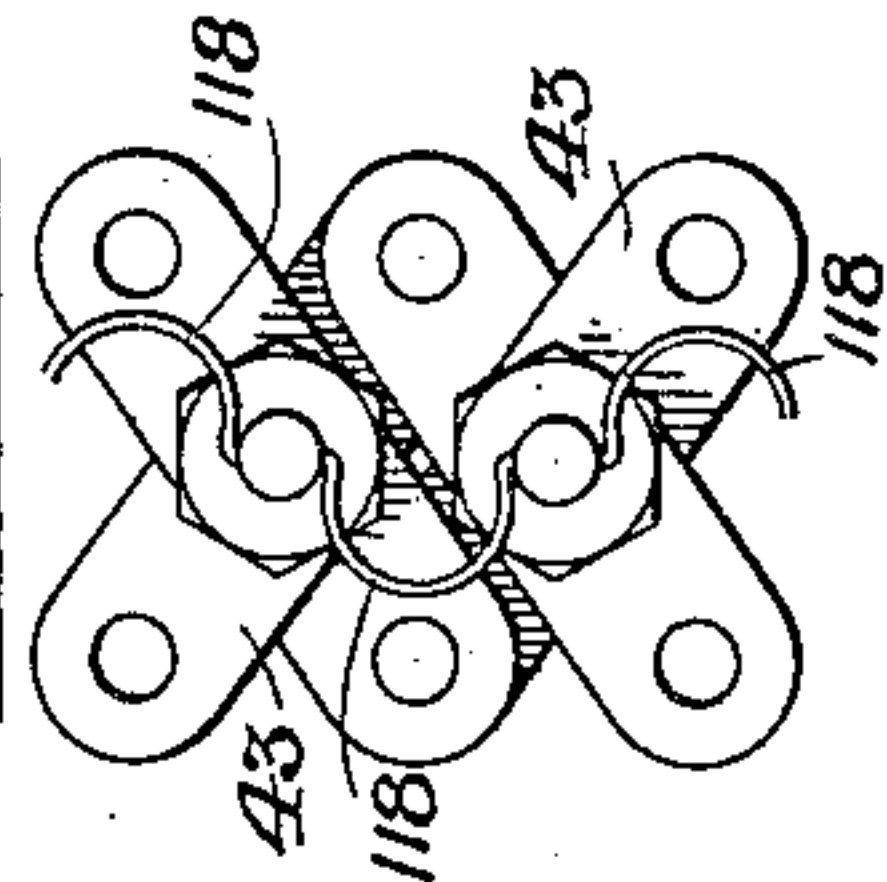


Fig. 12.



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by his Attorneys:
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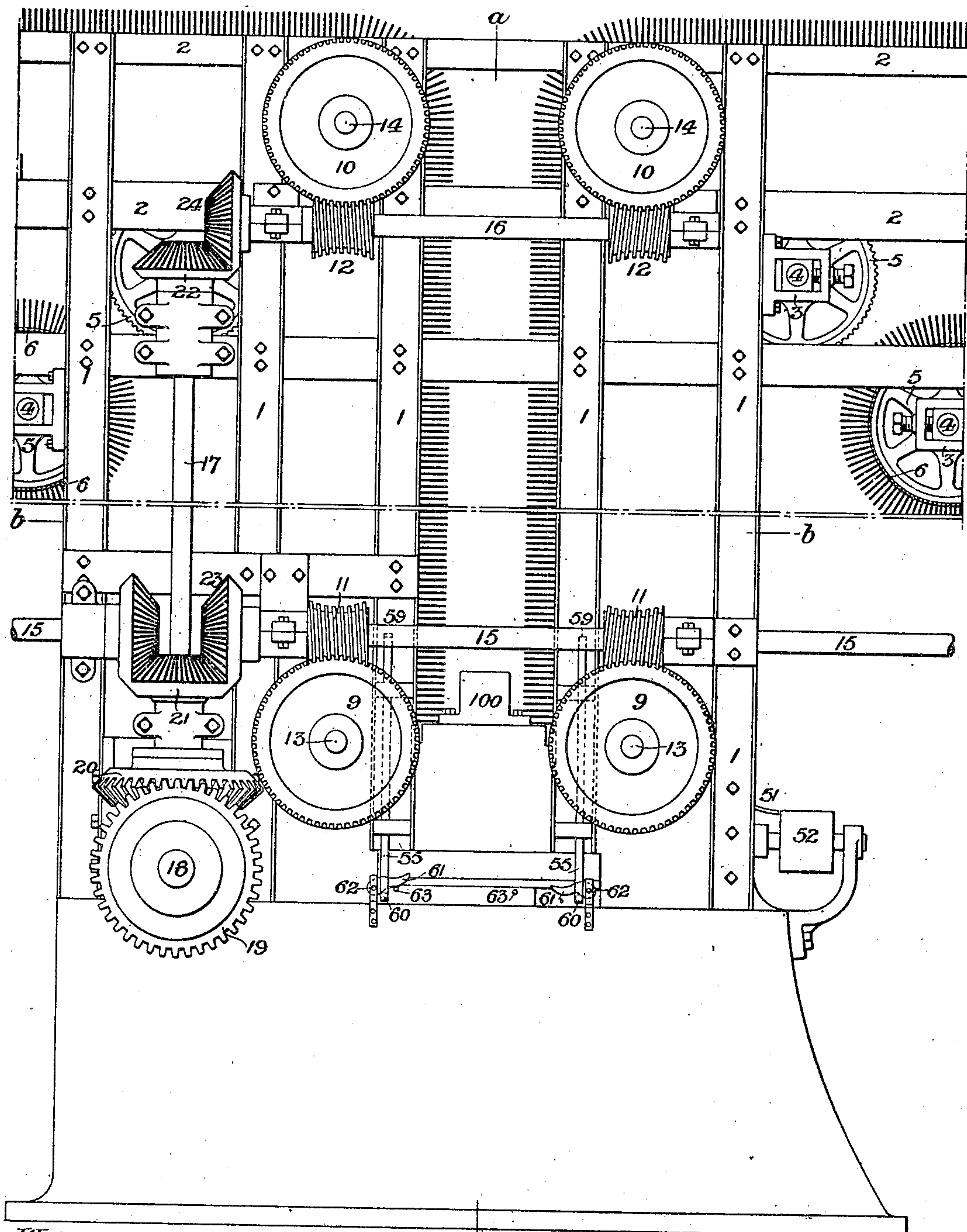
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8 SHEETS—SHEET 2.

Fig. 2.



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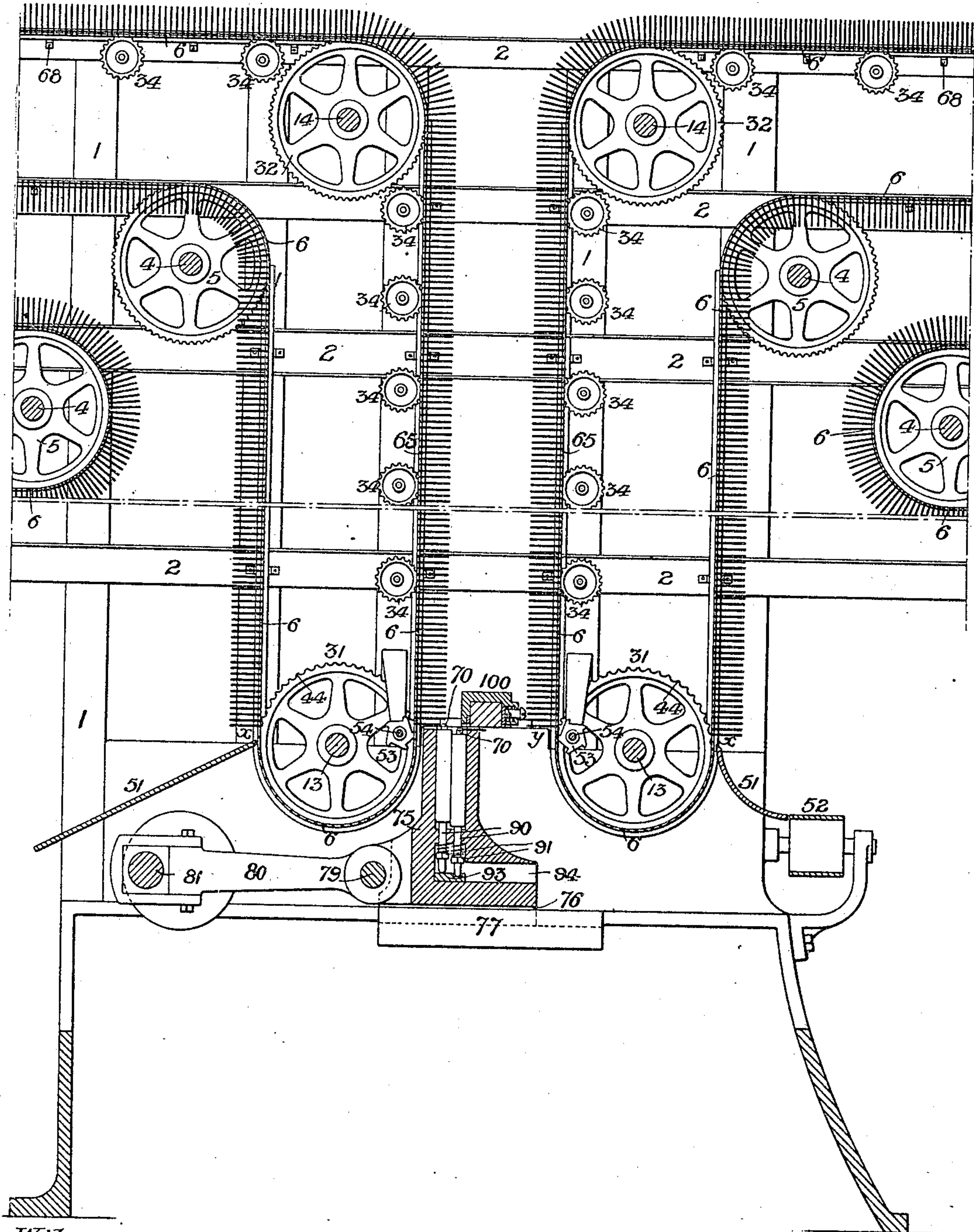
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8 SHEETS—SHEET 3.

