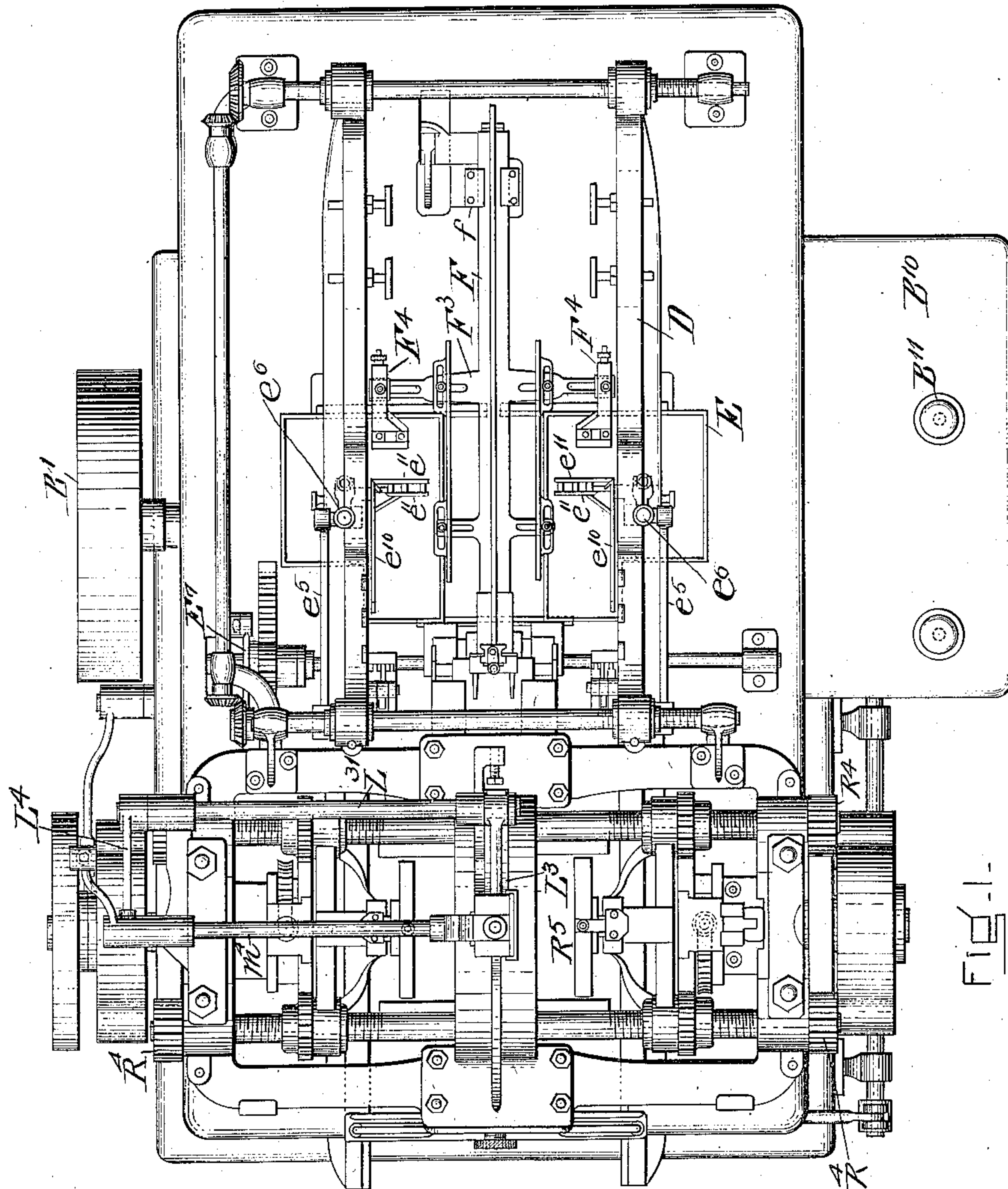


E. H. TAYLOR.
MACHINE FOR MAKING PAPER BOXES.
APPLICATION FILED JUNE 9, 1906.

966,618.

Patented Aug. 9, 1910.

17 SHEETS—SHEET 1.



WITNESSES=
M. E. Flaherty.
M. V. Foley

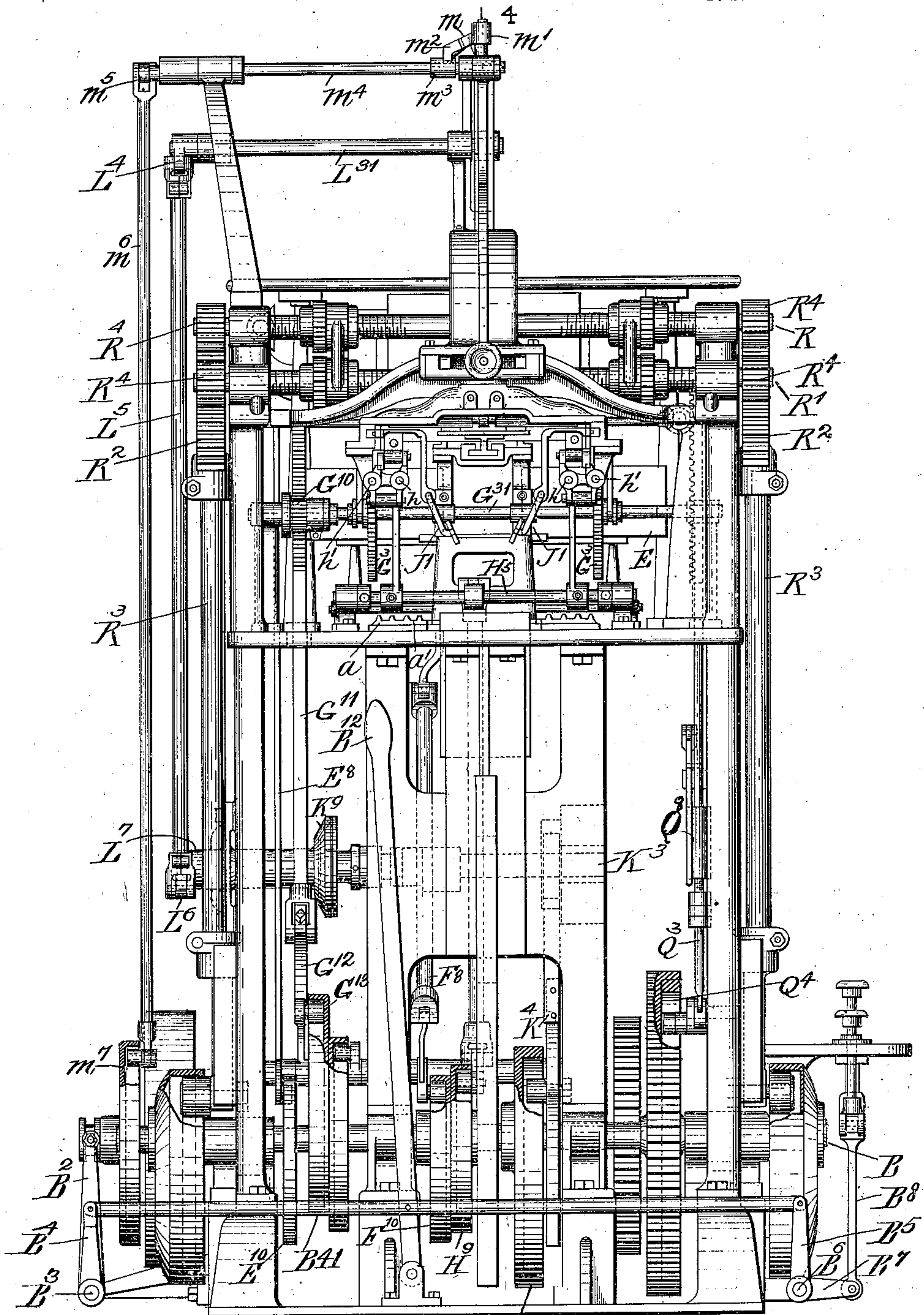
INVENTOR=
Eugene H. Taylor
By
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E. H. TAYLOR.
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17 SHEETS—SHEET 2.



WITNESSES:

M. E. Flaherty.
M. V. Foley

FIG. 2
4

INVENTOR:

Eugene H. Taylor.

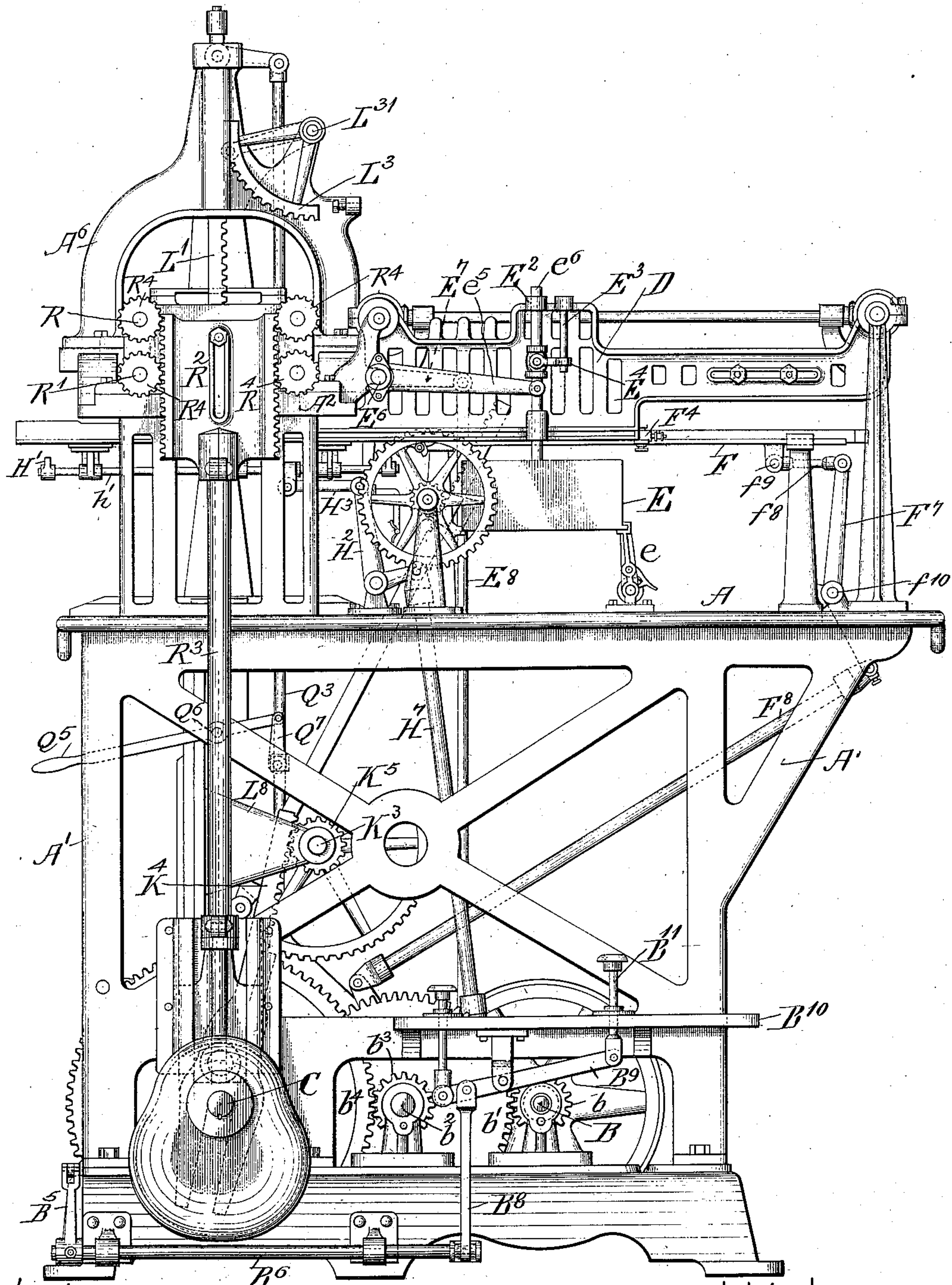
By
Franklin H. Brown
his attorney.

