

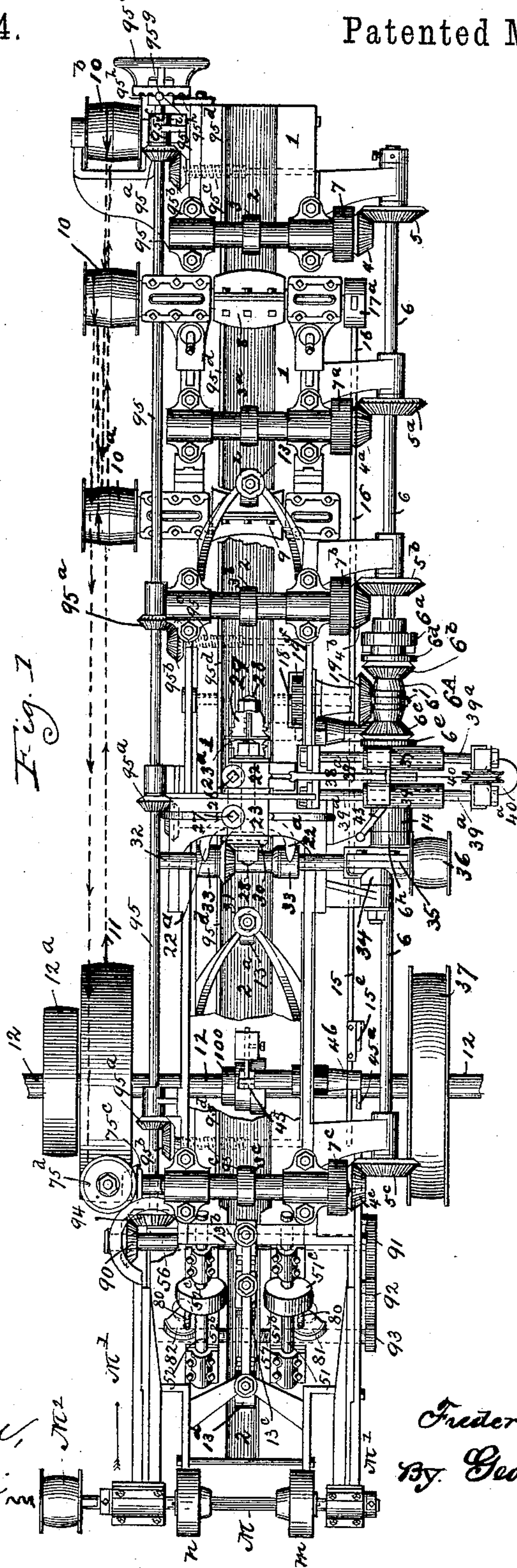
(No Model.)

5 Sheets—Sheet 1.

F. H. BROWN.
STAVE MAKING MACHINERY.

No. 452,094.

Patented May 12, 1891.



Witnesses,
J. J. Mann,
L. P. Levin

Inventor,
Frederick Hawkins Brown,
By Geo W. Levin.

Atty.

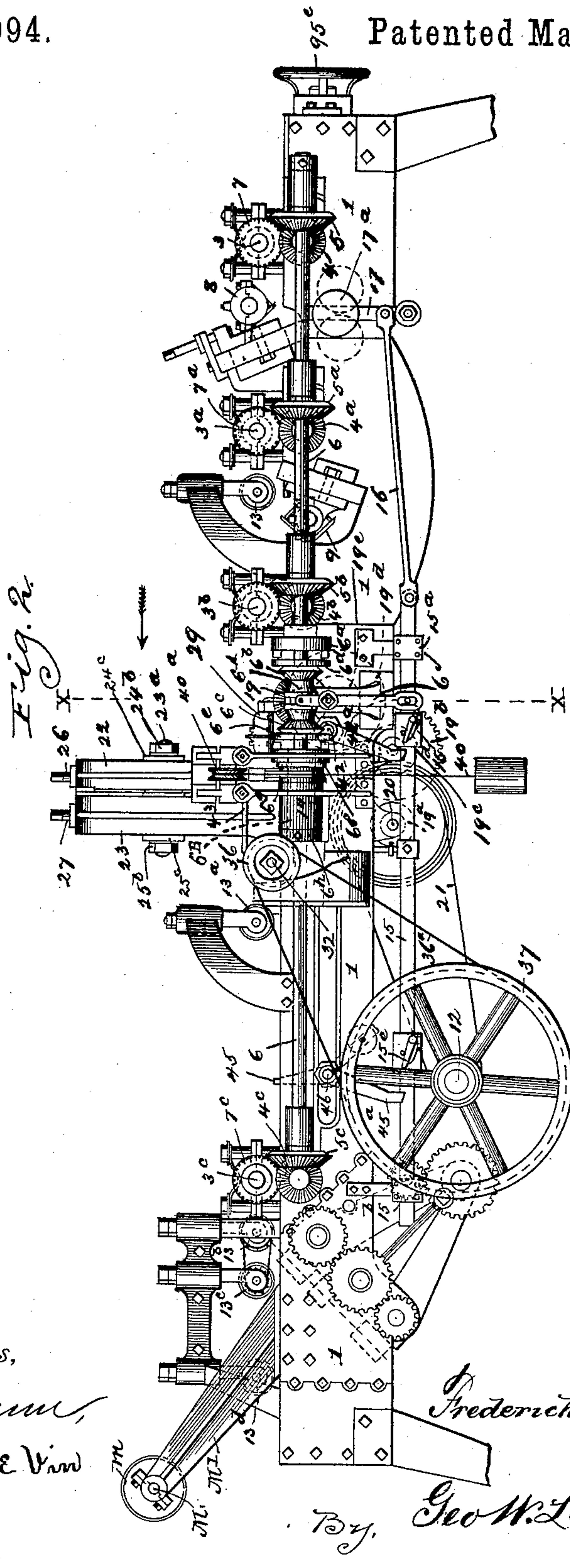
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5 Sheets—Sheet 2.

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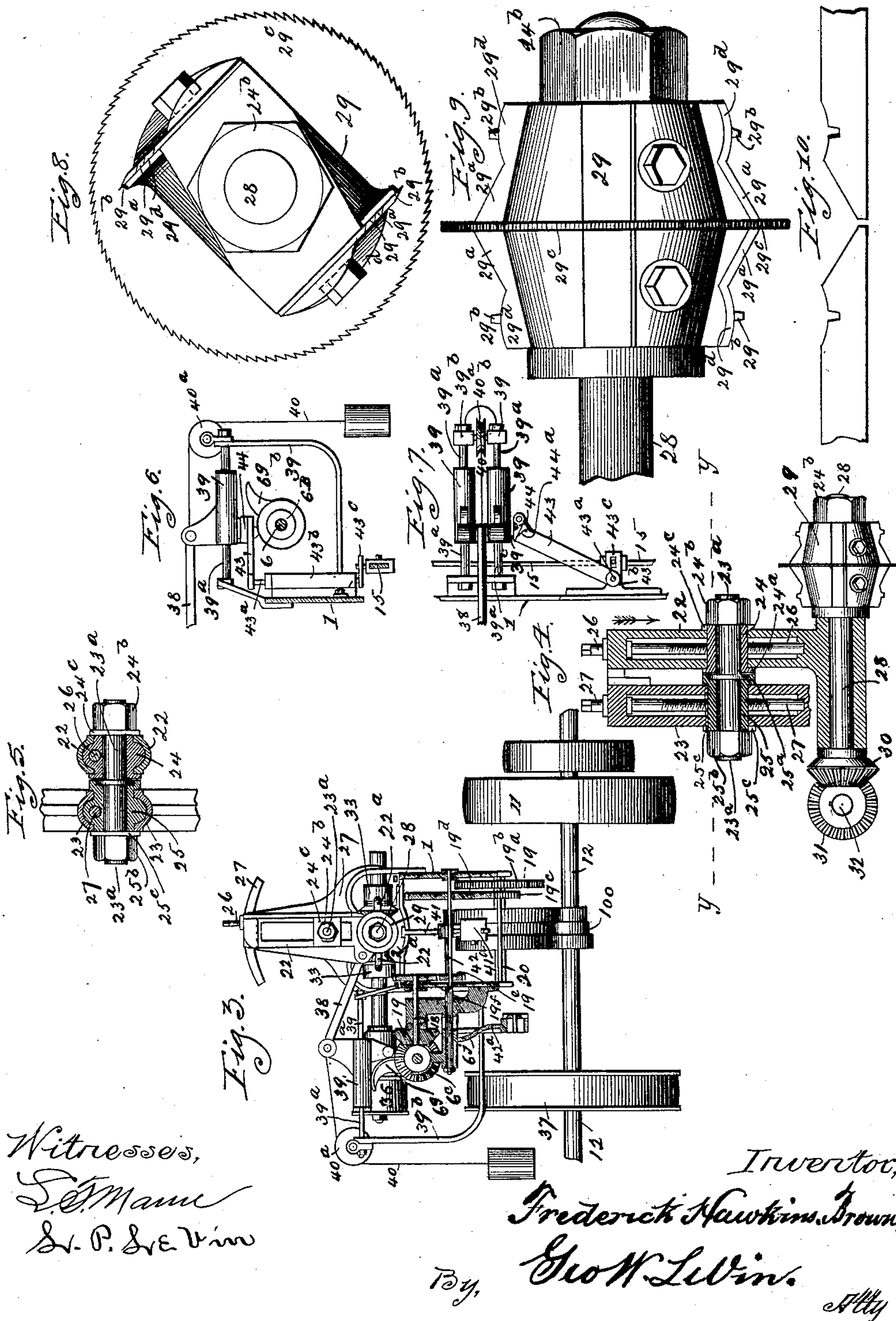
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5 Sheets—Sheet 3.