Fig. 3.



Witnesses:
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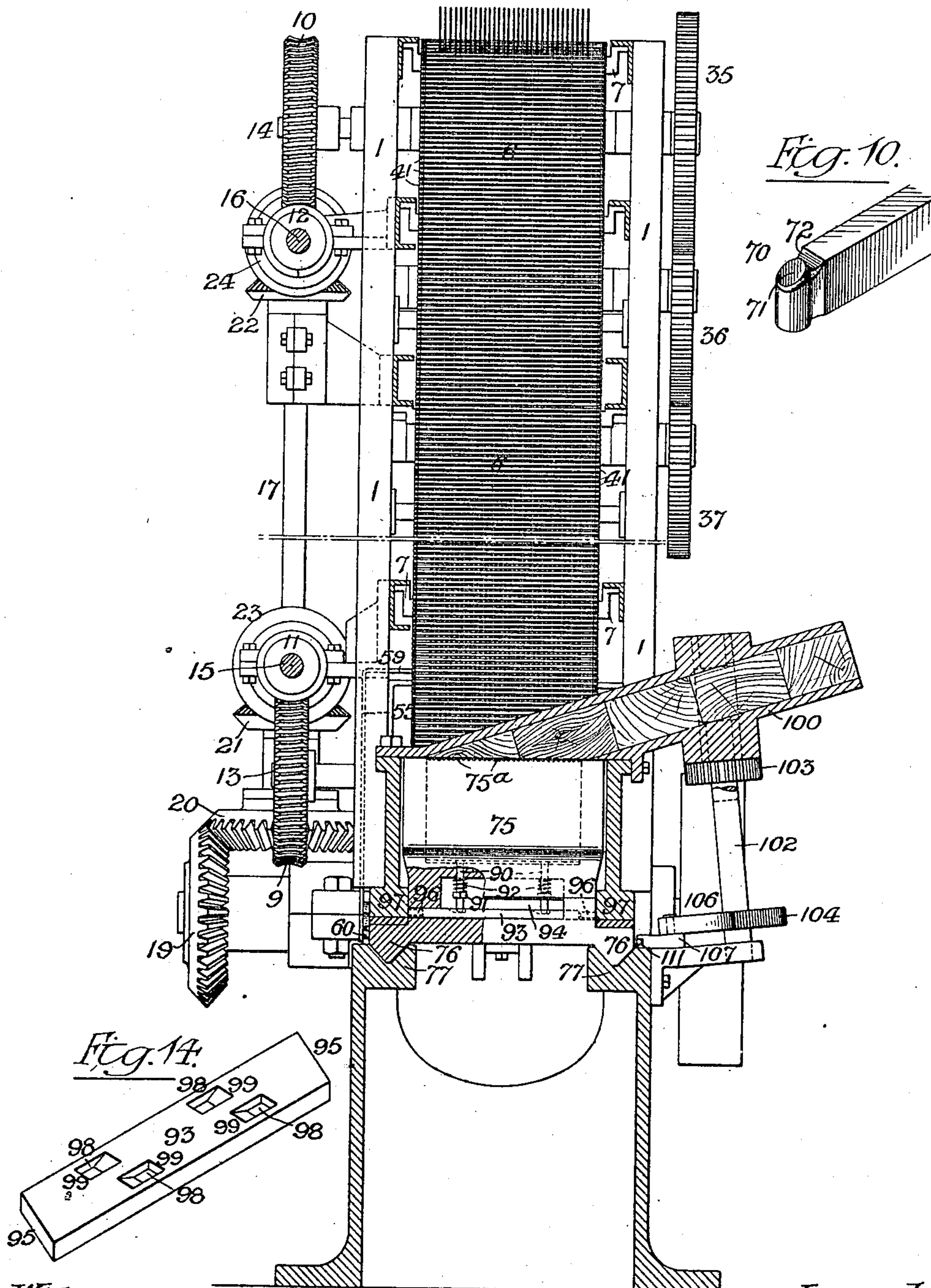
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8 SHEETS—SHEET 4.

Fig. 4.



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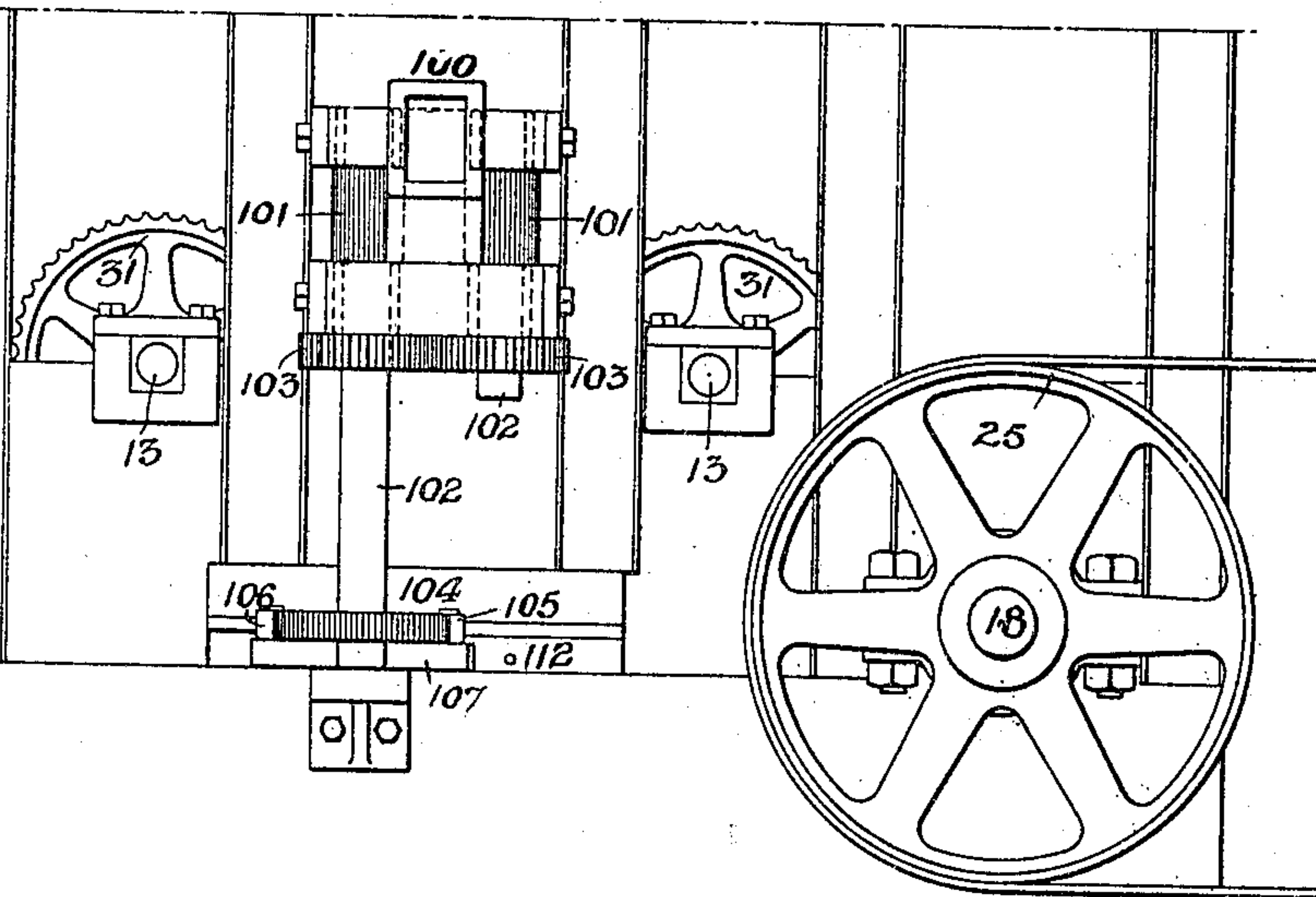
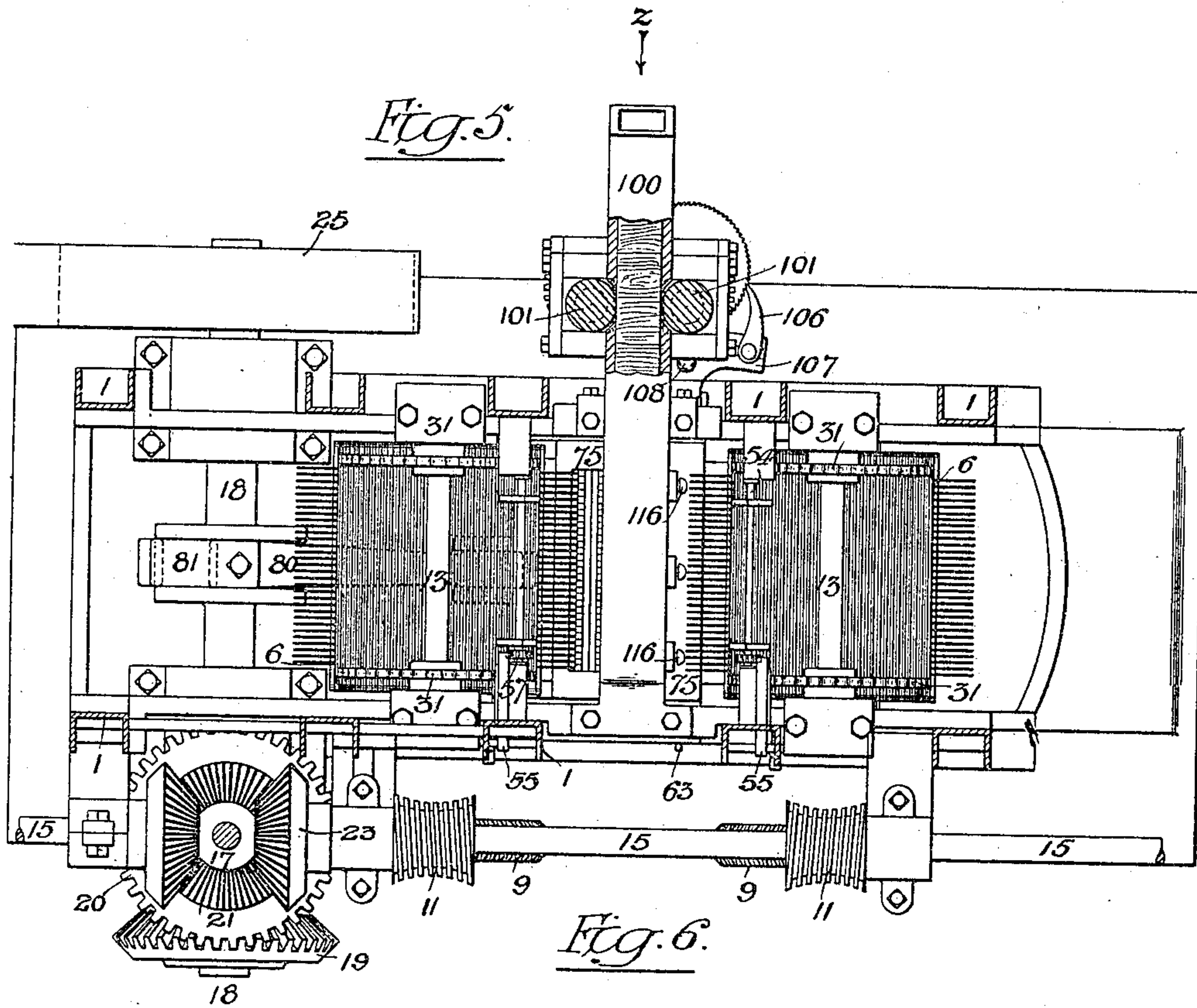
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No. 837,694.