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MACHINE FOR MAKING PAPER BOXES.
APPLICATION FILED JUNE 9, 1906.

966,618.

Patented Aug. 9, 1910.

17 SHEETS—SHEET 3.



WITNESSES=

M. E. Flaherty.
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Fig. 3.

INVENTOR=

Eugene H. Taylor.

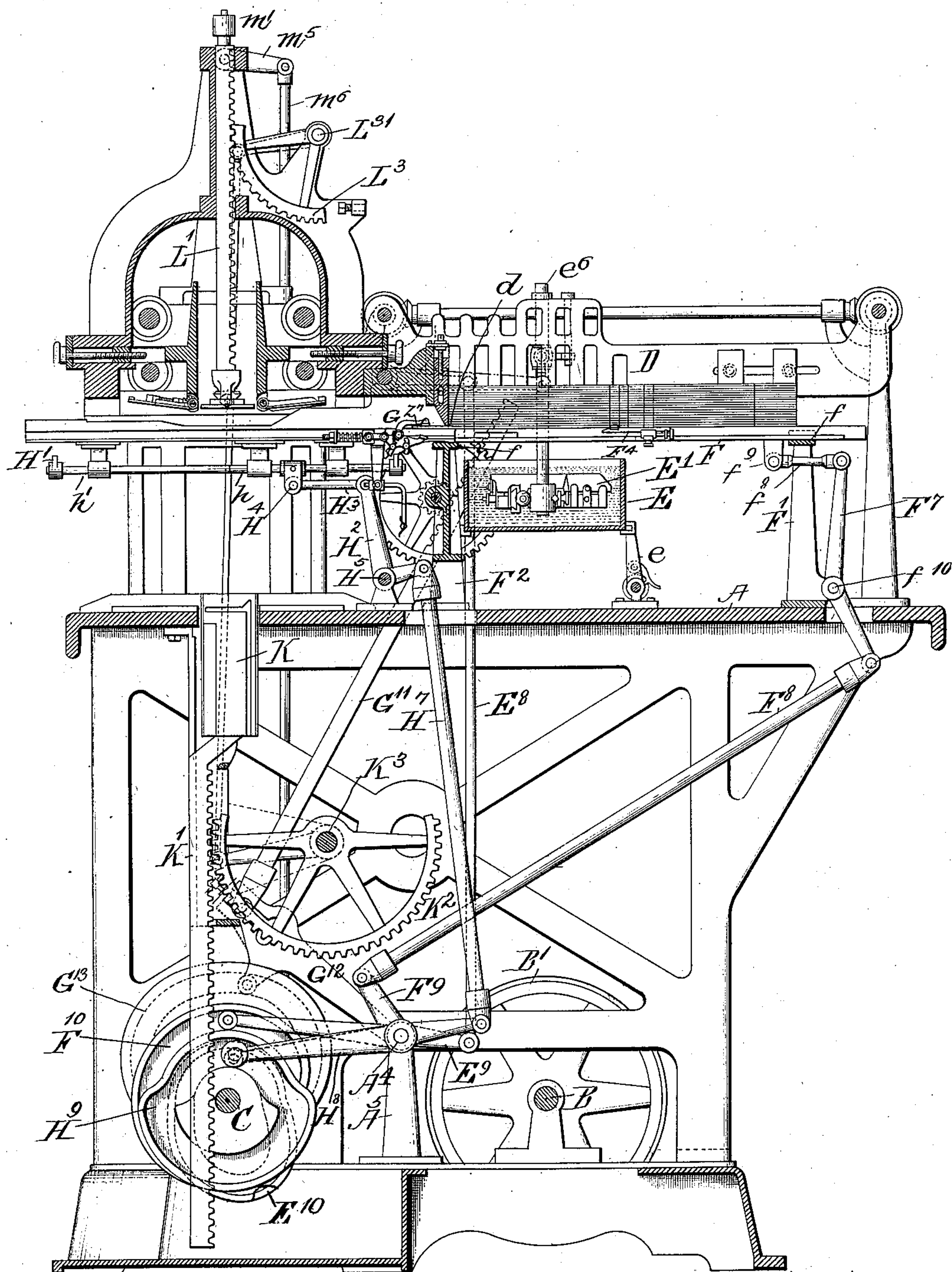
By *Charles H. Taylor*
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Patented Aug. 9, 1910.

17 SHEETS—SHEET 4.



WITNESSES:

M. E. Deakins.
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Fig. 4.

INVENTOR

Eugene H. Taylor

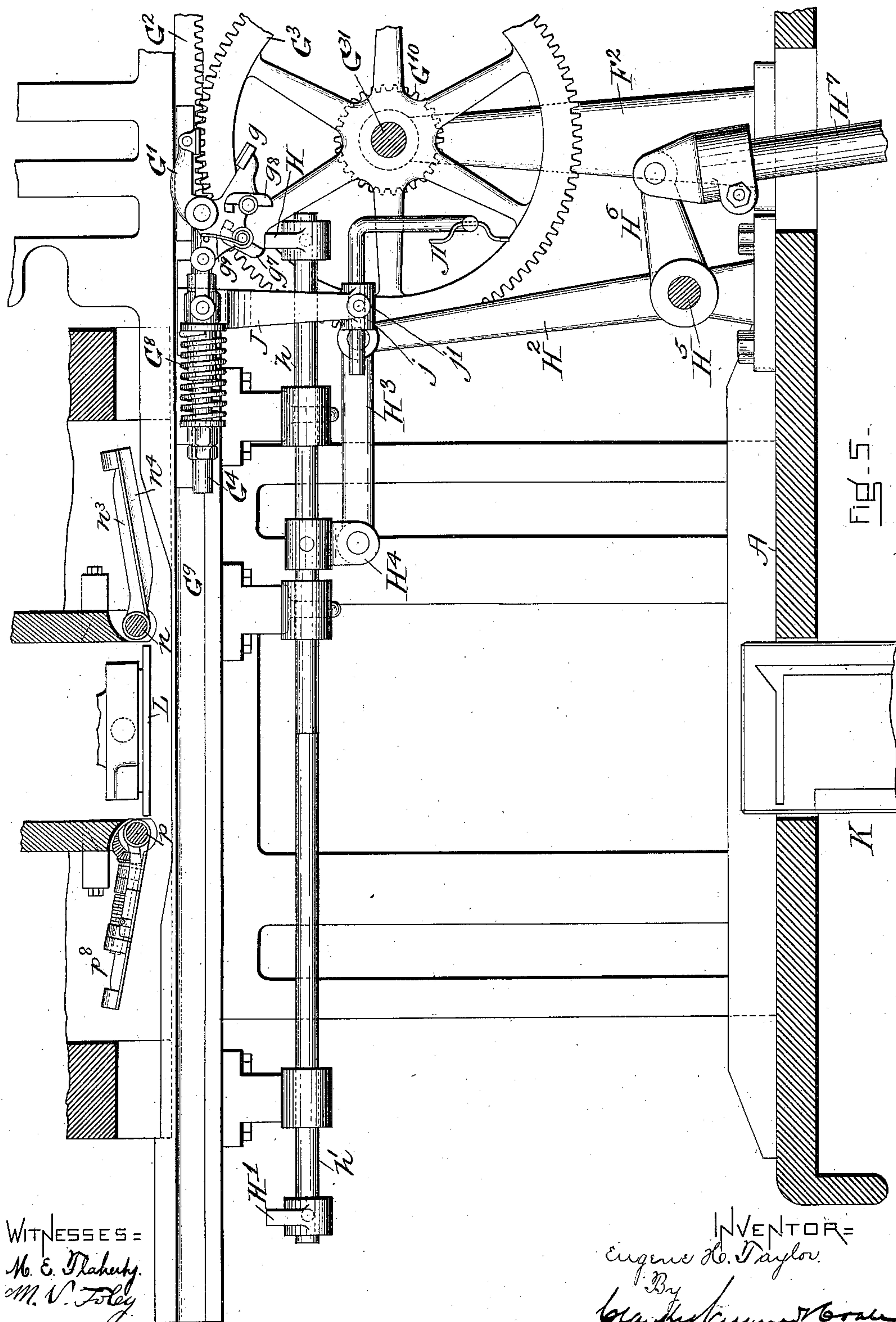
By *Franklyn M. Bone*
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MACHINE FOR MAKING PAPER BOXES.
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17 SHEETS—SHEET 5.



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17 SHEETS—SHEET 6.