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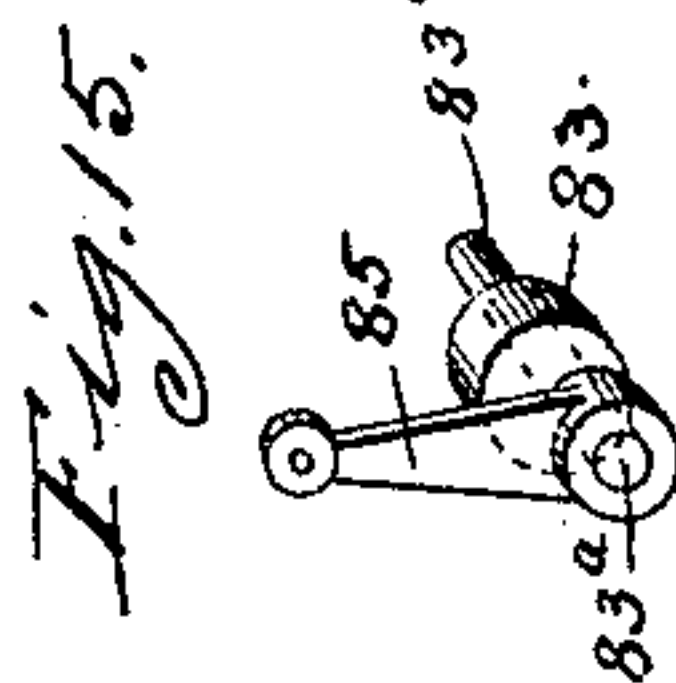
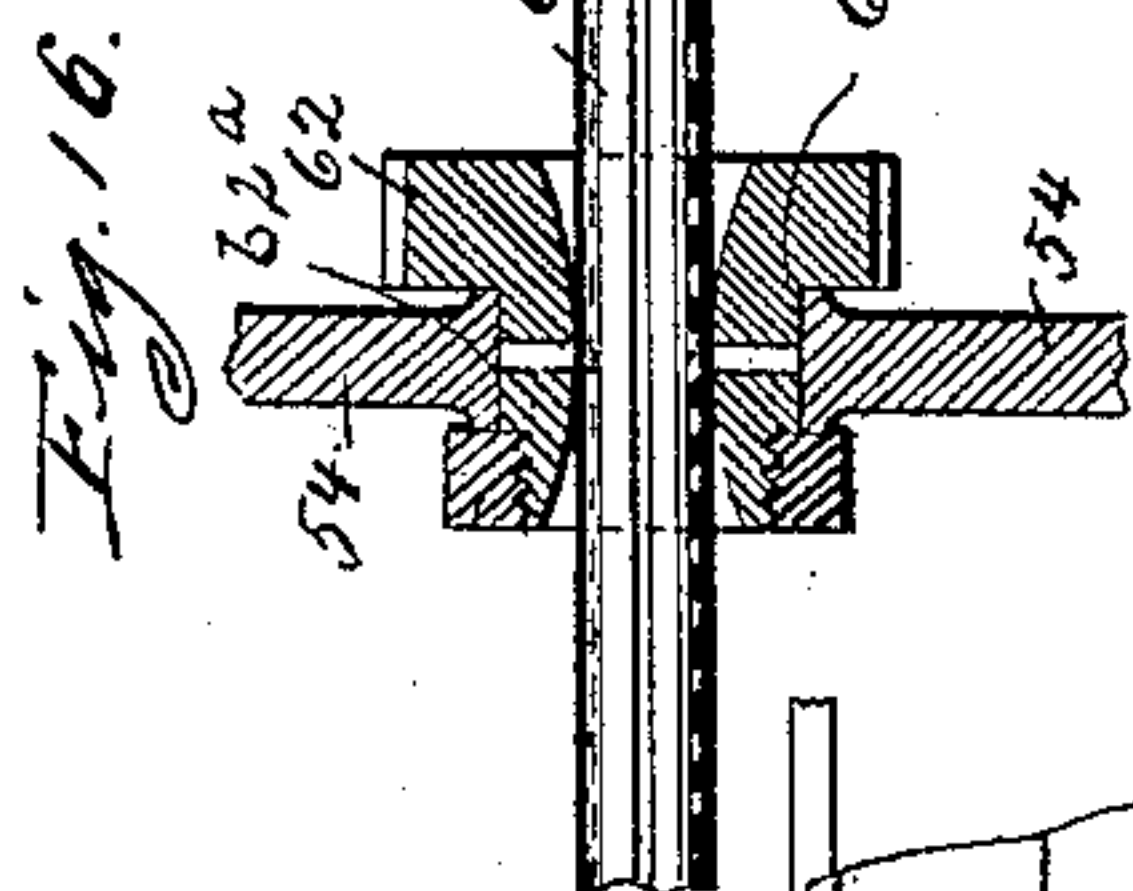