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APPLICATION FILED SEPT. 7, 1901.

8 SHEETS—SHEET 5.



Witnesses:

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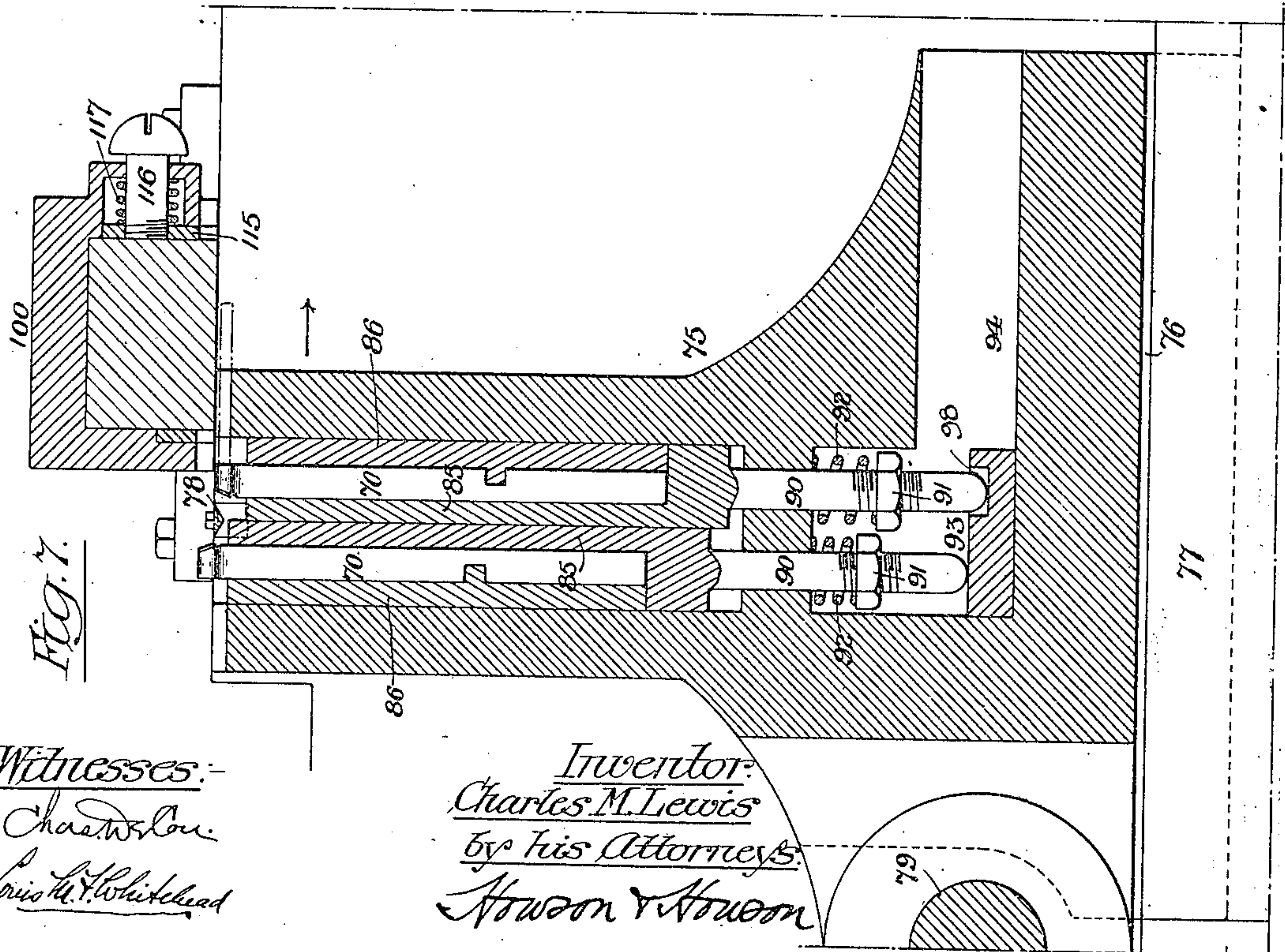
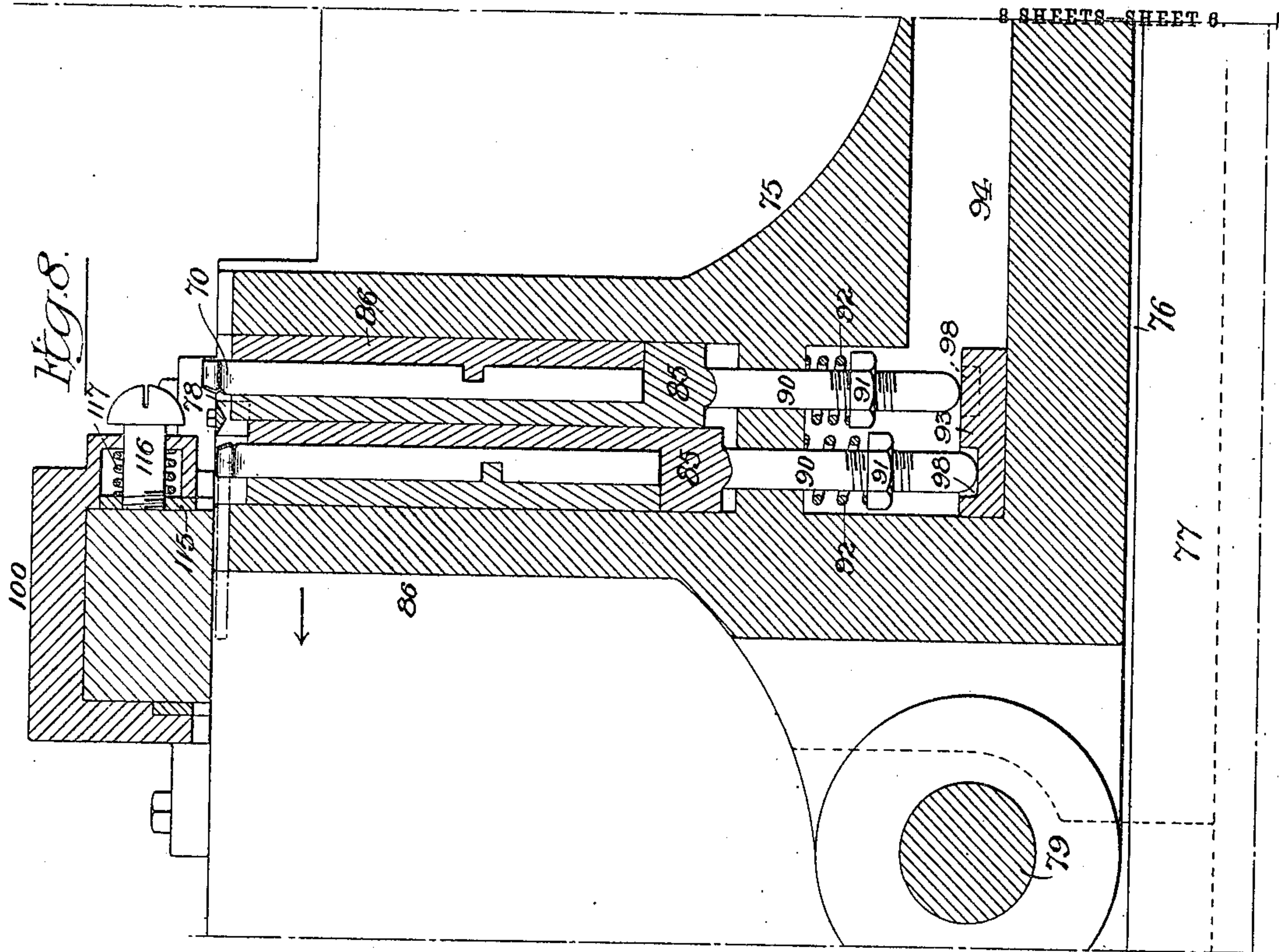
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PATENTED DEC. 4, 1906.