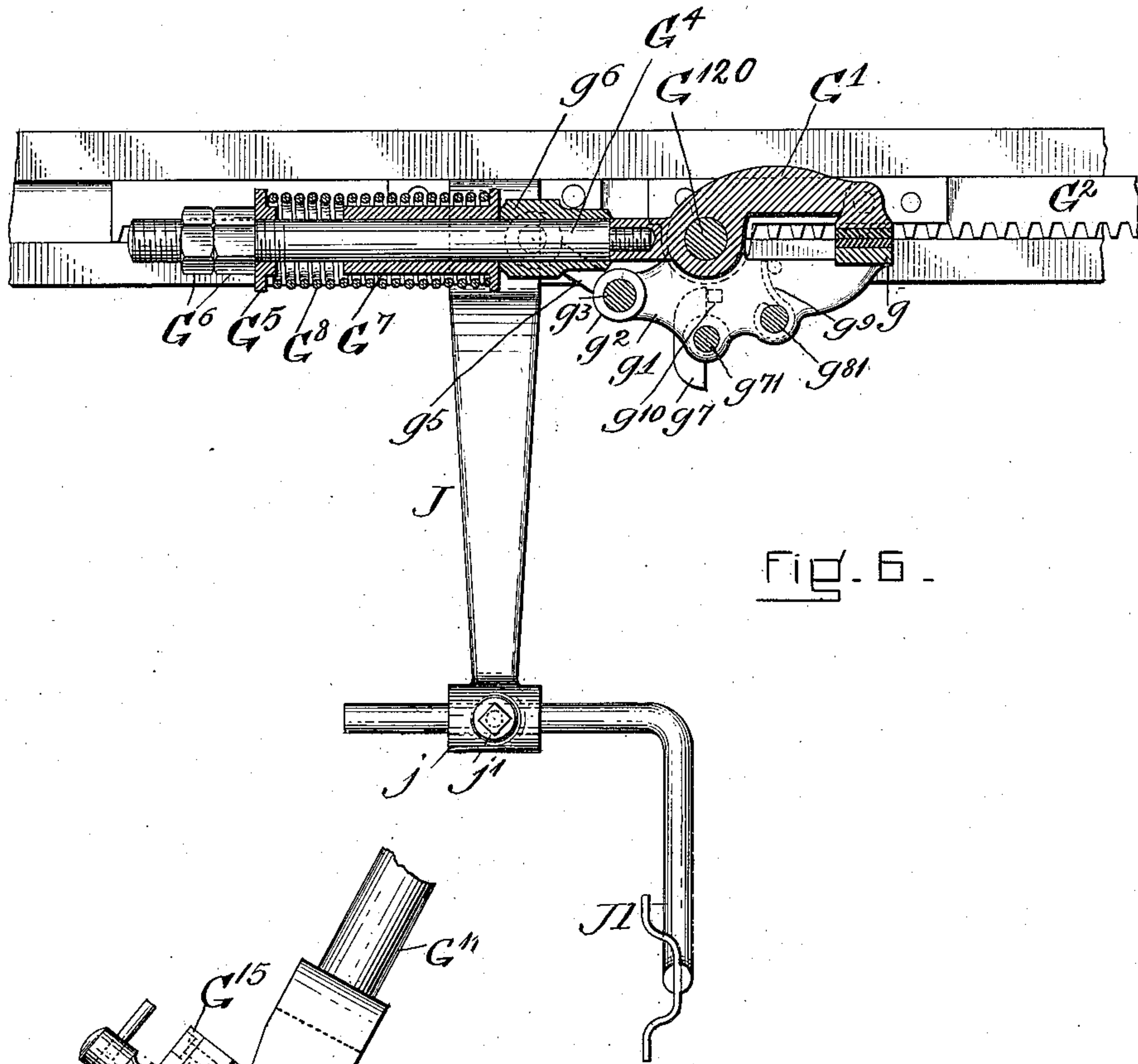


Fig. 6.

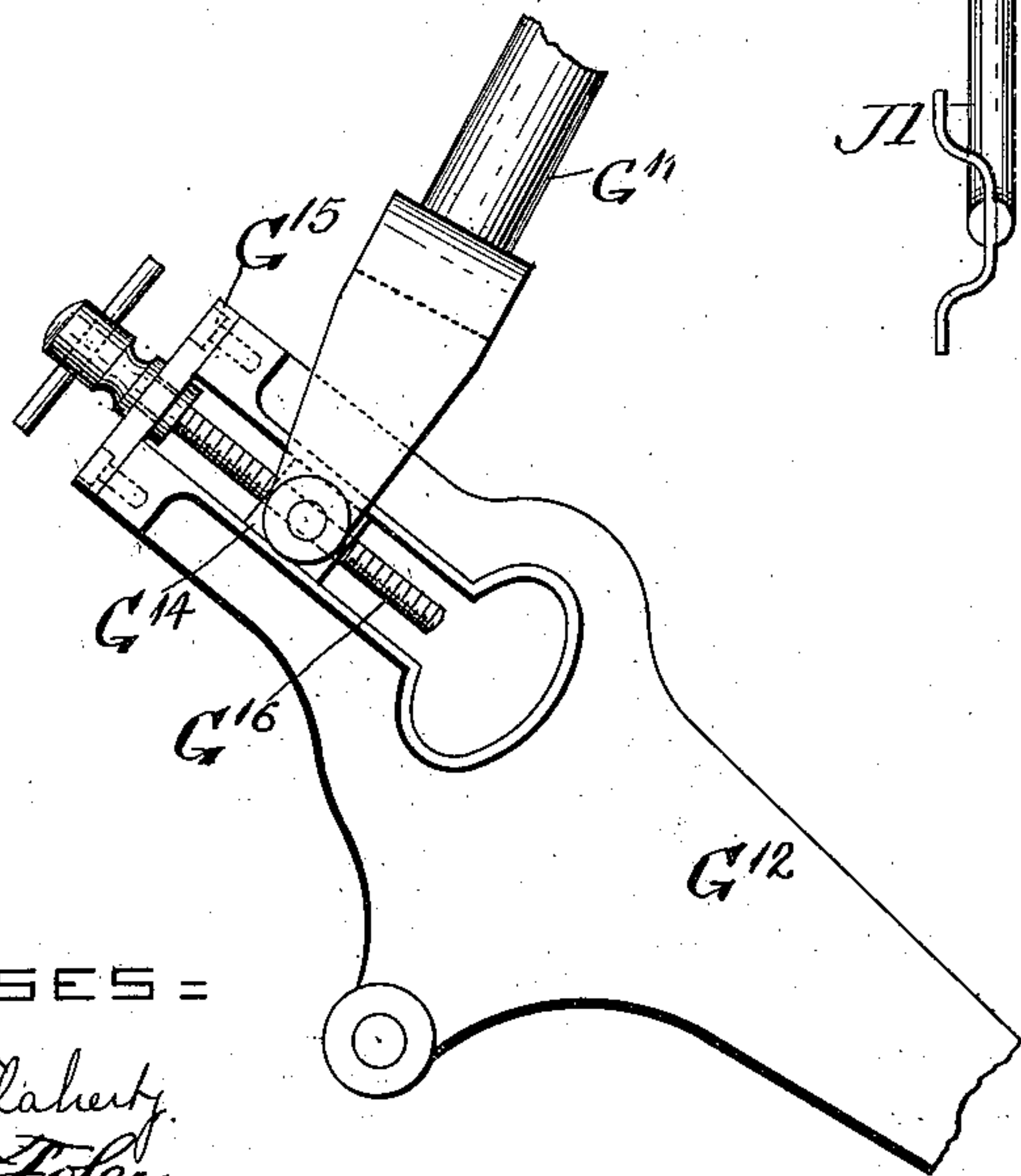


Fig. 6a.

WITNESSES=
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17 SHEETS—SHEET 7.

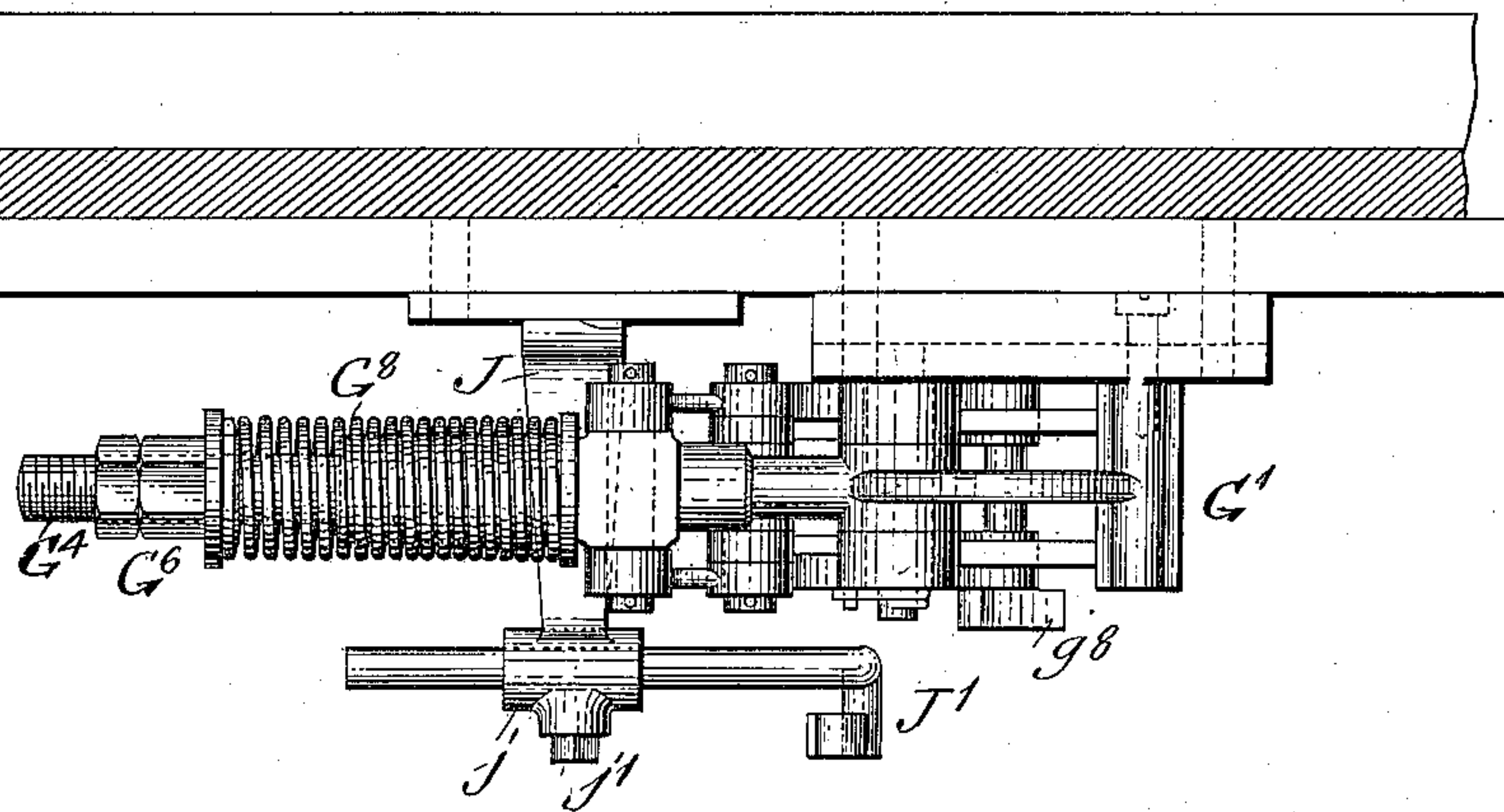


Fig. 7.