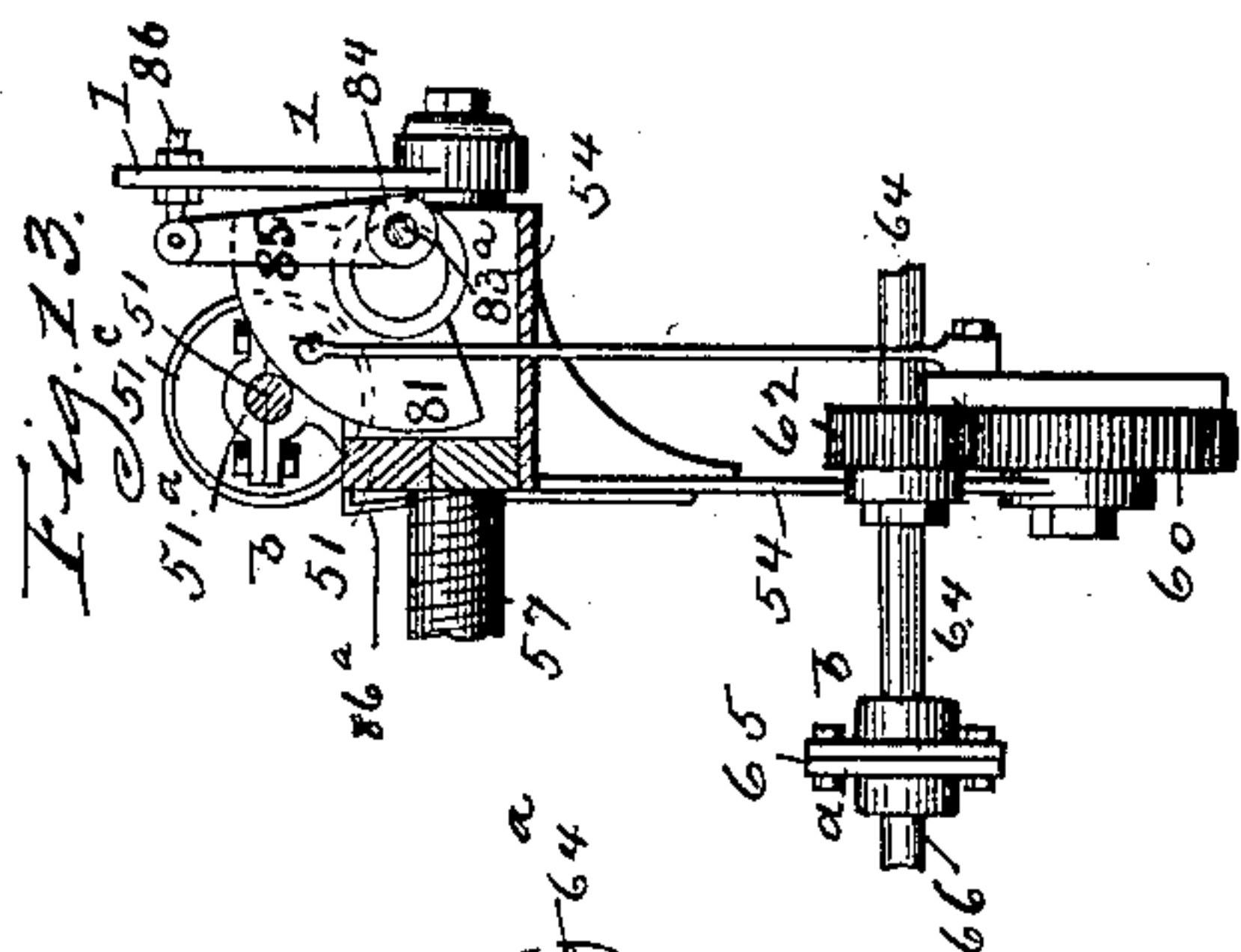
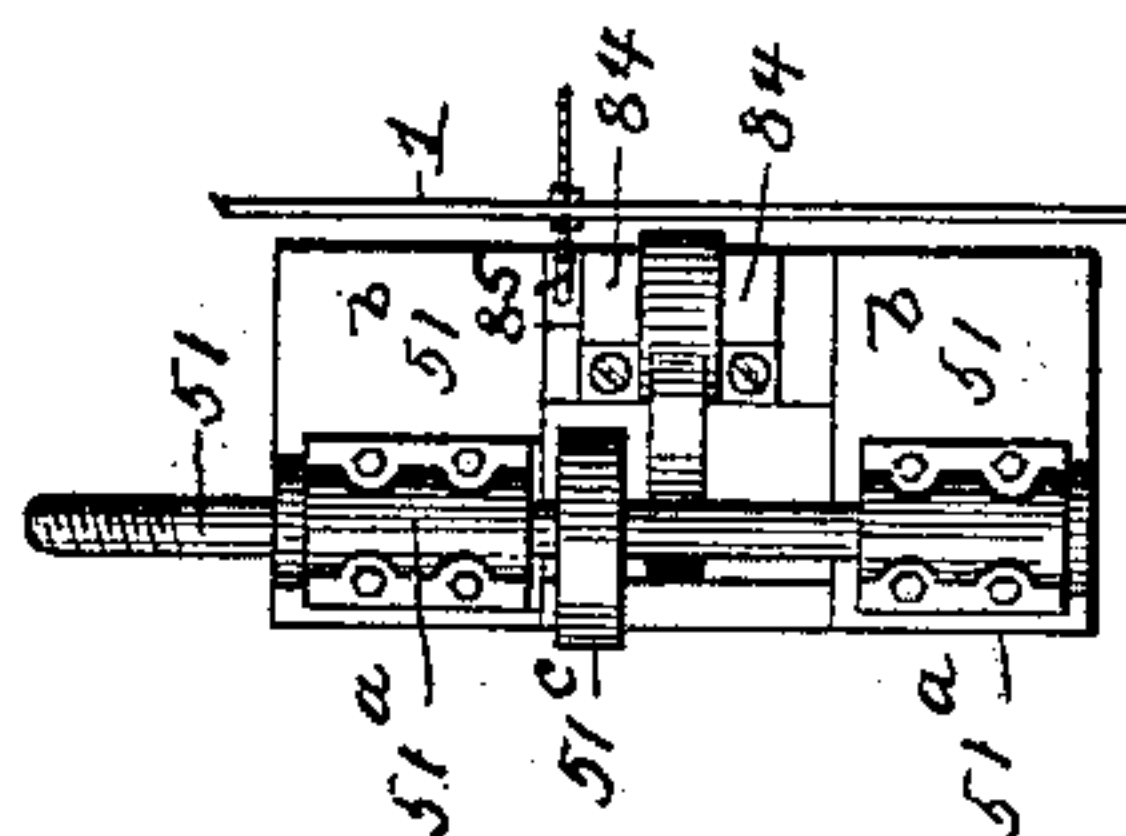
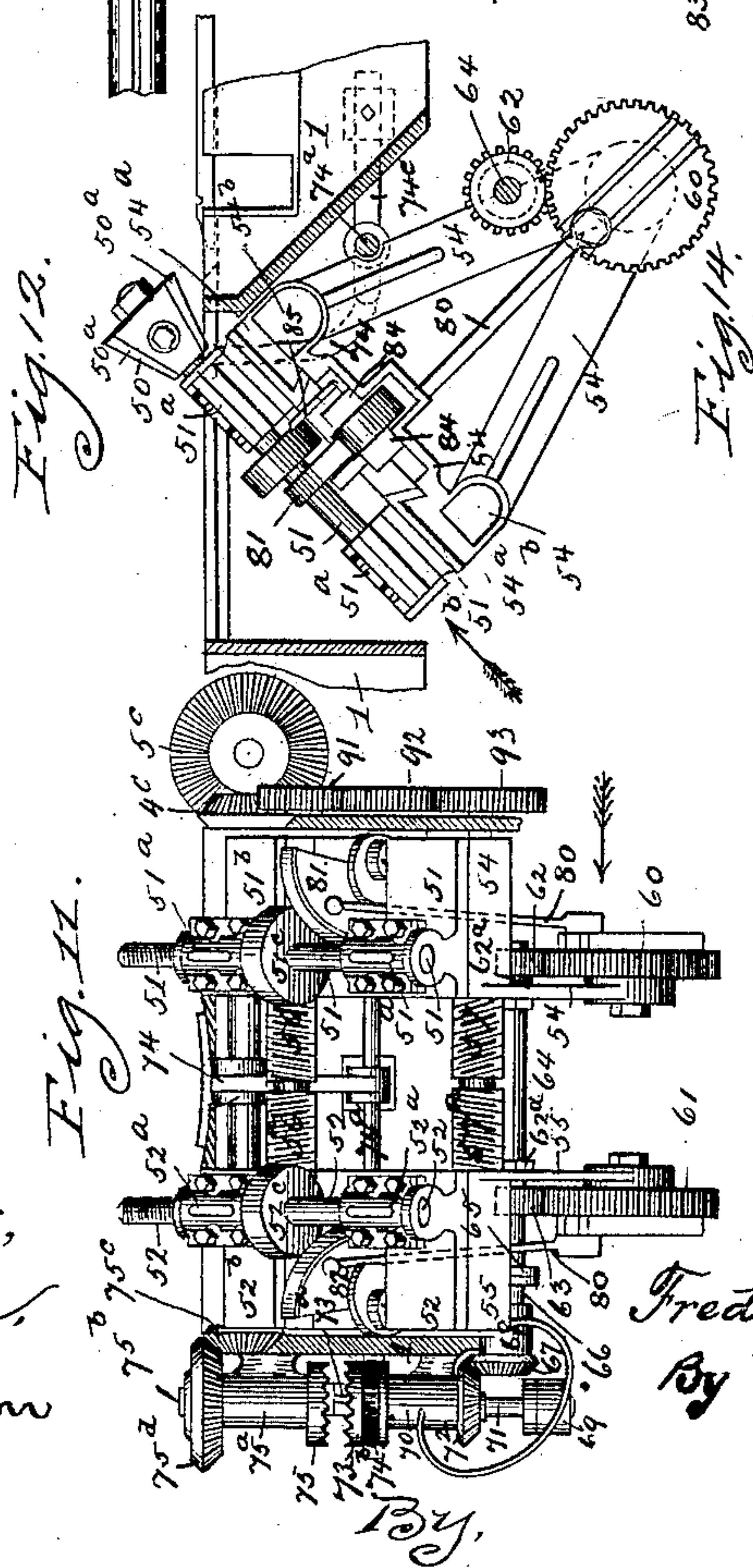
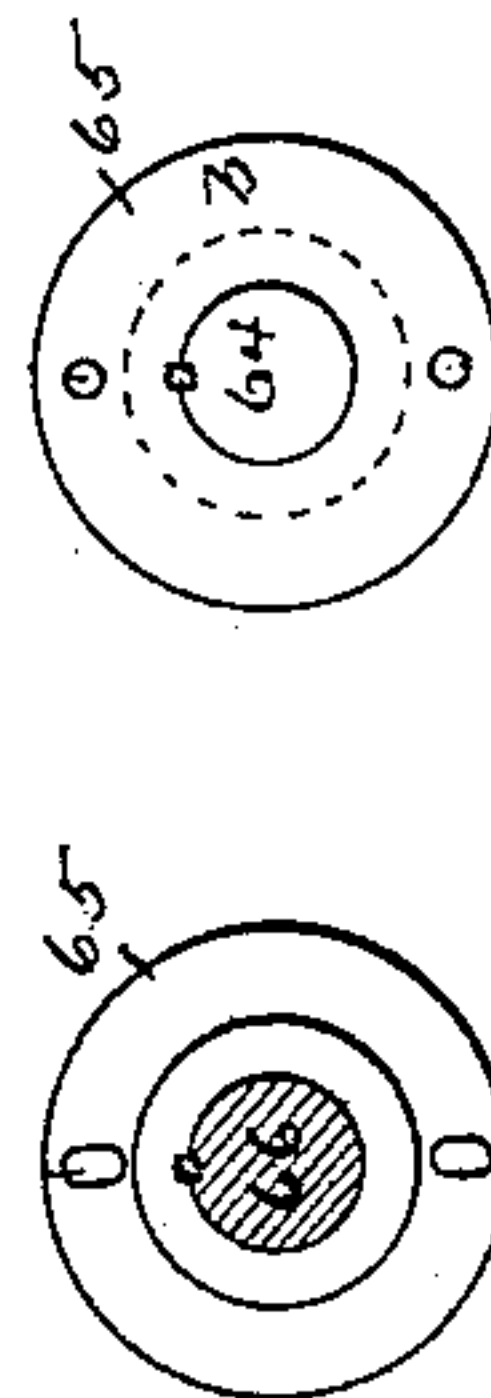