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MATCH MAKING MACHINE.
APPLICATION FILED SEPT. 7, 1901.

8 SHEETS SHEET 8



Witnesses:
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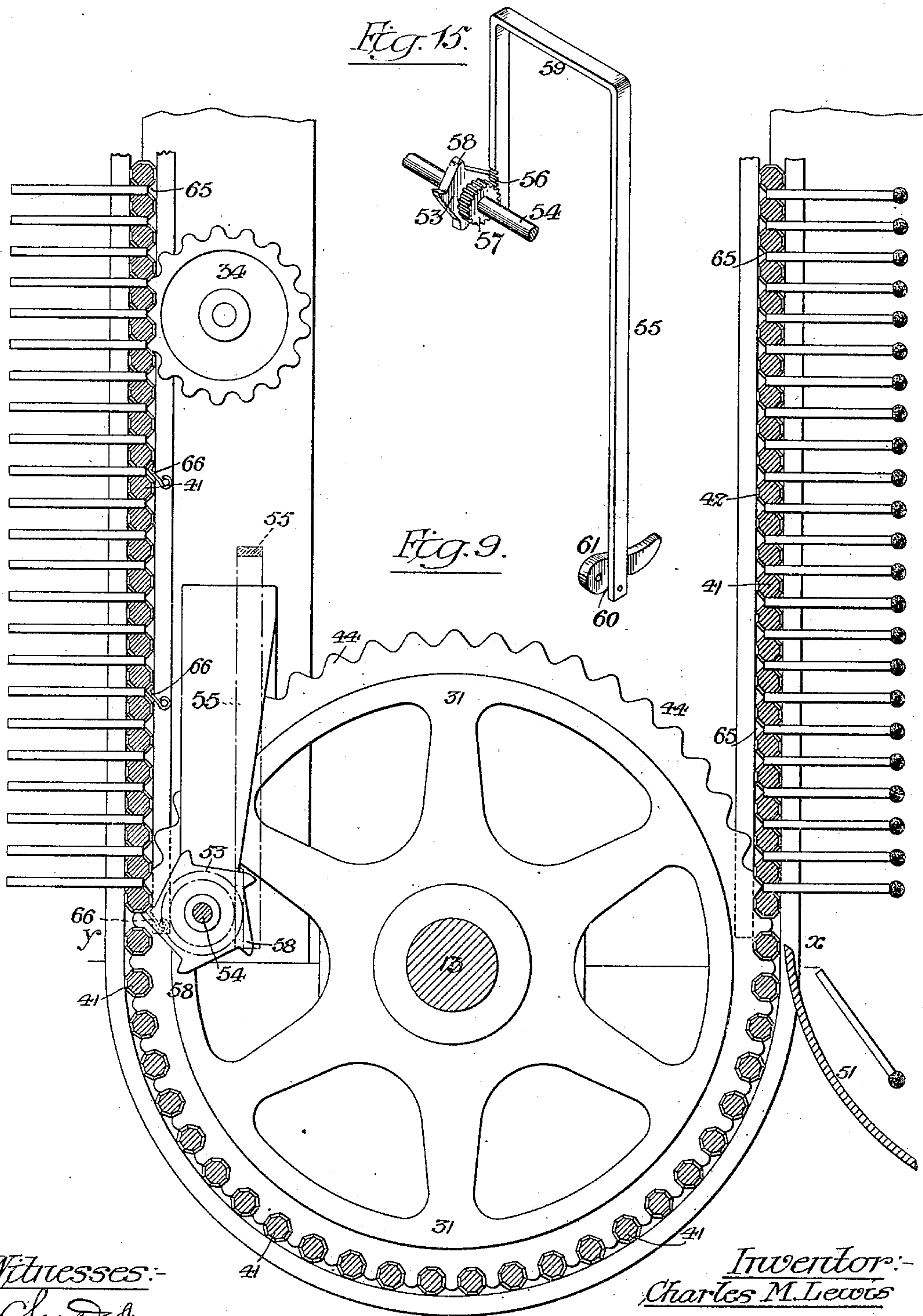
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APPLICATION FILED SEPT. 7, 1901.

8 SHEETS—SHEET 7.



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MATCH MAKING MACHINE.
APPLICATION FILED SEPT. 7, 1901.

8 SHEETS—SHEET 8.

Fig. 13.

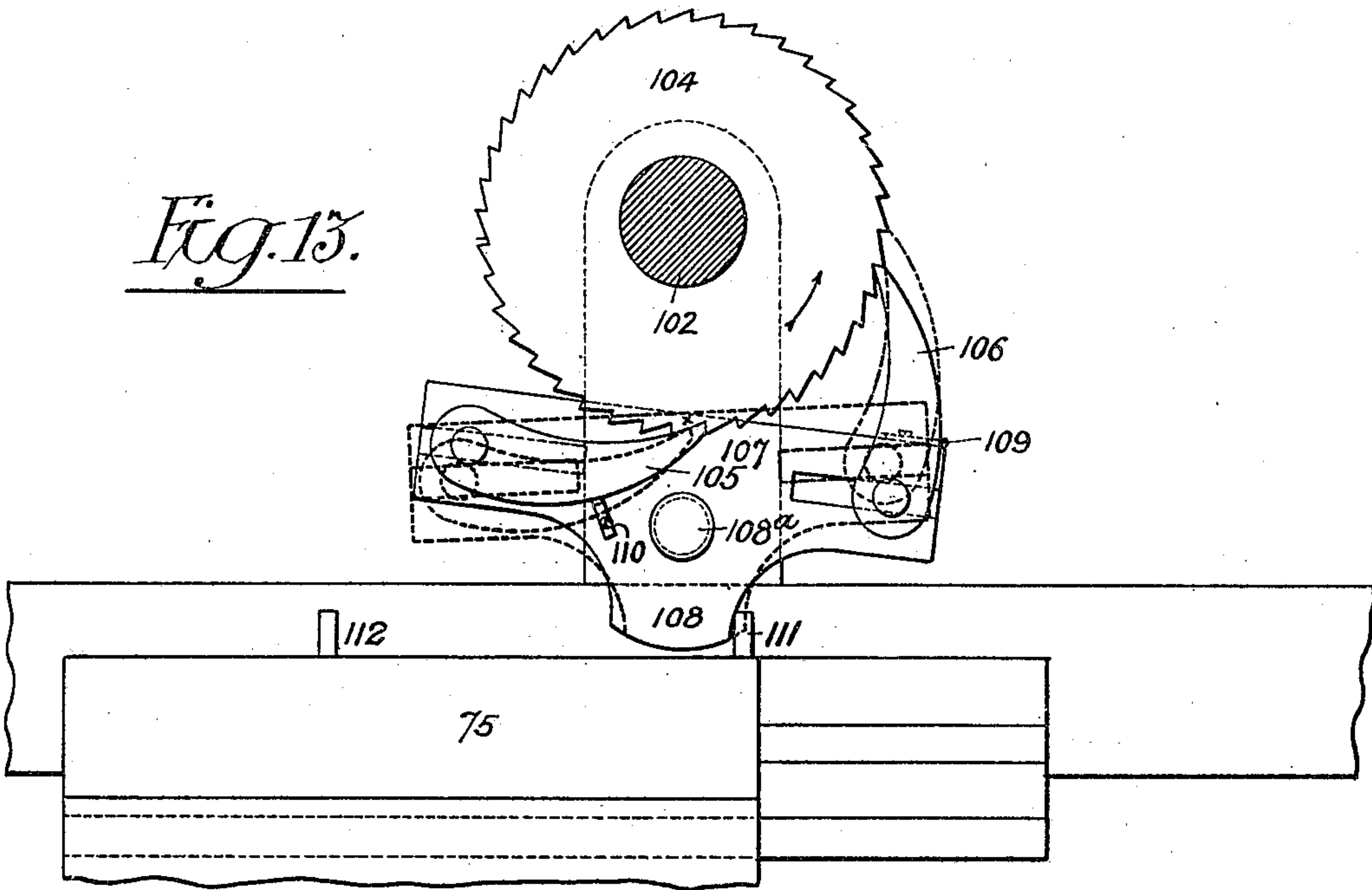
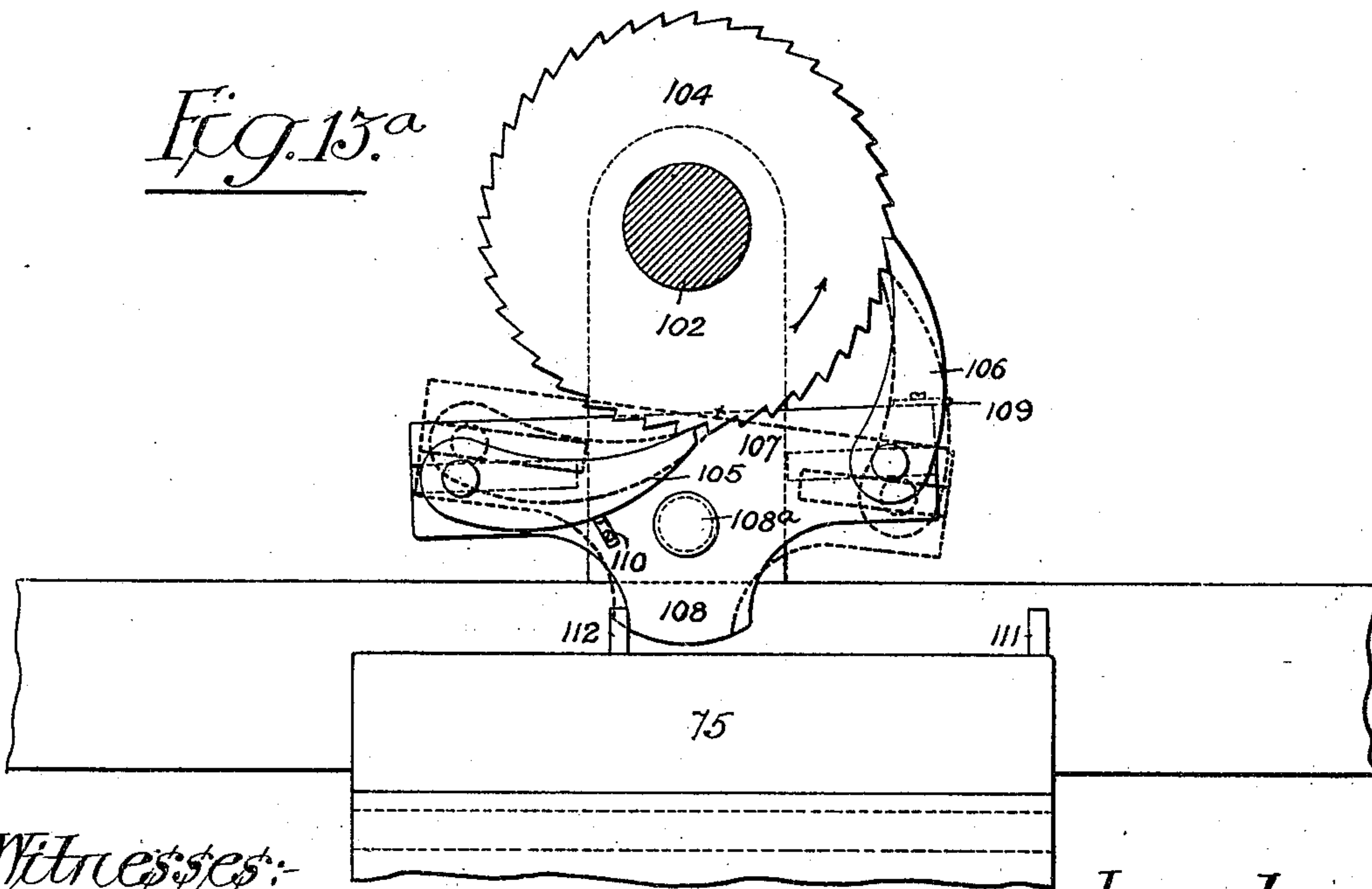