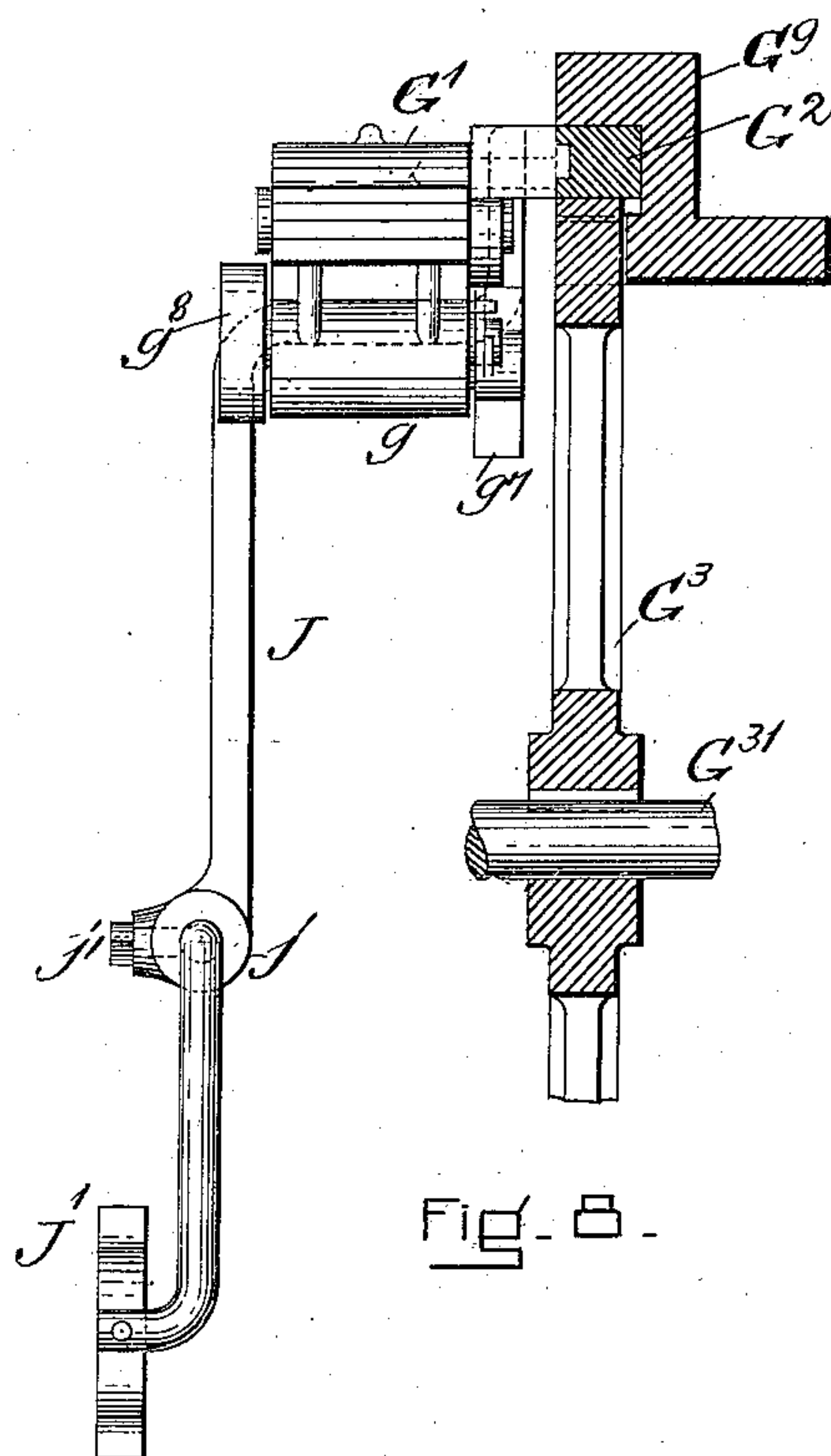


Fig. 8.

WITNESSES:

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Patented Aug. 9, 1910.

17 SHEETS—SHEET 8.

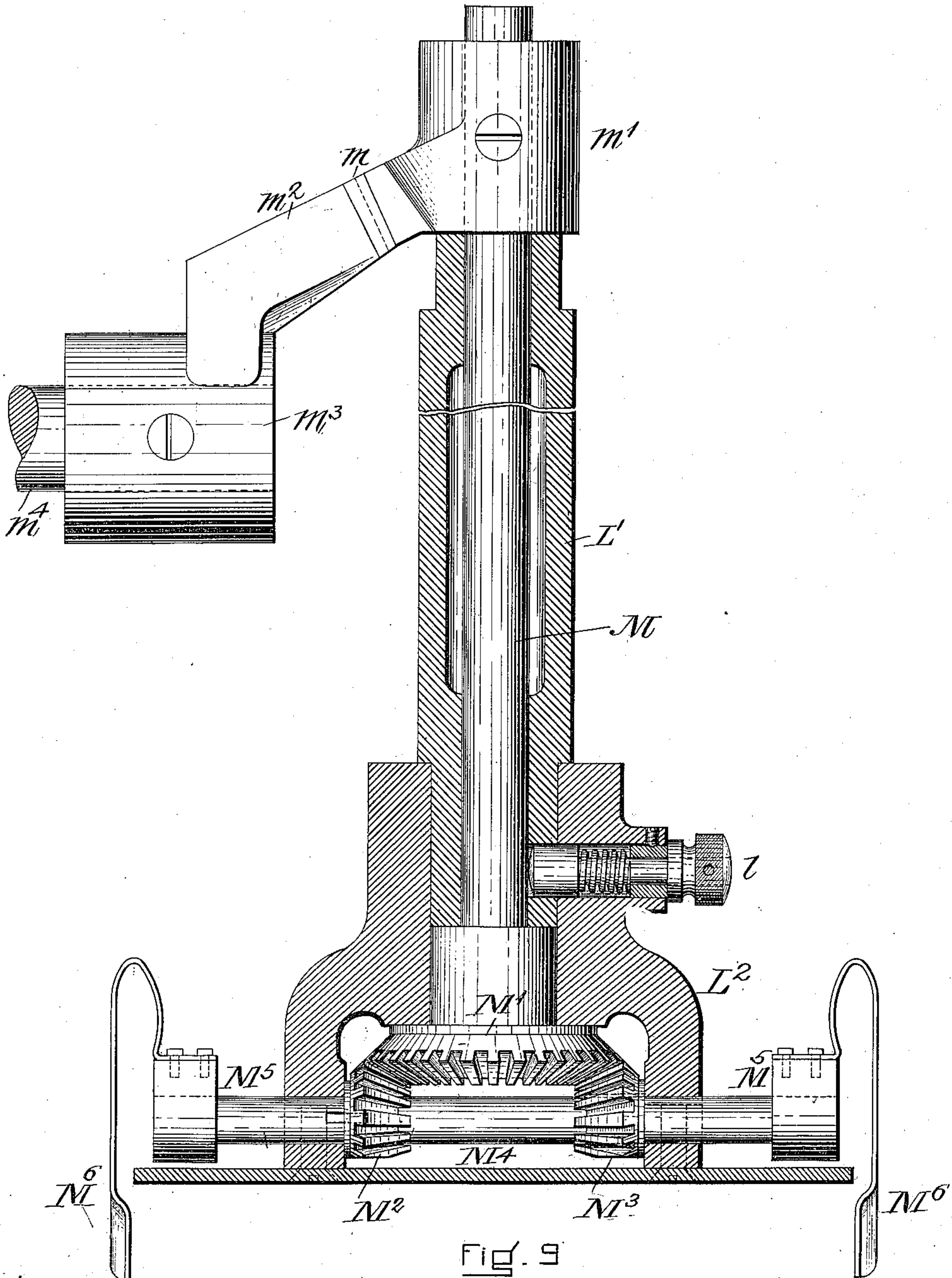


Fig. 9

WITNESSES:
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966,618.

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17 SHEETS—SHEET 9.

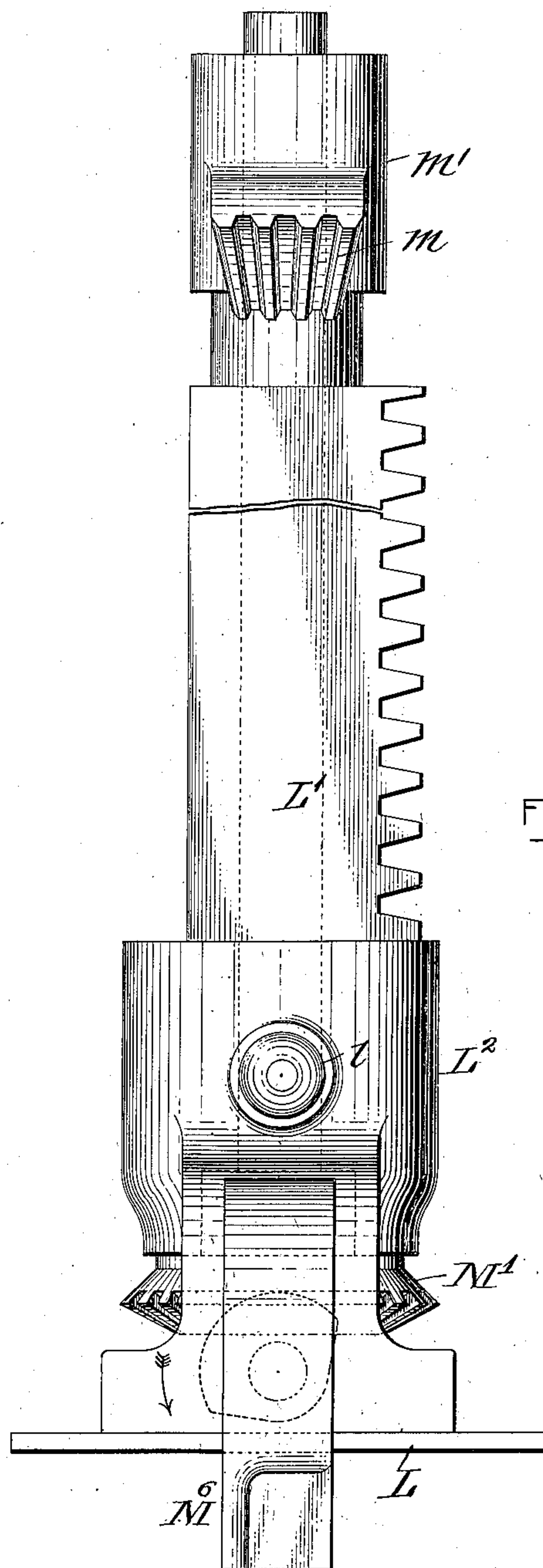


FIG. 10.