Fig. 17.



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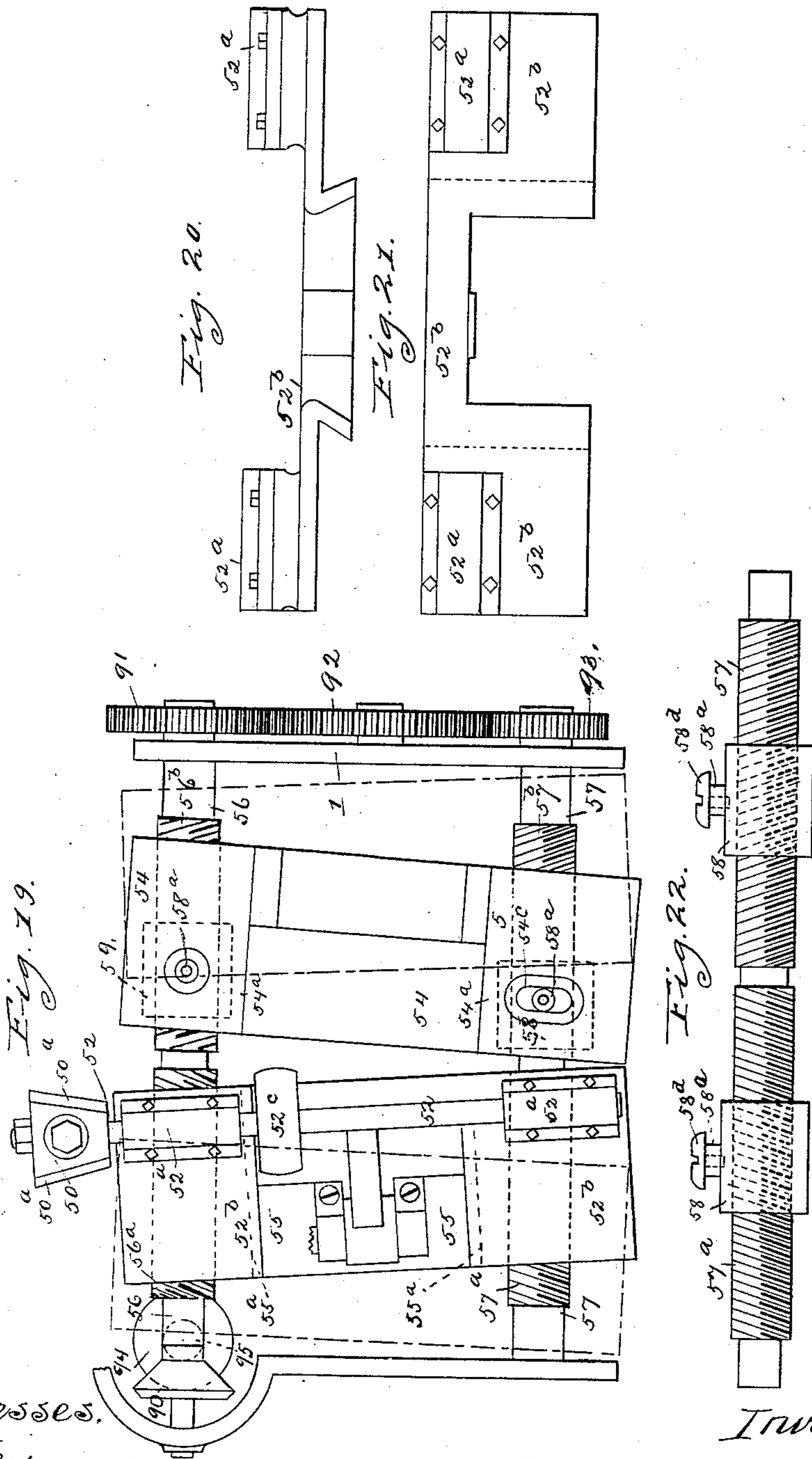
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UNITED STATES PATENT OFFICE.

FREDERICK HAWKINS BROWN, OF CHICAGO, ILLINOIS.

STAVE-MAKING MACHINERY.

SPECIFICATION forming part of Letters Patent No. 452,094, dated May 12, 1891.

Application filed September 17, 1890. Serial No. 365,290. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK HAWKINS BROWN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Stave-Making Machines, of which the following is a full, clear, and comprehensive description, reference being had to the accompanying drawings, and to the reference-numbers marked thereon, which form part of this specification.

The invention has for its principal object the production of barrel-staves in finished form from lumber which has been preliminarily rived or sawed, and to this end embodies specific features of mechanical construction and operative arrangement which enables the planing, chamfering, crozing, howeling, jointing, and cutting off of staves from continuous lengths of lumber fed to the machine.

The main features of the invention consist in the construction and operative arrangement of the chamfering, crozing, howeling, and cutting-off mechanism, whereby one end of each of two staves may be chamfered, crozed, howeled, and separated at one operation of the said mechanism; the construction and operative arrangement of the devices which automatically start in motion and arrest the action of the chamfering, crozing, howeling, and cutting-off mechanism and the lumber-feeding devices; the operative arrangement and construction of the jointing mechanism; the devices which automatically start in motion and arrest the action of the jointing mechanism, and the devices for adjusting the chamfering, crozing, howeling, cutting-off, and jointing mechanism, whereby the same may be adapted to the production of staves of large or small dimensions.