Fig. 13a



Witnesses:

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Frank L. A. Graham

Inventor:

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UNITED STATES PATENT OFFICE.

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TO ALFRED THOMPSON, OF SAFE HARBOR, PENNSYLVANIA.

MATCH-MAKING MACHINE.

No. 837,694.

Specification of Letters Patent.

Patented Dec. 4, 1906.

Application filed September 7, 1901. Serial No. 74,605.

To all whom it may concern:

Be it known that I, CHARLES M. LEWIS, a citizen of the United States, and a resident of Camden, Camden county, New Jersey, have
5 invented certain Improvements in Match-Making Machines, of which the following is a specification.

My invention relates to continuous-match-making machines in which are combined
10 knives for cutting the match-splints, a traveling chain or belt for carrying such splints, whereby they may be dipped into the various baths necessary to perfect the matches, means for introducing and discharging the
15 match-splints from said belt, and mechanism for actuating the machine and all of its coacting parts and connections, whereby the several operations may be carried out continuously.

20 My invention also includes special mechanism for operating the knives, whereby two sets of splints are made at each reciprocation of the same, two gangs of knives being employed which are carried by a reciprocating
25 head.

My invention further includes a special kind of belt or chain comprising match-carrying bars which are joined at their ends by a
30 flexible connection made up of a series of toggle-links.

My invention further includes special means for opening the chain to discharge the
35 splints and means for closing the same to engage the sets of splints as they are fed from the knives.

Other features of my invention will be fully pointed out hereinafter, reference being had to the accompanying drawings, in which—

40 Figure 1 is a diagram illustrating a side elevation of the machine, showing also the frame for carrying the chain, whereby the matches may be traversed through the machine. Fig. 2 is a side elevation, on a larger scale than Fig. 1, of a portion of the machine
45 and frame. Fig. 3 is a sectional elevation of the machine and a portion of the frame on the same scale and looking in the same direction as the view shown in Fig. 2. Fig. 4 is a cross-sectional view of the machine and the
50 frame, taken on the line *a a*, Fig. 2. Fig. 5 is a sectional plan view taken on the line *b b*, Fig. 2. Fig. 6 is a side elevation of a portion of the machine looking in the direction of the arrow *z*, Fig. 5. Figs. 7 and 8 are enlarged

sectional views of a portion of the mechanism, illustrating a detail of the invention. 55
Fig. 9 is a view of one of the opening sprocket-wheels, showing the chain passing around the same and showing also the means for closing the chain to engage a set of splints. Fig. 10 60
is a perspective view of the head of one of the knives employed in my improved match-making machine. Figs. 11 and 12 are views
in full size, showing side and end elevations, respectively, of the match-carrying bars 65
which make up the chain used with my machine. Figs. 13 and 13^a are plan views showing in different positions the mechanism for operating the match-wood-feeding devices,
and Figs. 14 and 15 are perspective views of 70
details of my invention.

The object of my invention has been to construct a machine for making matches which shall be economical in use and positive and rapid in action; to provide a novel and 75
economic means for forming the splints; to provide an efficient chain or belt for positively holding and carrying the match-splints; to insure the engagement of said
splints by the belt, and to discharge the same 80
when formed into complete matches.

A further object of my invention has been to improve the character of the splints, and for this purpose I have devised a special knife 85
for cutting said splints, such knife insuring the making of an approximately rounded splint.

A further object of my invention has been to provide means whereby the knives for cutting the splints can be reciprocated in a 90
horizontal plane. By employing two gangs or sets of knives adapted to be raised and lowered alternately into and out of the operative position two sets of splints can be cut
at every reciprocation of said knives and 95
such splints fed successively into two independently-moving chains or belts.

For convenience and clearness the description of my improved machine will be given under different heads, as follows: first, 100
the framework of the machine and the shafts and pulleys for carrying the endless chain or belt; second, the machine for driving the pulleys supporting the endless belt; third, the endless belt or chain for carrying the 105
match-splints; fourth, the carrying-bars and connecting devices forming said chain or belt; fifth, the means for opening and closing

the bars of the chain, whereby the match-splints may be introduced into and held by said chain; sixth, mechanism for operating the chain-closing devices; seventh, the guide-ways for the belt; eighth, the cutting-knife; ninth, the reciprocating head carrying a series of such knives; tenth, means for operating said head; eleventh, means for operating said knives alternately; twelfth, the carrier for the match-splint wood; thirteenth, means for feeding the match-splint wood to the knives; fourteenth, means for actuating the match-wood-feeding mechanism.

As I have noted hereinbefore, the machine which I have constructed is duplex in form—that is to say, the cutting or match-splint-forming mechanism is so arranged and operated as to form a series of match-splints when moved in each direction across the blocks of the match-wood and the splints so formed are fed into two continuously-moving belts or chains alternately, such belts or chains being arranged close to the cutting-knives. These chains or belts carry the match-splints through the length of the frame of the machine back and forth, and during the transit the splints are dipped into the various baths or mixtures necessary to transform them into matches.

So far as the description relates to the chain and its movement through the machine it will be confined to but one of the chains employed with my machine, it being understood that the other chain is precisely the same. It will also be understood that my machine may be operated to supply splints for one belt or chain only, if desired. It is more economical, however, to use two belts, for the reason that the work of the machine may be doubled without adding anything to the mechanism or increasing the power necessary to operate and feed a single belt.

First. The framework of the machine and the shafts and pulleys for carrying the endless chain or belt.—In Fig. 1 of the drawings, being a diagram of the framework of the machine, 1 represents a series of standards supporting the longitudinal pieces 2, on which are mounted suitable bearings 3 for the shafts 4 of the sprocket-wheels 5 for supporting and carrying the chain or belt 6 throughout the length of said framework. This framework is held together by suitable cross-pieces 7, and in addition to these strengthening means the shafts 4 also add stiffness to the frame. Between each of the main sprocket-wheels shelves or supporting guide-ways 8 are arranged for the belt or chain for the purpose of preventing any sagging of the same. These guideways are secured directly to the longitudinal pieces 2 of the frame.

The sprocket-wheels 5, over which the

chain passes, are driven by said chain, the latter being actuated by the worm-wheels 9 and 10, suitably journaled in the lower and upper portion of the frame, respectively, (see Fig. 2,) and motion is imparted to said worm-wheels by means of the worms 11 and 12. The wheels 9 and 10 are carried by the shafts 13 and 14, and the worms are mounted on the shafts 15 and 16. Motion is imparted to the worm-shafts from a counter-shaft 17, which is connected to and driven from the main driving-shaft 18 by means of the bevel-gears 19 and 20. The counter-shaft 17 carries the bevel-gears 21 and 22, which mesh with the bevel-gears 23 and 24, mounted on the ends of the shafts 15 and 16. The main driving-shaft 18 is driven from any suitable source of power by means of the pulley 25, located on the opposite side of the machine.