WITNESSES=
M. E. Flaherty.
M. V. Foley

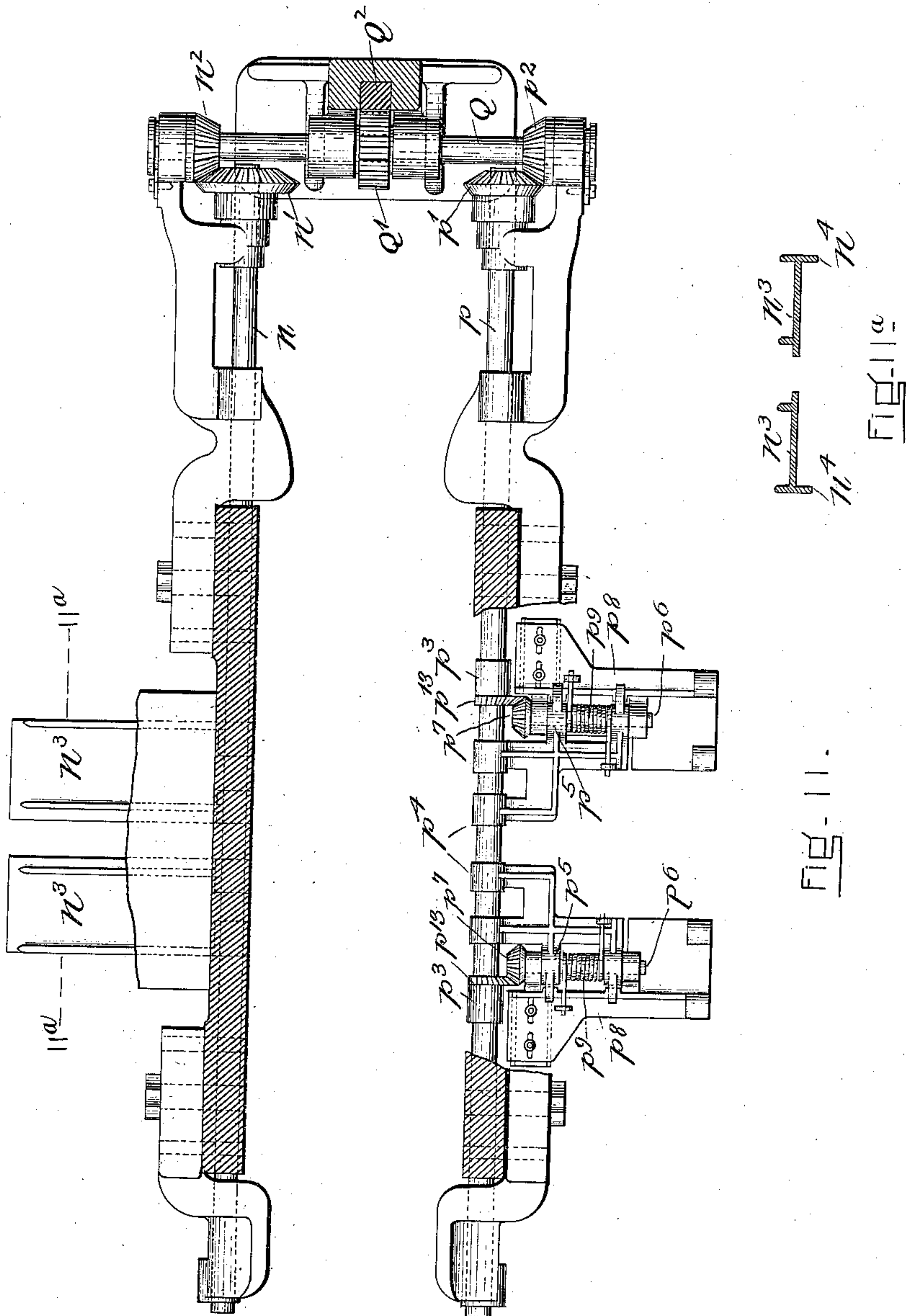
INVENTOR=
Eugene H. Taylor.
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966,618.

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17 SHEETS—SHEET 10.



WITNESSES:
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966,618.

E. H. TAYLOR.
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17 SHEETS—SHEET 11.

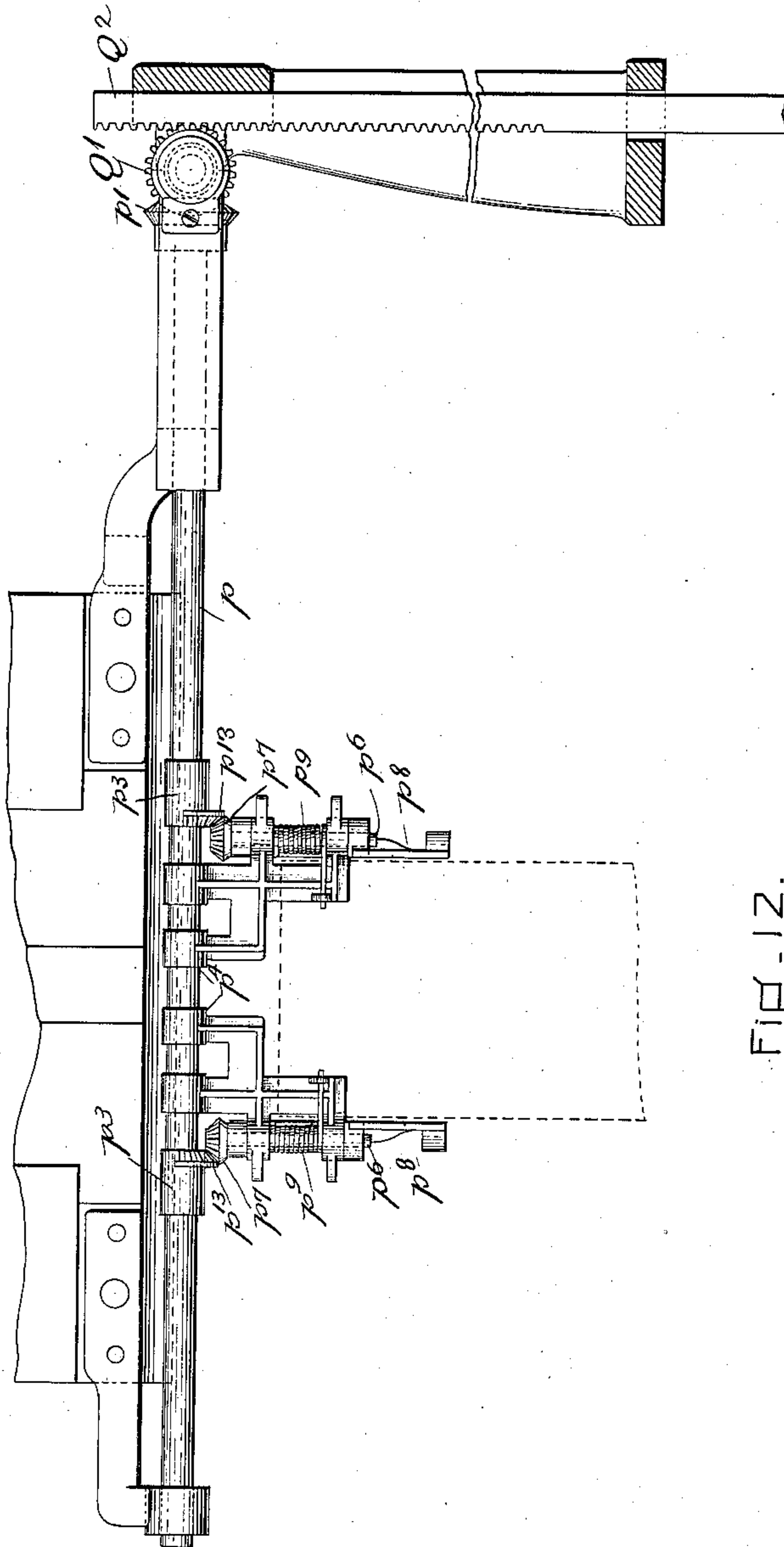


FIG. 12.

WITNESSES=

M. E. Flaherty
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INVENTOR=

Eugene H. Taylor.

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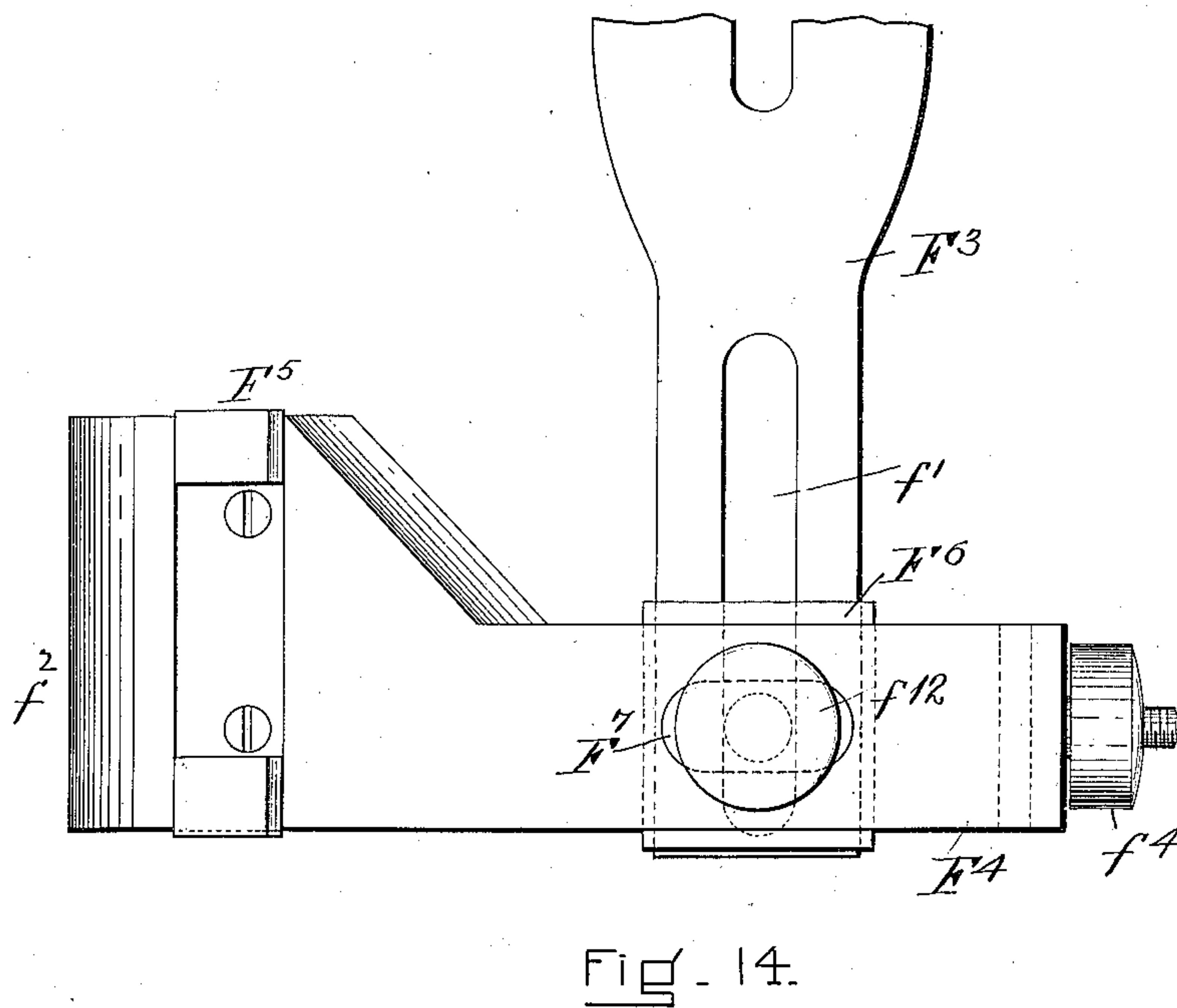
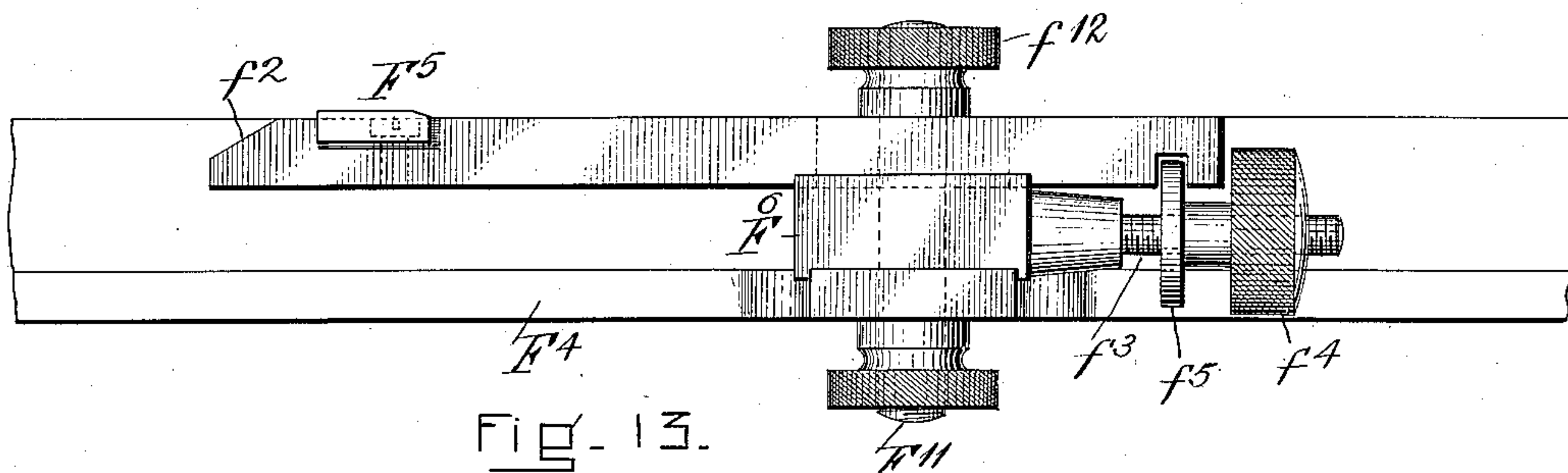
Charles E. Brown
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MACHINE FOR MAKING PAPER BOXES.
APPLICATION FILED JUNE 9, 1906.