Other and specific features are embraced in the invention, all of which are hereinafter fully set forth, and pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a top plan view of a machine embodying the several features of my invention. Fig. 2 is a side elevation thereof. Fig. 3 is a detail taken transverse the machine upon the line *xx* of said Fig. 2, looking in the direction indicated by the horizontally-drawn arrow

shown adjacent thereto, intended to illustrate the construction and operative arrangement of the chamfering, crozing, howeling, and cutting-off mechanism and the devices which effect operation of the same and the starting and stopping of the lumber-feeding devices. Fig. 4 is a broken sectional detail particularly showing the operative arrangement of the devices through which adjustment of the chamfering, crozing, howeling, and cutting-off devices is effected. Fig. 5 is a horizontal sectional detail further illustrative of said adjusting devices, taken on the line *YY* of Fig. 4. Fig. 6 is a broken detail, mainly in side elevation, showing the reciprocable cross-head connected with the swinging frame which carries the chamfering, crozing, howeling, and separating cutter-head, and the cam which operates the cross-head to effect cross-motion of said swinging frame. Fig. 7 is a top plan detail illustrating the co-operative arrangement with said cross-head of the tripping-arm by which the lumber-feeding devices are put in action following the retraction of the cross-head to its normal position. Fig. 8 is an end elevation of the compound chamfering, crozing, howeling, and separating cutter-head. Fig. 9 is a side elevation of said cutter-head, more fully showing the construction and arrangement of the cutters carried thereby. Fig. 10 is a broken detail illustrative of the action upon the lumber of the chamfering, crozing, howeling, and separating cutters shown, whereby the ends of two staves are finished at one operation. Fig. 11 is a detail, mainly in elevation, showing the stave-jointing mechanism and the devices which automatically effect their operation, the view being from the direction indicated by the arrow shown near the end of the machine in Fig. 1. Fig. 12 is a detail in side elevation looking in the direction indicated by the horizontally-drawn arrow shown in Fig. 11, showing one of the jointing-heads with its spindle and slide-bearings, the devices which move the same to and fro transverse the machine, the tripping-lever forming part of the devices which put the jointing mechanism in action, and the position which the jointing-heads occupy with relation to the plane upon which the lumber moves. Fig. 13 is a broken end detail, looking in the direction indicated by

the upwardly-inclined arrow shown in Fig. 12 intending to particularly illustrate the operative arrangement of the devices through which the throw of the cam which moves the slide-bearings of the jointing-head spindles inwardly is effected, also showing the resistance-spring which returns the said slide-bearings to their normal position coincident with the back-stroke of the cam. Fig. 14 is a top plan detail particularly intended to show one of the slide-bearings, which carries one of the jointing-head spindles and the cam which moves the same in one direction transverse the machine. Fig. 15 is a detail illustrative of the eccentric-shaft, upon which the cam which moves the jointing-head spindle journals. Fig. 16 is an enlarged broken sectional detail showing the shaft which carries the pinion through which motion is given to the cam-operating crank-gear, one of said pinions, and the bearing within which said pinion journals. Fig. 17 illustrates, in front and rear elevation, respectively, the two plates forming the universal coupling employed in conjunction with the pinion-shaft shown in next above-described view; Fig. 18, details in cross-section, showing two staves respectively differing in width and therefore differing in the angle to which their respective jointing-surfaces are cut, the said view being mainly intended to illustrate the action of the jointing-heads to effect cutting of the lumber at a proper jointing angle when operated from different positions of adjustment. Fig. 19 is a top plan detail of the jointing mechanism. Figs. 20 and 21 are rear elevation and top plan view, respectively, of one of the sliding plates which carry the journal-bearings for the cutter-head spindles. Fig. 22 is a detail in elevation of one of the compound screws, with its nuts, forming part of the jointing mechanism which effects movement of the slides upon which the jointing-head-spindle slide-bearings work to their various positions of adjustment.

Referring by number to the details of construction shown in the said several views, 1 is the main frame of the machine, which sustains its various working parts.

2 is a concave table, which extends longitudinally of the main frame, having such special form and being manifestly provided with such openings as are necessary for the accommodation and operation of certain of the working devices.

3 3^a 3^b 3^c indicate suitably-sustained feed-rolls located above the table 2. Corresponding feed-rolls (not shown) located below said table carry bevel-gears 4 4^a 4^b 4^c, respectively, which engage with similar gears 5 5^a 5^b 5^c carried by a longitudinal shaft 6, sustained in bearings forming part of or fixed to the side of said frame. The spindles of the lower feed-rolls carry spur-wheels (not shown in the drawings) which engage with corresponding gears 7 7^a 7^b 7^c, fixed to the spindles of said feed-rolls 3 3^a 3^b 3^c, respectively.

8 and 9 indicate concave and convex planing-heads carried by spindles located above and below the table 2, respectively. The said spindles carry pulleys 10 10^a, respectively, which receive motion from a belt (not shown) driven by a pulley 11, carried by the main driving-shaft 12 of the machine, the said belt extending from said driving-pulley 11 over said pulley 10, thence back to pulley 10^a, thence to a tightener-pulley 10^b, located near the leading end of the machine, and thence back to said driving-pulley 11.

13 13^a 13^b 13^c 13^d indicate pressure-rolls operatively located above the table 2. The longitudinal shaft 6 fixedly carries a clutch 6^a and an adjacently-located longitudinally-reciprocable loose sleeve 6^A, to which is attached (suitably distanced apart) bevel-gears 6^b 6^c, and outside thereof clutch-plates 6^d 6^e, respectively. The shaft 6 also carries adjacent to the clutch-plate 6^c an idle rotatable cam-sleeve 6^B, to which is fixed a clutch 6^f. The said sleeve 6^B is rotatively sustained by a bracket 14, projecting laterally of the frame 1, being held therein as against longitudinal movement by the hub of the cam 6^e and a collar 6^h, fastened to the other end thereof. The sleeve 6^A is operatively connected by means of a pivoted yoke-lever 6^j with a tripping-bar 15, sustained in guides 15^a 15^b, carried laterally by the frame 1, a rod 16, attached to one end of said bar, connecting the same with a lever 17, pivoted to said frame and provided at its free end with a weight 17^a for effecting quick and full movement of the tripping-bar. A shaft 18, located transverse the machine, fixedly carries at its outer end intermediate the said bevel-gears 6^b 6^c, carried by the sleeve 6^A, a bevel-gear 19, the said shaft receiving continuous motion through a train of spur-gears 19^a 19^b 19^c 19^d 19^e 19^f, driven through a cone-shaft 20 by a belt 21 (see Fig. 2) from a pulley 100 on the main driving-shaft 12.

22 indicates a swinging frame held to an upright frame or bracket 23, fixed to the main frame of the machine by means of a stud 23^a, sustained in bearing-blocks 24 25, carried by said frame and capable of vertical adjustment in slide-bearings provided therein. The block 25 is provided with a flange 25^a, which enables the securing of the stud 23^a immovably to the frame 23 when a nut 25^b, arranged to work on the threaded end of said stud, is set hard down on a washer or flange-plate 25^c, carried thereby, which bears against the face of said frame 23. The block 24 is likewise provided on its inner end with a flange 24^a for bearing against the rear face of said swinging frame 22 when a nut 24^b, working on the end of the stud 23^a, is set against a washer or flange-plate 24^c, which works on said stud against the front face of said frame.

26 27 indicate adjusting-screws working vertically through said frames and in said bearing-blocks 24 25, respectively, the screw 27 enabling the lowering or raising of the block 25, and therefore vertical adjustment of

the swinging frame with relation to the horizontal plane of the table 2, the screw 26 enabling vertical adjustment of the swinging frame with relation to the stud 23^a and manifestly determining the radius upon which the said frame shall oscillate. The swinging frame carries at its lower end, longitudinally of the main frame, a spindle 28, provided on one end with a cutter-head 29, which carries howeling, chamfering, crozing, and separating cutters 29^d, 29^b, 29^a, and 29^c, and on the other end with a bevel-gear 30, preferably formed of rawhide, which meshes with a corresponding gear 31, carried by and longitudinally movable on a shaft 32, which works in bearings 33, rigidly connected by means of a yoke-extension 22^a with the swinging-frame 22, and in a bearing 34, laterally pivoted to a bracket 35, attached to or forming part of the main frame. The said gear works upon a feather (not shown) carried by its said shaft 32, and is therefore capable of moving longitudinally thereof, so as to keep in engagement with the gear 30 as the frame 22 oscillates upon the stud 23^a, the bearings 33 obviously sliding on the said shaft and the bearing 34 vibrating responsive to the vibratory or swinging motion of the frame 22. The outer end of said shaft 32 carries a pulley 36, which is given continuous motion through a belt 36^a, working from a pulley 37, carried by the main driving-shaft 12.