Second. The mechanism for driving the pulleys supporting the endless chain or belt.—The chain or belt 6 passes around the opening sprocket-wheels 31, mounted near the splint-forming mechanism, around the sprocket-wheels 32, mounted in the upper part of the frame, and around other sprocket-wheels 33, located at the opposite end of the frame of the machine. Between these sprocket-wheels 32 and 33 idler pulleys or wheels 34 are also arranged to support the chain. The opening sprocket-wheels 31 are carried by the worm-wheel shafts 13, and the sprocket-wheels 32 are driven therefrom by the worm-wheels 10, driving in turn the gear-wheels 35, 36, and 37 to move the chain, the gear-wheels 35 being carried by the worm-wheel shafts 14 on the opposite side from said wheels.

Third. The endless belt or chain for carrying the match-splints.—The chain or belt for carrying the match-splints is clearly shown in cross-section, Fig. 9, in connection with one of the opening sprocket-wheels 31, and also in Figs. 11 and 12, which views are full size. This chain or belt is made up of a series of bars 41, octagonal in cross-section and having a series of grooves 42 extending entirely around the surface of the same, the grooves of one bar registering with the grooves of the adjoining bars, whereby pockets or receptacles are formed for the matches. The ends of these bars are joined by links 43, connected in pairs, whereby a flexible joint is formed between the ends of said bars. By this arrangement the chain or belt may be readily opened by the teeth 44 of the sprocket-wheel 31, the flexible connections between the bars flattening and causing such bars to separate. I prefer to have the teeth 44 of the opening sprocket-wheels 31 rounded, so as to engage the hubs 45 of the ends of the bars 41 forming the chain.

Fourth. The carrying-bars and connecting devices by means of which said chain or belt is formed.—In the present instance the bars 41, forming my improved chain or belt, are adapt-

ed to carry forty match-splints, such splints being disposed about one-fourth of an inch apart, and I have found in practice that it will be difficult to use bars of greater length.

5 Between the flexible toggle-link connection at the ends of the bars and the octagonal portion said bars are reduced at 45, as noted above, to form engaging portions for the sprocket-wheels over which said bars pass
10 with the chain or belt of which they form members.

I prefer to form the bars 41 octagonal in cross-section, since such shape provides a beveled face at the point where the match-splints are introduced and also serves to permit the ready withdrawal of the matches when they reach the point of discharge. The grooves 42 in the bars are preferably semi-circular in shape, although I do not wish to
20 limit myself to such contour, and are of such depth that when the bars are laid close together the spaces formed by said grooves will be a trifle too small to receive a match, such arrangement providing a positive clamp
25 for the match-splint when the bars are closed against such splints.

Fifth. The means for opening and closing the bars of the chain, whereby the match-splints may be introduced into and held by said chain.—

30 In order to present the chain at the point where the match-splints are formed in proper condition to receive the splints, the opening sprocket-wheel 31 just described is employed having the special teeth 44, adapted
35 to engage the portion 45 of the bars of the chain or belt and separate the same, said chain passing around the wheel 31 in a separated condition. This will insure the discharge of the matches at the point *x* into a suitable delivery-spout 51, from which they pass
40 onto a transverse carrying-belt 52, by means of which the matches may be carried away to a suitable point for boxing. As the chain or belt continues its movement around the
45 wheel 31 the links will be held apart by the teeth 44 of said wheel to the point *y*, where the newly-cut splints are to be inserted therein.

We now come to the means for closing the
50 bars of the chain or belt, so that the match-splints introduced into the same may be held between said bars of the chain or belt. For this purpose I provide lifters 53, which are mounted on a cross-shaft 54 and are actuated by a vertically-moving member 55, hav-
55 ing a rack 56, engaging a pinion 57, carried by the shaft 54. The lifters 53 are provided with projections or teeth 58, which engage a portion of each link or bar of the chain and
60 close the same against the bar immediately in front as soon as a series of splints have been introduced into the space between said bars, and thereby hold said splints to the chain. The friction between the toggle-
65 links 43, which connect the ends of the bars

of the chain or belt, is usually sufficient to maintain said bars in the closed position into which they are forced by the lifters 53.

Sixth. Mechanism for operating the chain-closing devices.—The lifters 53 are not actu- 70 ally raised, but are given a partial rotation, so that their engaging teeth 58 are moved in the arc of a circle, and in order to impart such movement to said lifters I provide the vertically-moving members 55 just described, 75 mounted in suitable ways secured to the side of the machine and having the upper bent portions 59, which extend over each of the opening sprocket-wheels 31. These members carry the racks 56, adapted to engage 80 the pinions 57, mounted on the lifter-shaft, and thereby impart the partial rotation to said lifters. The movement of the lifters to raise and close the chain is coincident with the movement of the head carrying the cut- 85 ting-knives.

At the lower portion of the members 55 I provide rollers 60, and adapted to engage these rollers and raise said members at every reciprocation of the cutting-head are the 90 cam-levers 61, pivoted at 62 and operated by means of fixed pins 63, carried by the movable head. As said head continues its movement after a set of splints has been cut the pins 63 engage one of the cam-levers 61 and 95 turns it so as to act on the roller 60 and raise the member 55. The splints which have been cut by the forward movement of the head are carried back by the rearward movement of the knives and then laid in the belt. 100 Immediately after said splints have been laid in the belt the movement of the member 55 actuates the lifter 53 to close the bar of the chain against such splints.

Seventh. The guideways for the belt or chain.—As soon as the splints have been engaged by the bars of the chain or belt the latter moves on, and the vertical movement, as clearly shown in Fig. 9, is through a guide- 105 way 65. Mounted in this guideway are the spring-fingers 66, which come under the bars of the chain as soon as they are released by the lifters, and serve to keep said chain in a taut condition, insuring the holding of the match-splints. As the chain reaches the 115 upper portion of this guideway it passes to one of the sprocket-wheels 32 and thence to the horizontal guideways 8, carried by the frame of the machine. These guideways 8 are supported by brackets 68, secured to the 120 standards 1 of the frame of the machine, and the chain when passing between the carrying and driving sprocket-wheels is always supported by said guideways.

Eighth. The cutting-knife.—For use in con- 125 nection with the improved form of match-making machine forming the subject of my invention I have devised a new and improved knife, which is shown in side elevation in Figs. 7 and 8 and in perspective view, Fig. 130

10. This knife 70 is so formed that it provides a cutting edge entirely surrounding the opening 71 for the passage of the match-splint, and I am thereby enabled to cut a match-splint substantially round for its entire length. Between the cutting edge of this knife and the knife-bar a recess or groove 72 is formed, which permits the making of a cutting edge substantially circular.

10 *Ninth. The reciprocating head for carrying the knives.*—The head 75, in which the cutting-knives 70 are secured, is clearly shown in the enlarged sectional views, Figs. 7 and 8, and said head extends across the bed of the machine, being provided with runners 76, adapted to slides 77 in said bed. The knives are so fixed in said head as to be capable of vertical movement in alternate sets, but are firmly held against lateral or longitudinal movement. As the cuts made by said knives in the blocks of match-wood will leave thin strips of the material between each groove from which a splint has been taken and as I desire to remove these "fins," so to speak, I arrange between the sets of splint-cutting knives carried by said head 75 the two-edged knife or plane 78, which is fixed in position to said head and moving in advance of the match-splint cutters planes the surface of the match-wood blocks presented to such cutters. This plane 78 is readily removable for sharpening, and it will be noted that it is substantially triangular in cross-section, having the two under beveled faces meeting the upper plane face.

35 *Tenth. Means for operating the head carrying the match-splint-cutting knives.*—Connected at 79 to the head 75 is a link 80, carried by a crank 81, secured to the main driving-shaft 18 of the machine, and when said shaft is rotated the head 75 will be reciprocated back and forth. The movement of the head 75 is so timed that it will present a set of splints to the space between the bars of the chain or belt at every movement of the same, care being taken to have the crank well set up and constantly adjusted, so that the head will be given its full movement to insure the positioning of the splints between the bars of the chain or belt.

50 *Eleventh. Means for operating said knives alternately.*—Carried by this head 75 are a series of the knives 70, which have been described above, such knives being held in suitable frames 85 by means of the retaining-plates 86, which frames are capable of vertical movement within said head 75. When the head is moved in the direction of the arrow, Fig. 7, the knives on the left-hand side of the head are raised so as to sever a series of splints from the block of wood which is mounted above said head, and when said head is reciprocated in the opposite direction, as indicated by the arrow, Fig. 8, the knives on the right-hand side of the head will be

projected to cut the splints from the blocks of wood in the same manner as the other set of knives. It will be noticed on referring to Figs. 7 and 8 that the cutting edges of the knives 70 are turned toward each other, and as soon as the splints have been severed from the blocks they will be carried back by the knives and delivered to the chain and engaged by the bars of the same, as has already been described, grooves 75^a being provided to receive the splints. Each of the heads 75, in which the knives are mounted, is provided with downwardly-projecting pins 90, carrying adjustable nuts 91, between which and a portion of said head 75 springs 92 are interposed for the purpose of keeping said knives normally in the lowered position. In order to raise these knives, I provide the cam slide-plate 93, adapted to a suitable way 94 in the head and having beveled ends 95, the said bevels being on opposite sides. In order to move these slide-plates by engagement with their beveled ends, I provide stops or projections 96 on the bed 97 of the machine, which stops are adapted to contact with the ends of said slide-plate and move it from side to side as said head 75 is reciprocated back and forth. This plate 93 is also provided with the depressions 98, into which the depending projections 90 of the knife-frames 85 are moved alternately as said plate is moved from one side to the other. The high portion 99 of said plate adjacent to these depressions 98 positively supports the frame having the knives which are to cut upon the movement of the head in the raised position.

Twelfth. The carrier for the match-splint wood.—This carrier, mounted directly above the reciprocating head 75, is clearly shown in Figs. 4, 5, and 6 of the drawings and consists of the frame 100, extending from the side of the machine at an angle and lying over the head 75. Into this carrier are fed the blocks of wood, previously cut to such a size that splints of uniform length may be taken from the same. This frame may be secured to the bed or body of the machine in any suitable manner, and it is preferably removable in order that any jamming of the wood blocks may be corrected and the positive feed of the same insured.