966,618.

Patented Aug. 9, 1910.

17 SHEETS—SHEET 12.



WITNESSES:
M. E. Flaherty.
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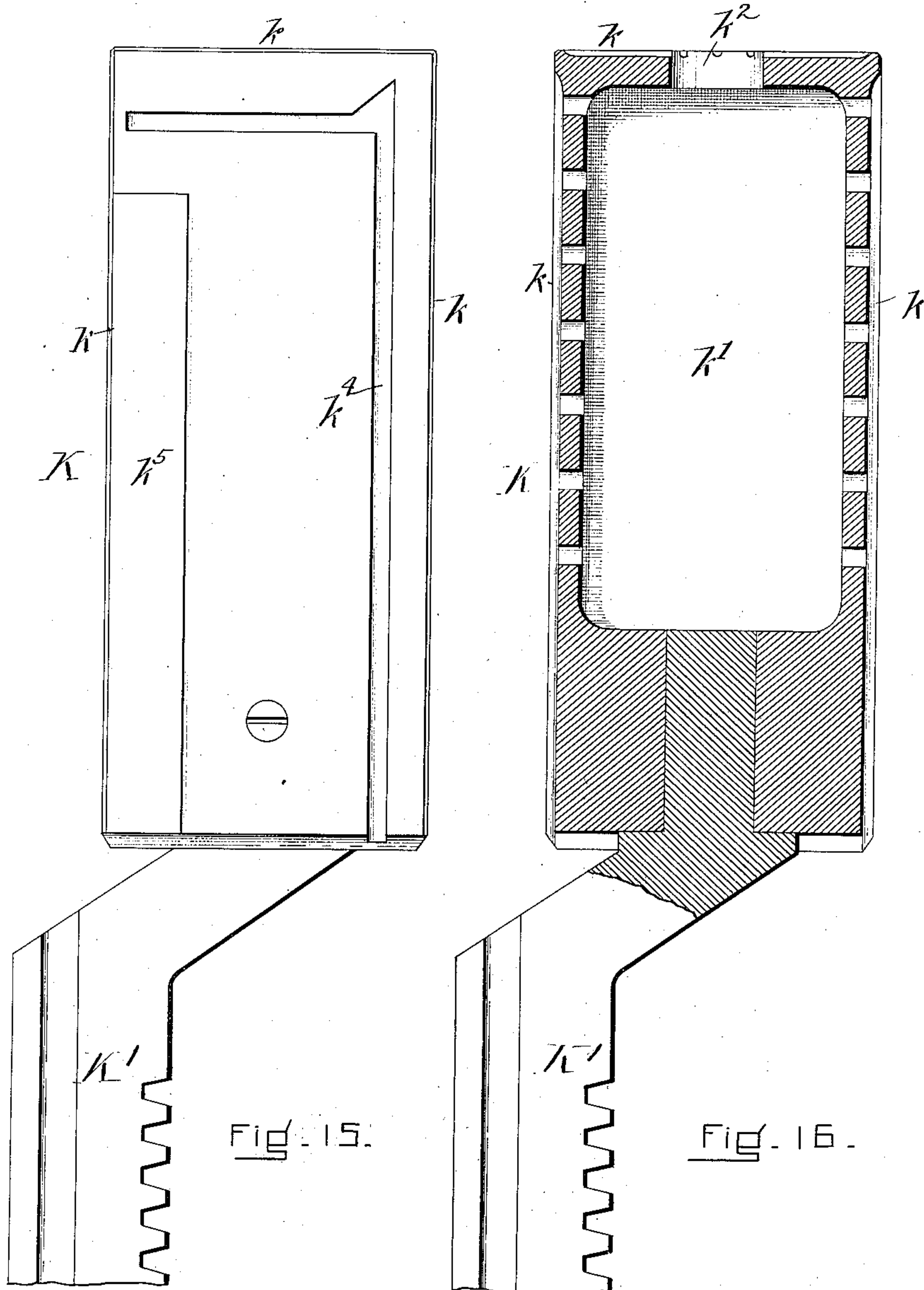
INVENTOR:
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MACHINE FOR MAKING PAPER BOXES.
APPLICATION FILED JUNE 9, 1906.

966,618.

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17 SHEETS—SHEET 13.



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17 SHEETS—SHEET 14.

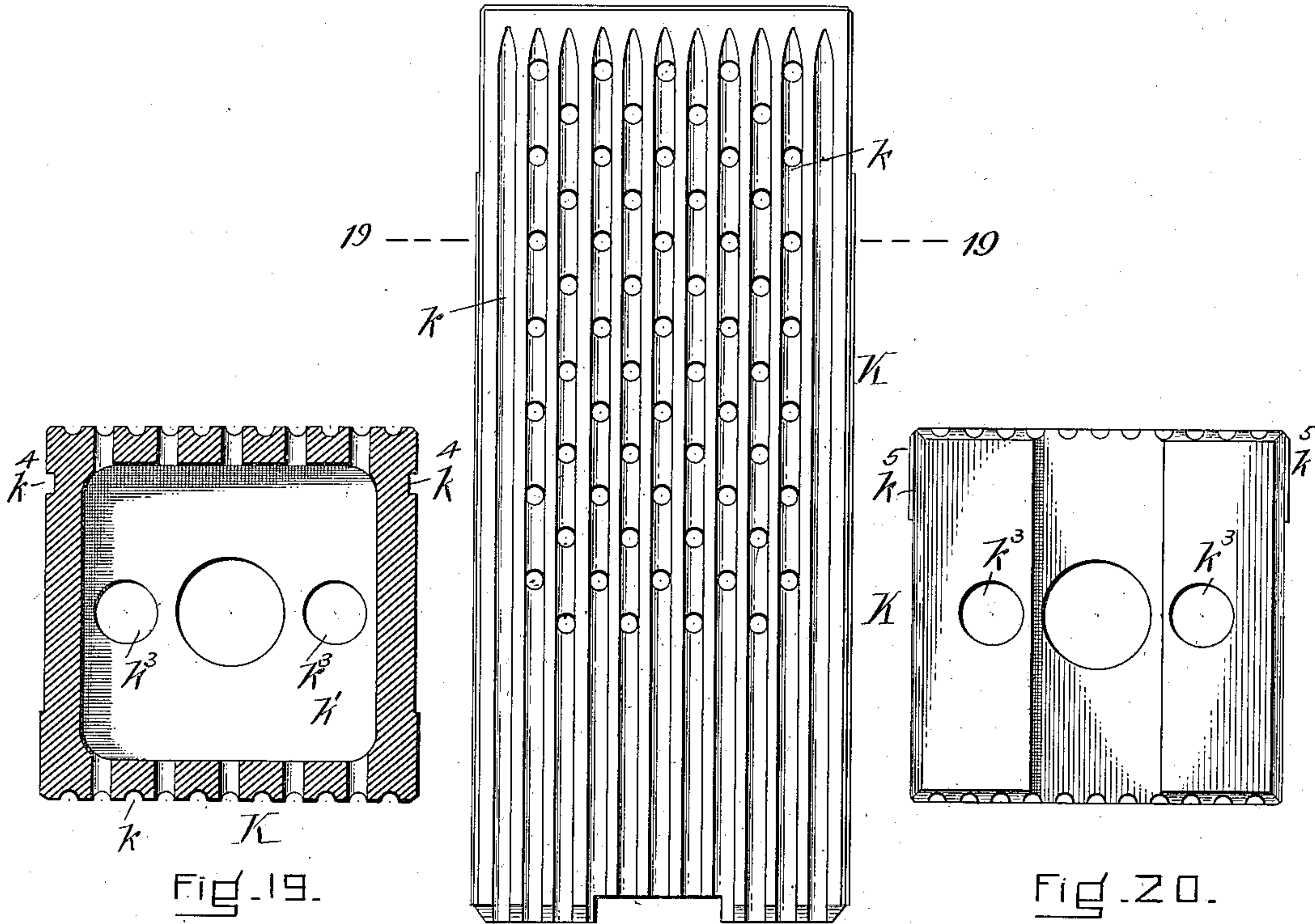


Fig. 19.

Fig. 17.

Fig. 20.