The swinging frame 22 is connected by means of a connecting-rod 38 (see particularly Fig. 3) with a cross-head 39, which plays on horizontal guides 39^a, sustained by a bracket or brackets 39^b and the frame of the machine. The cam 6^c, carried by the sleeve 6^b, plays against the said cross-head to carry the same inwardly, which effects cross motion of the swinging frame in one direction, while a weighted cord 40, attached by one end to said cross-head and working over the guide-sheave 40^a, retracts the cross-head to its normal position, effecting return motion of the said frame.

41 (see Fig. 3) indicates a vertically-inclined tripping-lever fixed to a horizontal shaft 42 sustained beneath the table 2, adjacent to the situation of the cutter-head 29, carrying on its outer end an arm 42^a, adapted when swung from its normal position to engage with a projection 15^d in the form of a spring-dog carried by the tripping-bar 15. The upper end of said lever 41 is arranged to so project above the table 2 as to be within the path of travel of the moving lumber, and to therefore be engaged by the leading end thereof as it is fed through the machine, engagement of the arm 42^a with the dog 15^d effecting longitudinal movement of the tripping-bar in one direction, which moves the yoke-lever 6^j so as to throw the bevel-gear 6^b in engagement with the rotating gear 19 and the clutch-plates 6^c to engagement with the clutch 6^f, which arrests the motion of the lumber-feeding mechanism and puts the cam 6^c in

rotation. The lower end of said lever 41 is provided with a counter-weight 41^a for retracting the lever to its normal position when released.

43 is a horizontally-projected lever (see Fig. 1, 6, and 7,) attached by one end to an axially-movable vertical shaft 43^a, which journals in a bearing 43^b, fixed to the side of the frame of the machine, the lower end of said shaft being operatively connected by means of an arm 43^c with the tripping-bar 15. The free end of said lever 43 is provided with a pivoted dog 44, normally held outwardly and within the path of travel of the cross-head 39, by a resistance-spring 44^a adapted to be engaged by a pin 39^c, projected laterally from the cross-head 39 as the cross-head is retracted to its normal position through the agency of the weighted cord 40, the said device yielding to the engagement therewith of the cross-head as it moves inwardly and allowing the same to pass in such direction for the full length of its stroke. The outward movement of said lever by said cross-head effects longitudinal movement of the tripping-bar in a direction which moves the yoke-lever 6^j to carry the bevel-gear 6^c, carried by the sleeve 6^a, to engagement with the bevel-gear 19, and the clutch-plate 6^d to engagement with the clutch 6^a, which puts the lumber-feeding devices in action.

45 indicates a weighted lever, the construction, arrangement, and operation of which are similar to that of the tripping-lever 41, above described, the arm 45^a carried by the shaft 46, to which said lever 45 is attached, being adapted to engage with a spring-dog 15^e, carried by the tripping-bar 15, and to effect longitudinal movement of the said bar similar to that effected by the arm 42^a.

The office of the tripping-lever 45, which is engaged by the leading end of successive staves which pass beyond the chamfering, crozing, howeling, and cutting-off mechanism, is to successively arrest the motion of the lumber-feeding devices and to put in action the devices which effect forward cross motion of the cutter-head frame 22, the tripping-lever 41 being held inactive—i. e., out of operative position—after the performance of a single function by the moving lumber so long as the lumber is continuously fed to the machine in such manner as will prevent said lever from dropping back to its normal position.

The jointing mechanism, located at or about the rear end of the machine, consists, in the main, of rotating cutter-heads 50, carried by spindles 51 52, the axes of which are set at an angle, desirably acute, to the plane upon which the lumber is caused to travel, and which are capable of swinging or radial and lateral adjustment and of reciprocating motion toward and from each other. The arrangement of the cutter-head spindles upon an angle to the plane upon which the lumber moves gives to the rotated cutters 50^a, carried

thereby, a shearing action which enables the cutting of the joint-surface of the stave in a smooth and finished manner, the radial and lateral operation of which the spindles are capable enabling such adjustment of the mechanism as adapts it to the jointing of staves of varying dimensions at proper and perfect angles. The jointing-head spindles 51 52 journal in bearings 51^a 52^a, being part of sliding plates 51^b 52^b, respectively adapted to slide to and fro athwart the machine on V-shaped shears 54^a 55^a, forming part of or fixed to frames 54 55, supported on horizontal compound screws 56 57, which journal in bearings carried or formed by the main frame 1, and which carry pairs of nuts 58 and 59, respectively located within pockets 54^b, provided in said frames beneath their slide-bearing portions. The said nuts are provided with cylindrical stems 58^a, respectively, which journal in corresponding openings 54^c, formed in the slide-bearing portions of said frames 54 55, (only one of said openings being shown, by way of example,) and are held in axially-movable connection therewith by means of screws 58^d, seated in said stems, with their heads working in suitable recesses provided therefor in the upper face of said frames 54 55, the openings 54^c being oblong in form, for the purpose hereinafter made apparent. Said frames carry at their lower ends crank-gears 60 61, which are driven by pinions 62 63, rotated by a shaft 64, which passes through their hubs and which carries at one end a coupling 65, (see Figs. 11, 13, and 17,) to which is connected a shaft 66, the said pinions journaling in bearings 62^a, fixed to or formed by the frames 54 55. The said pinions are trumpet-muzzled in their bore, as shown in Fig. 16, so as to admit of change of position of the frames by which they are carried through the action of the screws 56 57 without interfering with their operative connection with the shaft 64, upon and by which they are rotated.

The shaft 66 journals in a bearing 68, formed by or fixed to the main frame and carries at its outer end a bevel-gear 67, which meshes with a corresponding gear 72, carried by a shaft 71, which, working in fixed bearings 69 70, fixed to the main frame, carries at its upper end a clutch 73, longitudinally movable upon a feather 73^a, forming part of said shaft. Adjacent to said clutch 73 is located a clutch or clutch-plate 75, fixed to a spindle 75^b, which journals in a bearing 75^a, fixed to the main frame and carrying at its upper end a gear 75^d, which is engaged and actuated by a gear 75^c, carried by the spindle of the feed-roll located beneath the feed-roll 3^c. A tripping-lever 74, arranged to project above the table 2 within the plane of travel of the stave to be jointed and to be engaged and moved downwardly thereby, is hinged to a weighted arm 74^c, (see Fig. 12,) which is fixed to a shaft 74^a, which carries outside of the frame 1 a yoke-lever 74^b, (see Fig. 11,) which, embracing

the clutch 73 by means of a suitable groove provided therein, is adapted to move said clutch up and down longitudinally of its spindle 71 as the tripping-lever 74 is moved upwardly or downwardly.

The crank-gears 60 61 are connected by means of pitmen 80 with cams 81 82, which respectively work on eccentric-shafts 83, which journal by means of lateral projections 83^a in bearings 84, carried by the slide-bearing frames 54 55. To one of the journaling ends 83^a of each of said shafts is rigidly attached an arm 85, the free end of which is connected by a link or adjusting-screw 86 with the side of the frame 1 of the machine. The stem of the screw 56 (see Figs. 1 and 19) carries at one end a bevel-gear 90 and at its other end a spur-gear 91, which meshes with a similar gear 92, working upon a stud fixed to the side of the frame 1, and meshing with a corresponding gear 93, fixed to the stem of the screw 57. The screws 56 57 are composed of right and left thread parts 56^a 56^b 57^a 57^b, respectively, which work correspondingly in the nuts 58 59, held to the slide-bearing frames 54 55. The gear 93, carried by the stem of the screw 57, being smaller than the gears 91 92, when motion is given to the said gears through the gear 90 the screw 57 is caused to move more rapidly than the screw 56, therefore causing the outer or lower ends of the frames 54 55 on the screw 57 to move together or apart more rapidly than the upper ends thereof near which the jointing-heads 50 work. This differential movement of the frames is for the purpose of increasing or decreasing the angles at which the cutters 50^a, which are operatively arranged to work upon an angle to the axes of the spindles of their heads 50, shall work in cutting the joint-surface of staves which vary in width. Thus, for example, to insure a perfect coadaptation of stave-joints a stave of larger width for a barrel of given diameter requires (see Fig. 18) the joint-surface to be cut at an acute angle upon a plane, as line *b*, detail A, more distant from a right angle, as line *b*, detail A, than the joint-surface of a smaller stave. (See detail B.) The oblong form of the opening 54^c, within which the stems 58^b 58^a of the nuts 58 play, enables the free outward and inward swinging or radial movement of the outer ends of the frames 54 55, coincident with the less-rapid traversing motion of the upper nuts 59, upon which their upper ends pivot.