Thirteenth. Means for feeding the match-splint wood to the knives.—The blocks of the match-wood are moved through the frame 100 so that a portion of the same is always in position to be cut by one set or the other of the knives by means of suitable friction-rollers 101, journaled in the frame 100 and engaging the sides of said blocks. The rollers 101 are preferably corrugated or otherwise roughened on their engaging faces. In order that the rollers may be positively moved at each reciprocation of the head 75, I provide the shafts 102, carrying said rollers, with pinions 103, meshing with each other, and pro-

vide means for turning these pinions and the rollers controlled by the same at each reciprocation of the head 75, such means being clearly shown in Figs. 13 and 13^a. To effect this result, I mount on one of the shafts 102 a ratchet-wheel 104, the movement of which is controlled by pawls 105 and 106, carried by a plate 107, having a projecting arm 108, said plate being pivoted at 108^a so that a swinging movement may be imparted thereto by means engaging the projection. The pawls 105 and 106 are held in contact with the ratchet-wheel by means of spring-fingers 109 and 110.

15 *Fourteenth. Means for actuating the match-wood-feeding mechanism.*—Figs. 13 and 13^a show clearly the operation of the means for actuating the match-wood-feeding mechanism, the plate 107 being swung on its pivot by the pins 111 and 112, carried by the reciprocating head 75, engaging its projecting arm 108. Fig. 13 shows the plate swung to the left by the pin 111, which action has caused the pawl 105 to move the ratchet-wheel one tooth in the direction of the arrow and the pawl 106 to move back to engage the next tooth, and Fig. 13^a shows the plate swung to the right by the pin 112, which action has caused the pawl 106 to move the ratchet-wheel one tooth also in the direction of the arrow, the pawl 105 meanwhile moving back to engage another tooth. As the plate 107 is swung back and forth, causing the pawls to engage the ratchet-wheel, one of the shafts 102 is moved directly by the same, and this movement being communicated by the pinions 103 to the other shaft the rollers 101 are turned to feed the match-wood forward to the splint-forming knives 70. The ratchet-wheel 104 is moved a tooth at a time at each movement of the head, the pawls being so set with respect to said wheel that the swinging movement of the plate 107 in two directions will impart movement to the ratchet-wheel in one direction only. It will thus be seen that I provide a positive feed for the match-wood at each movement of the head 75, and thereby insure that a sufficient quantity of match-wood will be in position to be engaged by the knives to form the splints at every operative movement of said knives.

I make no special claim for the tanks containing paraffin and the igniting mixture to form the finished match, preferring to use any well-known structures for this purpose. My machine is of great length, insuring the positive drying of the match-heads before said matches reach the point of delivery, and at 113 and 114 in the lower run of the chain or belt I have shown suitable tanks for paraffin or other suitable mixture and the igniting mixture, respectively. At any point in advance of the paraffin-tank 113 I may arrange a suitable heating apparatus or pro-

vide for the discharge of heated air upon the match-splint carried by the belt.

Tension-plates 115 may be employed for keeping the match-wood in position, as shown in Figs. 7 and 8, such plates being carried by the screw-bolts 116 and held in contact with the wood by the springs 117.

While it is thought that the toggle-links will be sufficiently stiff to insure the contraction of the chain or belt, I guard against any accidental loosening of the same by providing springs, such as shown at 118 in Fig. 12, to hold the ends of the bars 41 in the contracted position. Any convenient form of spring may be used for this purpose, and while it will serve to prevent the accidental expansion of the bars it will not retard the opening of the chain by the sprocket-wheels 31.

While I have described certain mechanisms for accomplishing the result sought to be attained with the use of my improved machine, it will be understood that I do not wish to limit myself to their precise construction, for my invention includes the mechanical equivalents of such devices as well as the exact structures I have shown.

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

1. The combination in a match-splint-forming machine, of a horizontally-reciprocating head, two sets of punching-cutters carried by said head, said sets of cutters being arranged to operate alternately at each movement of the head, provision for supplying match-wood in position to be engaged by said cutters, means for moving the head, and means within the head actuated during its reciprocating movements for bodily moving one of said sets of cutters into the operative position at each movement of the head.

2. The combination in a match-splint-forming machine, of a horizontally-reciprocating head, two sets of punching-cutters carried by said head and vertically movable therein, alternately, coincident with the movements of the head, said sets of cutters being arranged to operate when in the raised position, provision for supplying match-wood in position to be engaged by said cutters, an independent horizontally-fixed knife disposed between the sets of punching-cutters and serving to shave or plane the irregularly-cut surface of the wood, between the engagements of the punching-cutters therewith, and means for reciprocating the head.

3. The combination in a match-splint-forming machine, of a horizontally-reciprocating head, two sets of vertically-movable punching-cutters carried thereby, said sets of cutters being arranged to operate alternately at each movement of the head, provision for supplying match-wood in position to be engaged by said cutters, an independent horizontally-disposed knife moving in the same

general plane as the punching-cutters and disposed between the same, said knife being two-edged and operating in advance of each movement of the cutters to shave or plane the irregularly-cut surface of the match-wood, and means for moving the head.

4. The combination in a match-splint-forming machine, of a reciprocating head, knives arranged in sets carried by said head, each set of said knives being vertically movable independently of the movement of the head whereby one set or the other is adapted to cut at every movement of the head, a match-wood reservoir, provision for feeding the wood to the knives, chains arranged adjacent to the reciprocating head, and means for depositing the splints therein directly from the knives, one set of splints being carried by one set of knives as the knives of the other set are cutting.

5. The combination in a match-splint-forming machine, of a reciprocating head, knives arranged in sets carried by said head and adapted to cut at every movement of the head, each of said sets of knives being vertically movable into the operative position, provision for feeding match-wood to said knives, chains arranged adjacent to the reciprocating head, means for depositing the splints in said chains alternately coincident with the movements of said head, said splints being carried by one set of knives as the other set is cutting, and means for moving said head.

6. The combination in a match-splint-forming machine, of a reciprocating head, knives arranged in sets carried by said head and adapted to cut at every movement of the head, a reservoir containing match-wood to be acted upon alternately by the sets of knives, provision for feeding the wood to the knives, chains composed of flexibly-jointed bars arranged at each end of the reciprocating head, means for delivering the splints cut by said knives to the chains, and means for causing each of said chains to grip the splints.

7. The combination in a match-splint-forming machine, of a reciprocating head, knives arranged in sets carried by said head, said knives being adapted to cut at every movement of the head, provision for feeding match-wood to a point common to each set of said knives, chains composed of flexibly-jointed bars adjacent to the reciprocating head, provision for carrying the splints by said knives to be engaged by said chains, and means for compressing the bars of said chains so as to clamp the splints between the same.

8. The combination in a match-splint-forming machine, of a reciprocating head, two sets of independently-movable punching-cutters carried by said head, means for moving said head back and forth, means for raising said sets of cutters alternately, simultaneously with the movement of the head,

provision for feeding match-wood to a point common to each set of cutters, and means for actuating the match-wood-feeding mechanism in advance of the operative movement of each set of cutters.

9. The combination in a match-splint-forming machine, of a reciprocating head, two sets of punching-cutters carried by said head, vertically-movable holders for said cutters, each of said holders being bodily movable, mechanism within the head actuated at each movement of the latter to effect the movement of the holders one of which is constantly in the lowered position, and means for raising said holders alternately at every movement of the head.

10. The combination in a match-splint-forming machine, of the reciprocating head, means for moving the same, knives arranged in sets and carried by said head, holders in which said knives are secured, said holders being bodily movable in a vertical direction, a cam-plate carried by the head and adapted to raise said knife-holders, the latter having coacting portions, and means for moving said cam-plate laterally as the head is moved.

11. The combination in a match-splint-forming machine, of the reciprocating head, means for moving the same, knives arranged in sets and carried by said head, holders in which said knives are secured, said holders being bodily movable in a vertical direction, downwardly-projecting stems carried by said holders, means for maintaining said holders in the normally lowered position, a cam-plate carried by said head and adapted to engage the stems of the knife-frames to raise the same, and means for moving said cam-plate laterally as the head is moved.

12. The combination in a match-splint-forming machine, of a reciprocating head, means for moving the same, knives arranged in sets and carried by said head, one set being adapted to cut at each movement of the head, holders in which said knives are secured, said holders being bodily movable in a vertical direction, downwardly-projecting stems carried by said holders, means for maintaining said holders in a normally lowered position, and a slide-plate having a series of depressions with beveled portions adjacent thereto for the stems of the frames, said slide-plate being movable transversely as the head is moved longitudinally, and serving to raise the knife-frames alternately at each movement of said plate.

13. The combination in a match-splint-forming machine, of the cutting-knives arranged in independently-movable sets, a head for carrying the same, means for moving said head, means for operating the sets of knives alternately simultaneously with the movement of the head, a match-wood reservoir having wood to be moved to a point common to each set of knives, feed-rolls engaging said wood and serving to move it

toward the knives, pinions carried by the rolls, shafts for driving the same, one of said shafts extending below its pinion, a ratchet-wheel carried thereby, and a pair of feed-pawls mounted upon a common carrier for actuating said ratchet-wheel alternately as the knife-carrying head is moved back and forth.

14. The combination in a match-splint-forming machine, of the cutting-knives arranged in independently-movable sets, a head carrying said knives, means for moving said head and operating the sets of knives alternately, a match-wood reservoir, feed-rolls in engagement with said wood for feeding it to a point common to each set of knives, and means for driving said feed-rolls, said means including a ratchet-wheel operatively connected to one of the feed-rolls, a pair of pawls in engagement with said ratchet-wheel and engaging the same as the head is moved back and forth, and a swinging plate carrying said pawls, said plate being moved by engagement with the reciprocating head whereby said pawls are thrown into operative engagement with the ratchet-wheel alternately at each movement of the head.