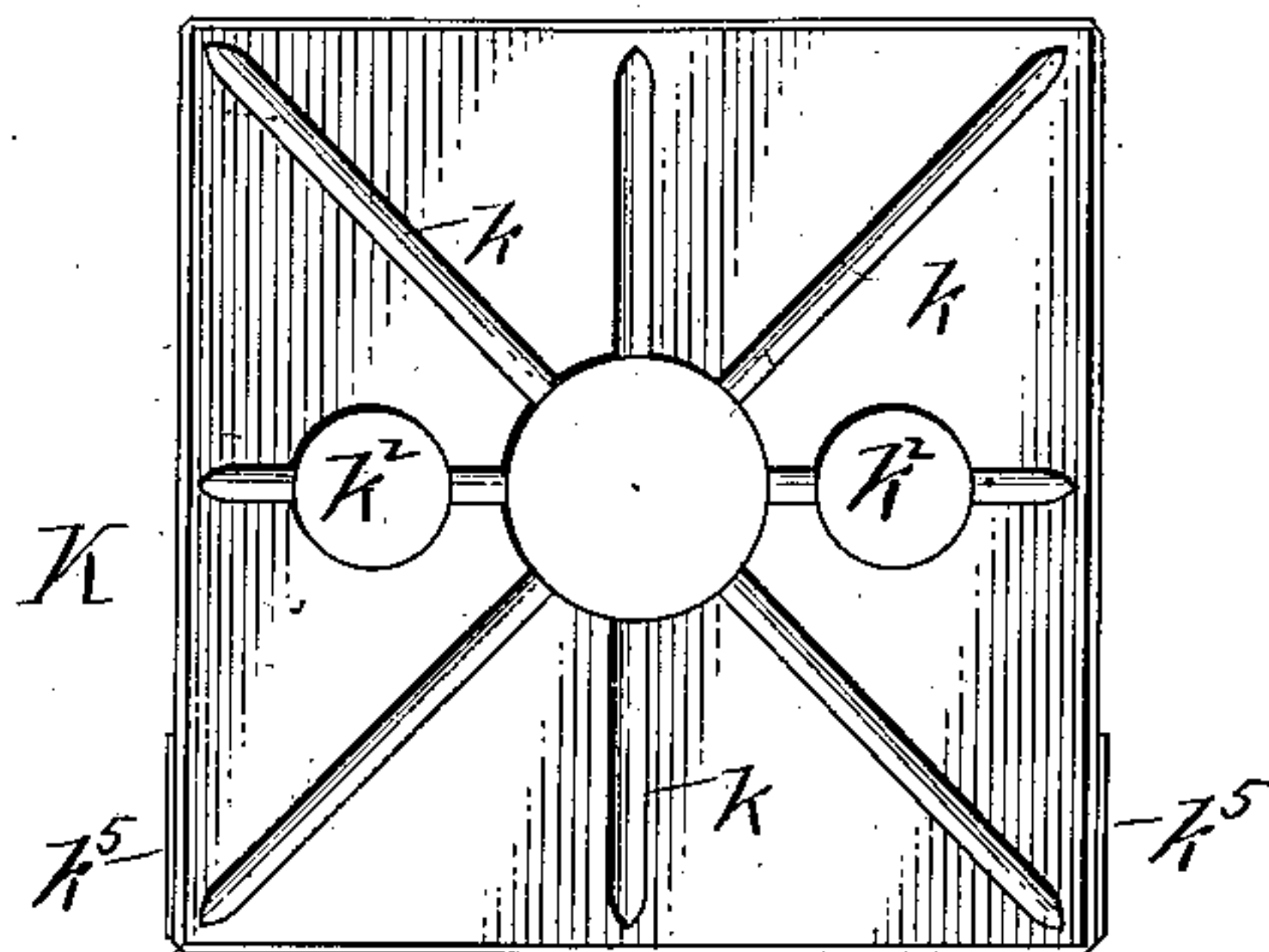


Fig. 18.

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Patented Aug. 9, 1910.

17 SHEETS—SHEET 15.

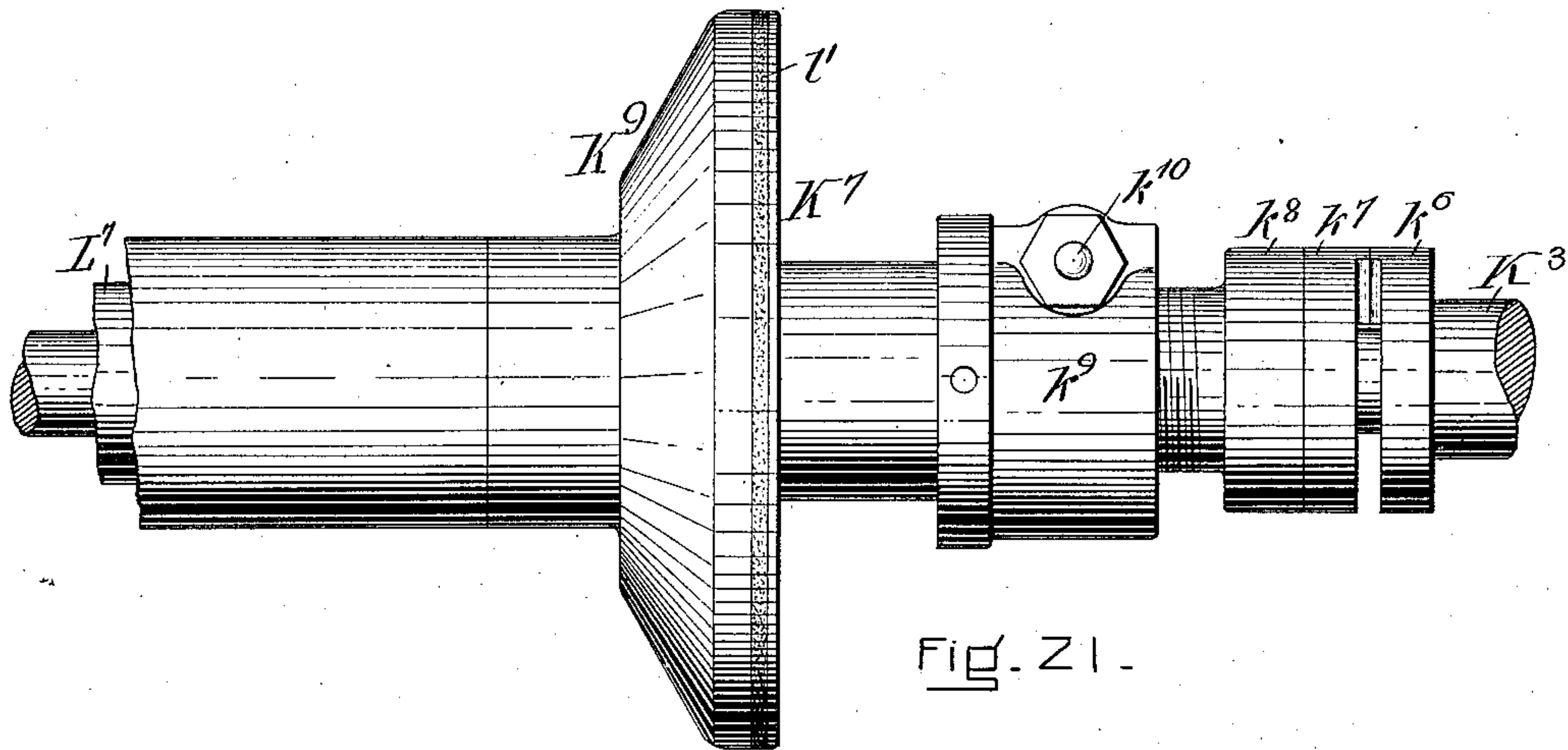


Fig. 21.

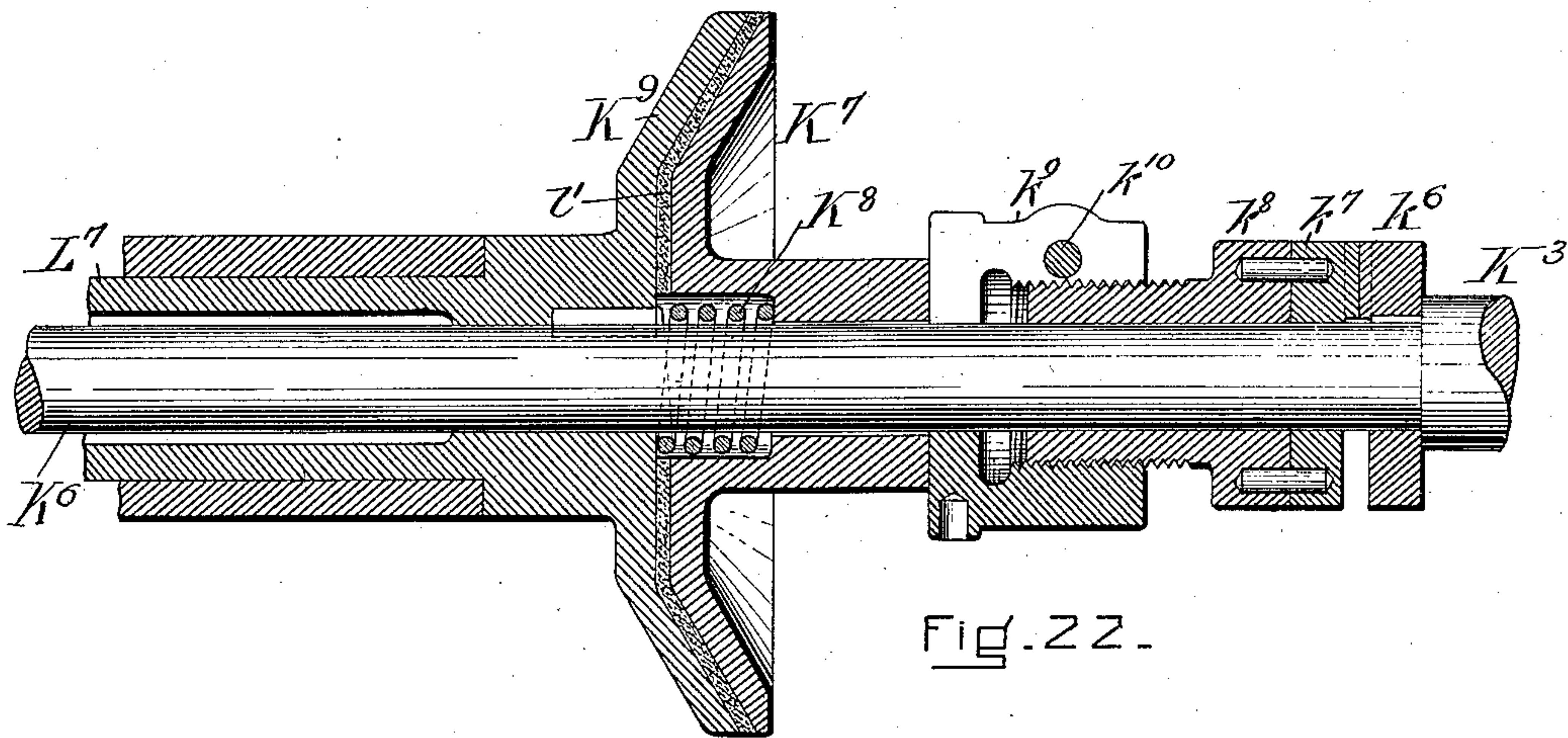


Fig. 22.