The cutter-head spindles 51 52 carry pulleys 51^c 52^c, respectively, which are actuated through belts (not shown) operated by pulleys *m n*, fixed to a shaft *M*, sustained by brackets *M'*, projecting from the frame 1, being in turn rotated by means of a pulley *M*², fixed thereto, and a belt (not shown) operated by a pulley 12^a, carried by the main shaft 12.

The arms 85, connected with the eccentric-shafts 83^a, being adjustable by means of the devices 86 or through change of position of the slide-bearing frames, regulate, through the

eccentrics 83, the throw of the cams 81 82 to carry the sliding plates 51^b 52^b inwardly, springs 86^a (see Fig. 13) being desirably employed for returning said plates to their original position coincident with the back-stroke of the cams.

The stem of the compound screw 56 carries at its outer end, opposite to the spur-gear 91, a bevel-gear 90, which meshes with a similar gear 94, carried by a shaft 95, located longitudinally of the frame 1. The said shaft carries at its outer end (see Fig. 1) a registering wheel or plate 95^e, provided on its inner face with a series of radial grooves 95^h. Adjacent to said plate or wheel 95^e and fixed to the frame 1 is located a plate 95^f, provided with a single groove 95ⁱ. A pin 95^g, inserted in the groove of said plate 95^f and a groove of the plate 95^e as the same are brought immediately opposite to each other, secures the shaft 95 fixedly in position. The adjusting of the jointing mechanism being effected through the shaft 95, which carries the plate or wheel 95^e, the necessity for employing devices for locking said operating-shaft in position is manifest.

Upon the table 2 (see Figs. 1 and 3) works a guide-bar 95^d, provided for properly guiding the lumber to the cutting mechanisms, being adapted to move laterally of said table to points of adjustment corresponding with the varying widths of lumber to be converted into staves. The said guide-bar is thus operated by means of screws 95^c, seated therein, which journal in bearings fixed to or forming part of the main frame, being operated through bevel-gear 95^b, fixed thereto, which are actuated by corresponding gears 95^a, carried by the shaft 95. The said guide-bar is arranged, as is obvious, to be adjusted simultaneously and in substantial correspondence with the adjustment of the jointing mechanism by means of said shaft 95.

The operation of the machine is as follows:
The main driving-shaft 12 being put in rotation, the shaft 18, carrying the bevel-gear 19, is actuated by the belt 21 from the cone 100 on the shaft 12 through the cone-shaft 20 and spur-gears 19^a 19^b 19^c 19^d 19^e 19^f. The tripping-lever 41, being in its normal position, with the yoke-lever 6^j, carried by its shaft 42, in position which brings the bevel-gear 6^c, forming part of the sleeve 6^A, to engagement with the gear 19 and the clutch-plate 6^d to engagement with the clutch 6^a, carried by the feed-shaft 6, puts in action the lumber feeding and planing mechanisms. The guide 95^d and the jointing mechanism being preliminarily adjusted in correspondence with the width of material to be operated upon, a length of sawed or rived lumber is introduced to the machine upon the table 2. The feed-roll 3 and corresponding lower roll engaging the lumber, carries the same forward to be operated upon by the concaving cutter-head 8, following which it is engaged by the feed-roll 3^a and corresponding lower roll and car-

ried forward to be operated upon by the convexing cutter-head 9, being next engaged by the feed-roll 3^b and corresponding feed-roll and fed forward to engagement with the tripping-lever 41, located below the cutter-head 29. The tripping-lever 41, being moved by the lumber, causes, by means of the yoke-lever 6^j, carried by the shaft 42, the sleeve 6^A to be moved longitudinally of the shaft 6, bringing the bevel-gear 6^b into engagement with the gear 19, the clutch-plate 6^d from engagement with the clutch 6^a, and the clutch-plate 6^e to engagement with the clutch 6^f, carried by the sleeve 6^B, the lower end of the lever 6^j, connected with the tripping-bar 15, moving through the connecting-rod 16 the counterweight-lever 17 to insure the full throw of the mechanism thus moved to proper operating position, whereby the certain feeding devices thus far operating upon the lumber are thrown out of action. The cam 6^g, forming part of the sleeve 6^B, is started in rotation, carrying the cross-head 39 forward, which in turn, by means of the connecting-rod 38, moves the swinging frame 22, which carries the rotating cutter-head upon its pivot 23^a, and therefore the chamfering, crozing, howeling, and separating cutters athwart the lumber. As the tripping-bar 15 describes the movement above set forth, the horizontally-projected lever 43, connected to said bar by the shaft 43^a and arm 43^c, is caused to swing inwardly, the dog 44, carried by its free end, occupying a position within the path of travel of the cross-head 39. As the said cam is rotatively carried forward it passes beyond engagement with the cross-head, freeing the same, and thereby permitting it and the swinging frame 22 to be retracted by the weighted cord 40 to their primary positions. As the cross-head describes its return movement it engages with the said dog, carried by the arm 43, carrying the same outwardly, which by its connection through the shaft 43^a and arm 43^c with the tripping-bar 15 moves the said bar longitudinally, so as to carry the sleeve 6^A into position which brings the gear 6^c again into engagement with the gear 19, thus restarting the lumber-feeding devices. The lumber, being again started in motion, next engages with the tripping-lever 45, throwing the same forward, the arm 45^a, carried by the shaft 46, engaging with the spring-dog 15^e, carried by the tripping-bar 15, and causing the said bar to move longitudinally and thereby, through the yoke-lever 6^j, to carry the gear 6^b of the sleeve 6^A into engagement with the gear 19, the clutch-plate 6^d from engagement with clutch 6^a, and the clutch-plate 6^e to engagement with the clutch 6^f, arresting the motion of the feeding mechanism and again putting in action the chamfering, crozing, howeling, and separating mechanism. One stave having been thus far finished, except as to the jointing, and being separated from the balance of the lumber, and the feeding mechanism being again put

in action on the return-stroke of the cross-head 39, the lumber, which is again started in motion, abutting against the end of the stave, carries the same forward under the pressure-roll 13^a until it is engaged by the feed-roll 3^c, which, being speeded faster than the other feed-rolls, carries the stave sufficiently rapidly through the jointing mechanism to pass beyond the same before the next stave, duly cut off, shall have reached the position to be operated upon thereby. As the stave enters between the jointing cutter-heads 50 it engages by its leading end with the tripping-lever 74, (see Figs. 11 and 12,) which, being thrown downwardly, causes the yoke 74^b, carried by the shaft 74^a, to move the clutch 73 longitudinally of the shaft 71, upon which it is feathered, to engagement with the clutch or plate 75, carried by the geared spindle 75^b, which receives motion through the gear 75^d by the gear 75^c, fixed to the feed-roll 3^c, which is driven through a gear 4^c, fixed thereto, by a gear 5^c, carried by the main feed-shaft 6. The spindle 71 being thus put in revolution, the gear 72, carried thereby, actuates the gear 67, fixed to the shaft 66, which carries one half of the coupling 65, the shaft 64, which carries the other half of said coupling and the pinions 62 63, being thereby put in motion and actuating the crank-gears 60 61. As the said crank-gears start in motion the cams 81 82, operated by the pitmen 80, move so as to permit the sliding plates, which carry the jointing-head spindles to gradually move outwardly in conformity with the swell or curve to be given to one half longitudinally of the joint-surface of the stave, the rotating cutters 50^a obviously being constantly at work upon such surfaces. The crank-gears having described a half-revolution coincident with the passage of one half of the stave through the jointing mechanism, on the additional half-revolution of the gears and farther travel of the stave the cams are caused to move the sliding plates inwardly and gradually in conformity with the decreasing swell or curve to be given to the remaining half of the stave.