15. The combination in a match-splint-forming machine, of the cutting-knives arranged in independently-movable sets, a head carrying said knives, means for moving said head and operating the sets of knives alternately, a match-wood reservoir, feed-rolls in engagement with said wood for feeding it to a point common to each set of knives, pinions carried by the shafts of said feed-rolls whereby they may be driven in unison, a ratchet-wheel carried by the shaft of one of said pinions, a swing-plate pivoted to the frame of the machine, a pair of pawls carried by said plate and engaging the ratchet-wheel as the head is moved back and forth, and provision for moving said plate by the reciprocating head, said pawls being thereby thrown into operative engagement with the ratchet-wheel alternately at each movement of the head.

16. The combination in a match-making machine, of the splint-forming mechanism, and a carrying chain or belt for traversing said splints through the machine, said chain comprising bars between which the splints are to be held, and expansible and contractile connections for the ends of said bars whereby said chain may be expanded and contracted.

17. The combination in a match-making machine, of the splint-forming mechanism, a carrying chain or belt for traversing said splints through the machine, said chain comprising bars between which the splints are to be held, expansible and contractile connections for the ends of said bars whereby said chain may be expanded and contracted, and

means for maintaining said chain in the contracted position.

18. The combination in a match-making machine, of the splint-forming mechanism, and a chain or belt for traversing said splints through the machine, said chain comprising a series of bars between which the splints are held, and frictional end-connecting members for said bars, said members permitting expansion and contraction of the chain.

19. The combination in a match-making machine, of the splint-forming mechanism, and a belt for traversing said splints through the machine, said belt comprising a series of flexible chains made up of toggle-links carrying a series of bars between which the splints are held.

20. The combination in a match-making machine, of the splint-forming mechanism, and a belt for traversing said splints through the machine, said belt comprising a series of chains made up of toggle-links permitting expansion and contraction of the same, said chains carrying a series of bars between which the splints are held.

21. The combination in a match-making machine, of the splint-forming mechanism, and a belt for traversing said splints through the machine, said belt comprising a pair of chains arranged at the outside of a series of bars to which said chains are connected, said chains being made up of toggle-links permitting expansion and contraction of the same, thereby permitting the discharge of the finished matches and the reception of the newly-formed splints.

22. The combination in a match-making machine, of the splint-forming mechanism, a chain or belt for traversing said splints through the machine, coacting rods forming said chain and adapted to receive the splints between the same, and a series of toggle-links connecting the ends of said rods.

23. The combination in a match-making machine, of the splint-forming mechanism, a chain or belt for traversing said splints through the machine, coacting rods forming said chain and adapted to receive the splints between the same, a series of toggle-links connecting the ends of said rods, and springs carried by the ends of said rods for keeping said chain in the normal contracted position.

24. The combination in a match-making machine, of the splint-forming mechanism, a chain or belt for traversing said splints through the machine, said belt comprising rods or bars connected at their ends only by expansible and contractile means whereby the chain may be expanded or contracted, guideways for said chain, and means adjacent to said guideways for keeping said chain in the contracted position.

25. The combination in a match-making machine, of the splint-forming mechanism, a chain or belt for traversing said splints

through the machine, said chain comprising bars connected at the ends by links forming toggle-joints between adjoining bars, guide-ways for the ends of said bars whereby the chain may be kept in proper alinement, and springs adjacent to said guideways for main-
5 maintaining the chain in the contracted position.

26. The combination in a match-making machine, of the splint-forming mechanism, a
10 chain for traversing said splints through the machine comprising a series of rods flexibly jointed at the ends, means for opening said chain to permit the insertion of the splints between the rods, and means for positively
15 closing said rods as soon as the splints have been engaged thereby, said chain being maintained in the closed position by frictional contact of the end connections.

27. The combination in a match-making
20 machine, of the splint-forming mechanism, a chain or belt for traversing said splints through the machine comprising a series of independently-mounted rods having expan-
25 sible and contractile connections at the ends, means for opening said rods for the reception of the splints, and means for positively closing the chain as soon as the splints have been engaged by the rods, said chain being main-
30 tained in the closed position by means of springs carried by and connecting the ends of said rods.

28. The combination in a match-making machine, of the splint-forming mechanism, a
35 chain or belt for traversing said splints through the machine comprising a series of rods having expansible and contractile connections at the ends, sprocket-wheels having specially-formed teeth for opening said chain whereby the rods may be placed in proper
40 position for the reception of the match-splints, and means exterior of the chain for engaging said rods to raise and close them against the splints as soon as the latter have been inserted.

29. The combination in a match-making machine, of the splint-forming mechanism, a
45 belt for traversing said splints through the machine comprising a series of rods having expansible and contractile connections at the
50 ends, sprocket-wheels having special teeth for opening said rods whereby the chain may be presented in proper shape for the reception of the match-splints, and lifter mechanism for engaging said rods to raise and close
55 them against the splints as soon as the latter have been inserted.

30. The combination of the chain for trav-
60 ersing the splints, expansible and contractile members for the edges of said chain, means for opening said chain whereby the splints may be inserted therein, a lifter for closing said chain, a vertically-moving rack-bar for operating said lifter, a shaft upon which said lifter is mounted, and a pinion secured to

said shaft and engaged by the rack-bar 65 whereby said lifter may be operated.

31. A chain or belt for use in connection with match-making or match-splint-forming machines, comprising a series of rods be-
70 tween which the splints are adapted to be held, and expansible and contractile connections for the ends of said rods.

32. A chain or belt for use in connection with match-making or match-splint-forming machines, consisting of a series of rods or
75 bars polygonal in shape between which the match-splints are adapted to be held, said bars having coacting grooves providing pockets for the reception of the matches, and ex-
80 pansible and contractile connections for the ends of said rods or bars.

33. A chain or belt for use in connection with match-making or match-splint-forming machines consisting of a series of rods or bars
85 between which the match-splints are adapted to be held, and toggle-links connecting the ends of said rods or bars.

34. The combination in a match-splint-forming machine, of a series of endless chains, a reciprocating head, knives arranged in sets
90 and carried by said head, one set being adapted to cut at each movement of the head, provision for supplying match-wood to said knives, means for moving the head, and means for moving one set of said knives into
95 cutting position and lowering the other set of knives into the inoperative position, said knives when in the lowered position carrying the splints previously cut by the same to one of said chains. 100

35. The combination in a match-splint-forming machine, of a reciprocating head, punching-cutters arranged in sets and carried
105 by said head, said cutters being vertically movable therein and one set being arranged to cut at each movement of the head, means for imparting vertical movement to said sets of cutters, provision for supplying match-wood to said cutters, a horizontally-disposed
110 two-edged knife for trimming said wood and acting in advance of the operative set of punching-cutters, said trimming-knife being set between the sets of cutters and moving in a plane coincident with the lower cutting
115 edge of the same when they are in the raised or operative position, and means for moving said head.

36. The combination in a match-splint-forming machine, of a reciprocating head, knives arranged in sets and carried by said
120 head, one set being adapted to cut at each movement of the same, provision for feeding match-wood to said knives, a planing-knife for smoothing the cut surface of such wood so as to present it in good condition to the
125 splint-cutting knives, said planing-knife being two-edged and disposed between the two sets of splint-cutting knives and cutting in

advance of the knives at each movement of the head, and means for moving said head.

37. The combination in a match-making or match-splint-forming machine, of the reciprocating splint-forming mechanism, a chain or belt for traversing said splints through the machine comprising a series of rods with expansible and contractile end connections, cams for engaging said bars to close the same, a shaft carrying said cams, a pinion carried by said shaft, a rack-bar in engagement with said pinion whereby the cams may be operated to raise the bars of the chain, means for operating said rack-bar as the splint-forming mechanism is reciprocated and means for reciprocating said splint-forming mechanism.

38. The combination in a match-making or match-splint-forming machine, of a reciprocating head carrying the splint-forming mechanism, a chain or belt for traversing said splints through the machine comprising a series of rods with expansible and contractile end connections, sprocket-wheels for opening said chains to receive the splints, cams for closing said chain, means for operating said cams simultaneously with the reciprocation of the head, and means for reciprocating said head.

39. The combination in a match-making or match-splint-forming machine, of a reciprocating head carrying the splint-forming mechanism, a chain or belt for traversing said splints through the machine comprising a series of rods with flexible end connections, sprocket-wheels for opening said chain to receive the splints, cams for closing said chain, a shaft upon which said cams are mounted, a pinion carried by the shaft, a sliding rack-bar in engagement with said pinion, said bar being adapted to ways on the side of the

machine, engaging members carried by the reciprocating head for moving said rack-bar, and means for moving said head.

40. The combination in a match-making or match-splint-forming machine, of a reciprocating head carrying the splint-forming mechanism, a chain or belt for traversing said splints through the machine comprising a series of rods with flexible end connections, sprocket-wheels for opening said chain to receive the splints, cams for closing said chain, a shaft upon which said cams are mounted, a pinion carried by said shaft, a sliding rack-bar engaging said pinion, said bar being adapted to ways in the side of the machine, pivoted cams carried by the fixed portion of the frame of the machine, and pins carried by the reciprocating head for engagement with said cams to operate the rack-bars, and means for moving said head.

41. The combination in a match-making or match-splint-forming machine, of a reciprocating head carrying the splint-forming mechanism, knives arranged in sets and carried by said head, one set or the other being adapted to cut at every movement of the same, provision for feeding match-wood to said knives, means for raising said set of knives to their operative position, the portion of said head adjacent to the knives having grooves to receive and position the matches as they are carried back by the knives after severance from the match-wood blocks, and means for moving said head.

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

CHARLES M. LEWIS.

Witnesses:

MURRAY C. BOYER,
JOS. H. KLEIN.