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

1. In a stave-making machine, the combination of feed-rollers, planers, a combined chamfering, crozing, howeling, and cutting tool, trips and connections alternately actuating and stopping the feed and planer mechanism and the said tool, and a single actuating lever-bar for all the trips, substantially as described.

2. In a stave-making machine, the combination, with a planer and its operating and feeding mechanism, of a rigid bracket supported on the machine and having a sliding bearing vertically adjustable fixedly with relation to the bed and containing a stud extending transversely of the frame, a frame having a bearing longitudinally adjustable fixedly thereon and at which it is pivotally supported on the said stud to be oscillated

transversely of the bed, and a compound cutting-tool comprising a single separator between duplicate crozing, howeling, and chamfering knives on a rotary shaft journaled in the oscillatory frame, the said oscillatory frame being connected eccentrically of its pivotal support with its actuating mechanism, whereby adjustment of the bearing on the stationary frame raises or lowers the oscillatory frame and with it the tool with relation to the bed and adjustment of the bearing on the oscillatory frame regulates the radius of the arc traversed by the oscillatory frame and cutting-tool, substantially as described.

3. In a stave-making machine, the combination of feed-rollers, planers, a compound cutting-tool comprising a single separator between duplicate crozing, howeling, and chamfering knives, trips and connections alternately actuating and stopping the feed and planer mechanisms and the said cutting-tool, and a single-actuating lever-bar for all the trips, substantially as described.

4. In a stave making-machine jointing apparatus, the combination, with suitable feed mechanism, of cutter-heads at opposite sides of the line of feed of the stave on inclined rotary spindles supported in laterally-movable bearings connected with nuts near the opposite ends of the spindles, and adjusting-screws, one for each of the upper and lower pairs of nuts, the said screws being differential to cause, by turning them equally, the cutter-head ends of the spindle to be moved toward and from each other slower than the opposite ends of the spindles, the difference in the movements occasioned by so turning the screws being proportioned by the screws to maintain the same or approximately the same radius of each cutter whatever the relative distance apart to which they are adjusted for staves of different widths, substantially as described.

5. In a stave-making-machine jointing apparatus, the combination, with suitable feed mechanism, of cutter-heads at opposite sides of the line of feed of the stave on inclined rotary spindles supported in laterally-movable spring-controlled bearings connected with nuts near the opposite ends of the spindles, cam mechanism operating against the springs to apply the cutter-heads to the edges of the stave and form the bilge thereon, and adjusting-screws, one for each of the upper and lower pairs of nuts, the said screws being differential to cause, by turning them equally, the cutter-head ends of the spindles to be moved toward and from each other slower than the opposite ends of the spindles, the difference in the movement occasioned by so turning the screws being proportioned by the screws to maintain the same or approximately the same radius of each cutter whatever the relative distances apart to which the cutters are adjusted for staves of different widths, substantially as described.

6. In a stave-making-machine jointing ap-

paratus, the combination, with suitable feed mechanism, of cutter-heads at opposite sides of the line of feed of the stave on inclined rotary spindles supported in laterally-movable bearings connected with nuts near the opposite ends of the spindles, adjusting-screws, one for each of the upper and lower pairs of nuts, the said screws being differential to cause, by turning them simultaneously, the cutter-head ends of the spindles to be moved toward and from each other slower than the opposite ends of the spindles, the difference in the movement occasioned by so turning the screws being proportioned by the screws to maintain the same or approximately the same radius of each cutter whatever the relative distances apart to which the cutters are adjusted for staves of different widths, and adjusting means connected with the said screws and operative from the same point on the machine to effect their simultaneous turning, substantially as described.

7. In a stave-making machine, the combination of the planer, feed mechanism, a tool for separating, crozing, howeling, and chamfering the ends of staves, the actuating mechanism for said tool, and joint-cutting mechanism adjacent to the line of feed of the staves, differentially movable at opposite ends transversely of the said line to maintain the same or approximately the same radius of the cutter for different widths of staves, and provided with adjusting means operative from a single point on the machine to effect the said differential movement simultaneously at the opposite ends of the joint-cutting mechanism, substantially as described.

8. In a stave-making machine, the combination of the planer, feed mechanism, a tool for separating, crozing, howeling, and chamfering the ends of staves, the actuating mechanism of said tool, a guide-rail on the bed of the machine laterally adjustable for different widths of staves, joint-cutting mechanism adjacent to the line of feed of the staves, differentially movable at opposite ends transversely of the bed to maintain the same or approximately the same radius of the cutter for different widths of staves, adjusting means controlling the said guide-rail, and joint mechanism operative from a single point on the machine to effect simultaneously and correspondingly adjustment of the guide-rail and the differential movement at the opposite ends of the joint-cutting mechanism, substantially as described.

9. The combination, with the feed-rolls, of the feed-shaft 6, having gear-connection therewith and provided with a clutching device, as 6^a, the idle rotatable sleeve longitudinally reciprocable upon said shaft and provided with bevel-gears and clutching devices, substantially as set forth, the idle rotatable cam-sleeve carried by the feed-shaft provided with the clutching devices arranged to be engaged by the longitudinally-reciprocable rotary sleeve, the cutter-head, vibratory cutter-

head frame, the cross-head connected with said frame, means for retracting the cross-head, the actuating bevel-gear, as 19, tripping-lever 41, tripping-bar 15, and means connected therewith and with the longitudinally-reciprocable rotary sleeve for alternately moving said sleeve to and from the clutching devices respectively carried by the feed-shaft and cam-sleeve, all arranged and co-operating substantially as and for the purpose described.

10. The combination of the geared feed-rolls, the feed-shaft operatively connected therewith, the clutching devices, as 6^a, fixed thereto, the idle rotatable longitudinally-reciprocable sleeve provided with gears and clutching devices, substantially as set forth, the cam-sleeve provided with means for engaging with said reciprocal sleeve, the actuating-gear 19, the cutter-head, swinging cutter-head frame, the cross-head connected with said frame, means for retracting said cross-head, the tripping-bar, devices connected with the tripping-bar, the rotary reciprocable sleeve for reciprocally operating said sleeve, tripping devices operatively located adjacent to the working position of the swinging frame, having connection with and adapted to operate the tripping-bar to move the rotary reciprocable sleeve in one direction, and the lever 43, having operative connection with the tripping-bar, substantially in the manner and for the purpose set forth, arranged and adapted to be operated by the cross-head on its return movement, substantially as described.

11. The combination, with the fixed and swing frames 22 23, provided with slide-bearings substantially as set forth, stud 23^a, bearing-blocks 24 25, devices for securing said blocks immovably to their respective frames, the cutter-head spindle 28, and cutter-head 29, of the adjusting-screws 26 27, working through said frame and bearing-blocks, whereby is effected vertical adjustment of the swinging frame with relation to the horizontal plane of the table of the machine and the plane of movement of the lumber, and adjustment thereof with relation to the radius upon which it and the cutter-head shall oscillate, substantially as described.

12. The combination of the jointing-head-spindle supports, the depending frames forming supports therefor, means for operating said frames substantially in the manner described, the cams for operating the spindle-supports, the crank-gear sustained by the depending frames, devices connecting said gear with the cams, the pinions for operating said crank-gear, the shafts 64 66, coupling 65, bevel-gear 67, the shaft 71, spindle 75, suitable clutching mechanism carried by said shaft and spindle, the tripping-lever 74, arranged to be operated as described, devices connected therewith and with the clutching devices for operating the clutching devices, the gear 75^a, carried by the spindle 75^b,

the feed-roll 3^c, the bevel-gears 75^c and 4^c, carried by the feed-roll spindle, the feed-shaft, and gear 5^c, carried thereby, all arranged and co-operating substantially as and for the purposes herein set forth.

13. The combination of the jointing-head-spindle sliding plates, the sliding-plate supports, the compound screws, and the gears for

operating the same with the shaft 95, the grooved registering wheel and plate, and means for interlocking the same, substantially as and for the purpose described.

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