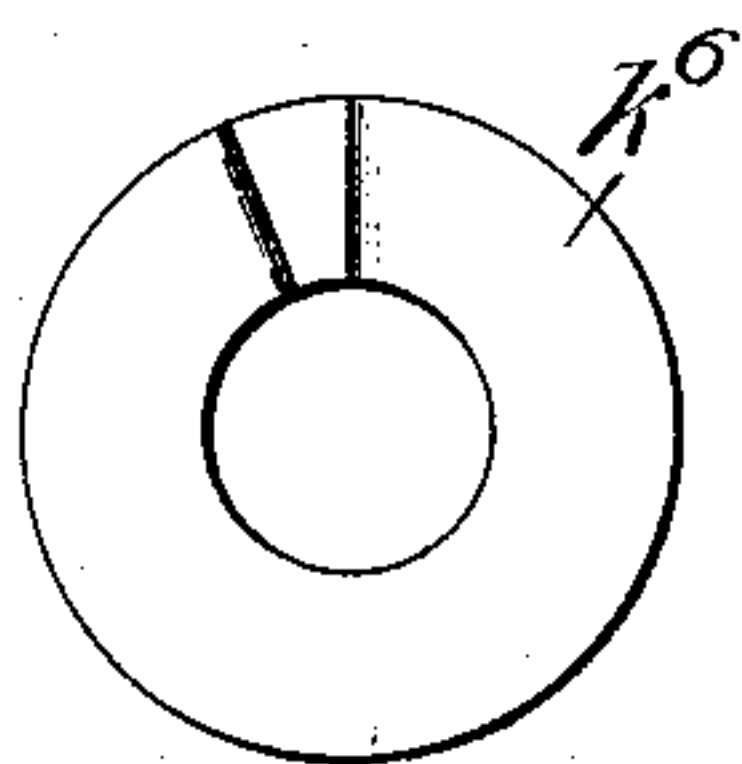


Fig. 23.

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966,618.

Patented Aug. 9, 1910.

17 SHEETS—SHEET 16.

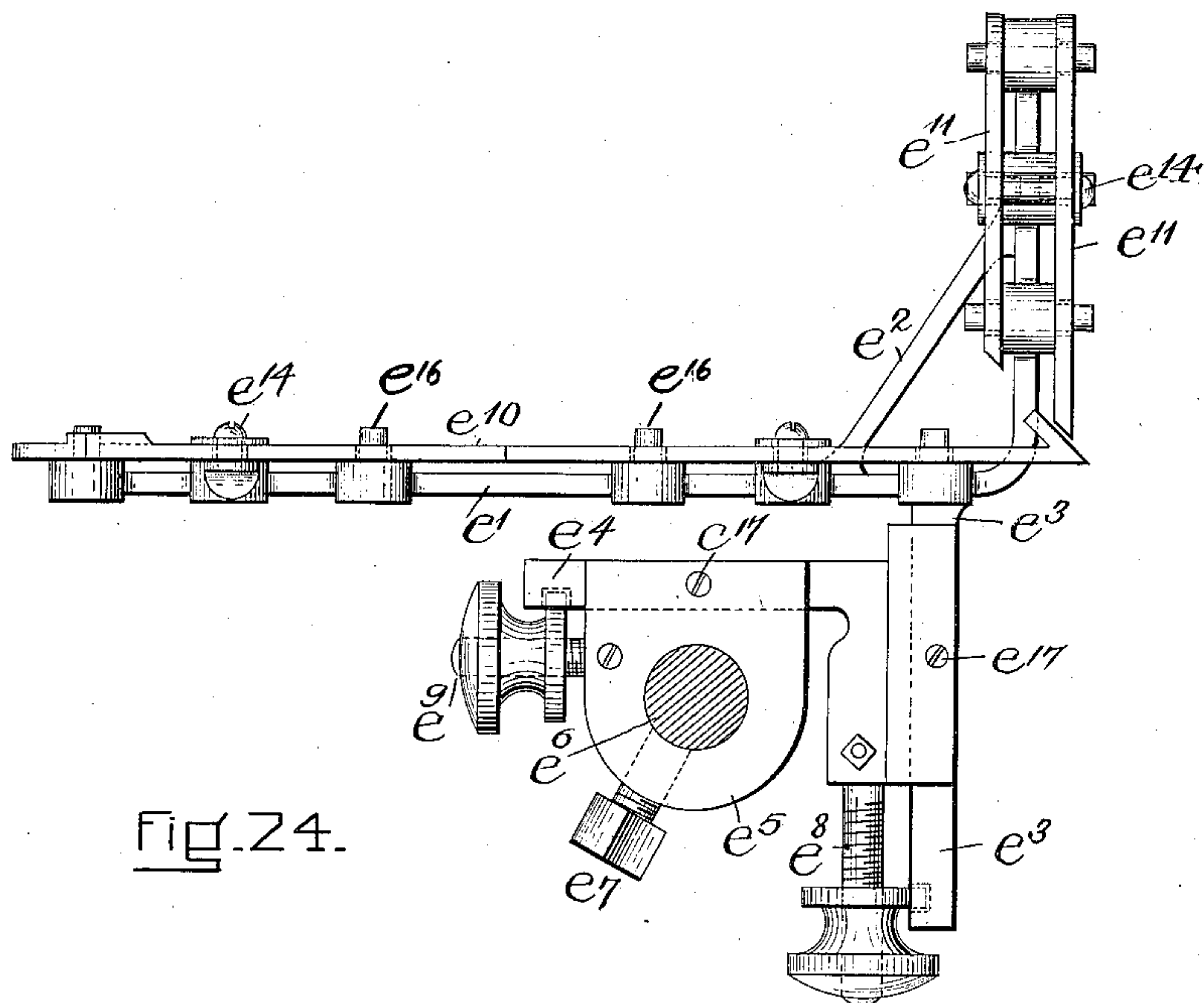


Fig. 24.

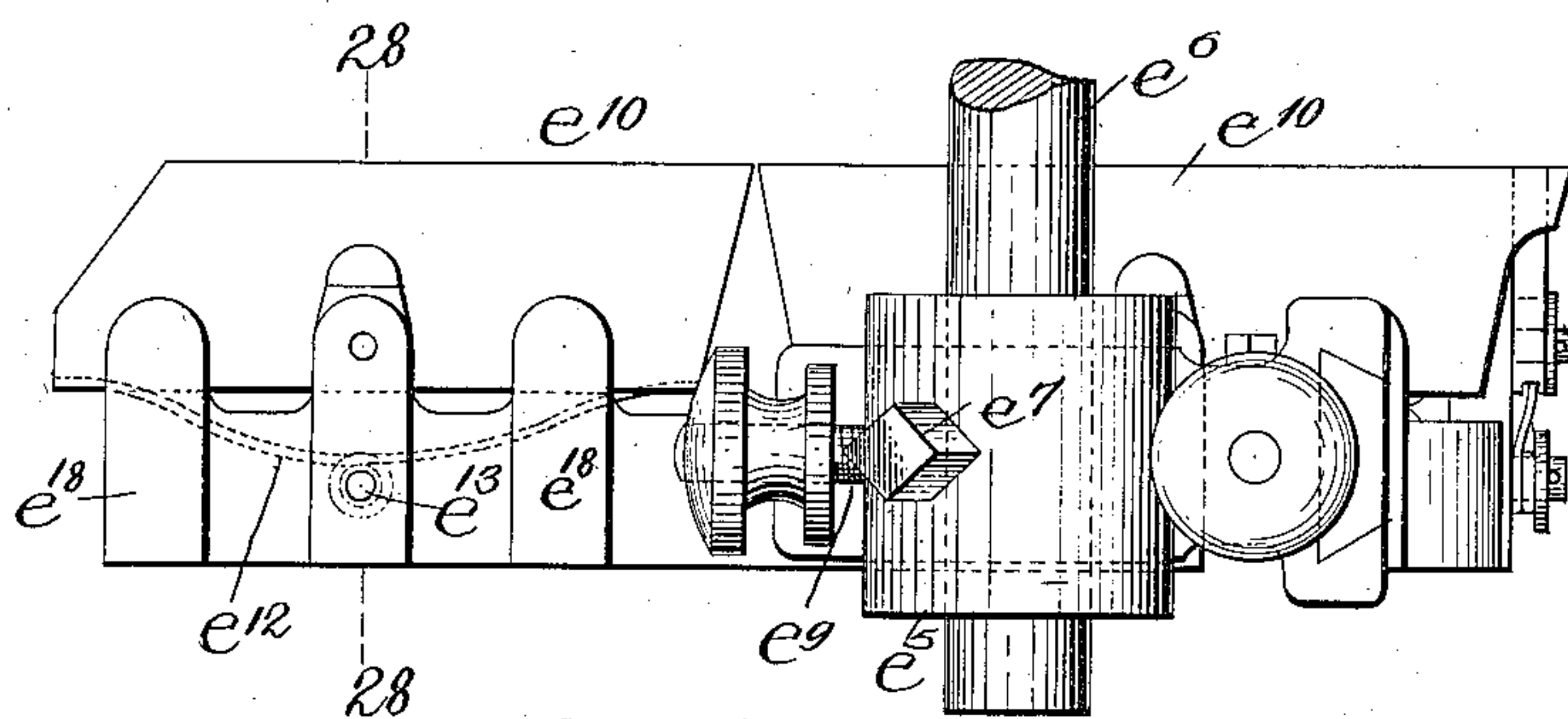


Fig. 25.

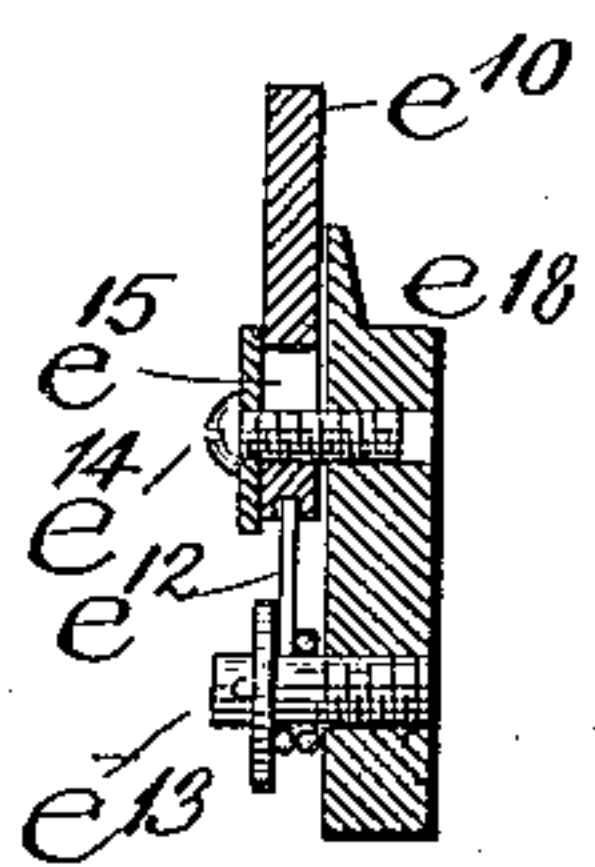


Fig. 28.

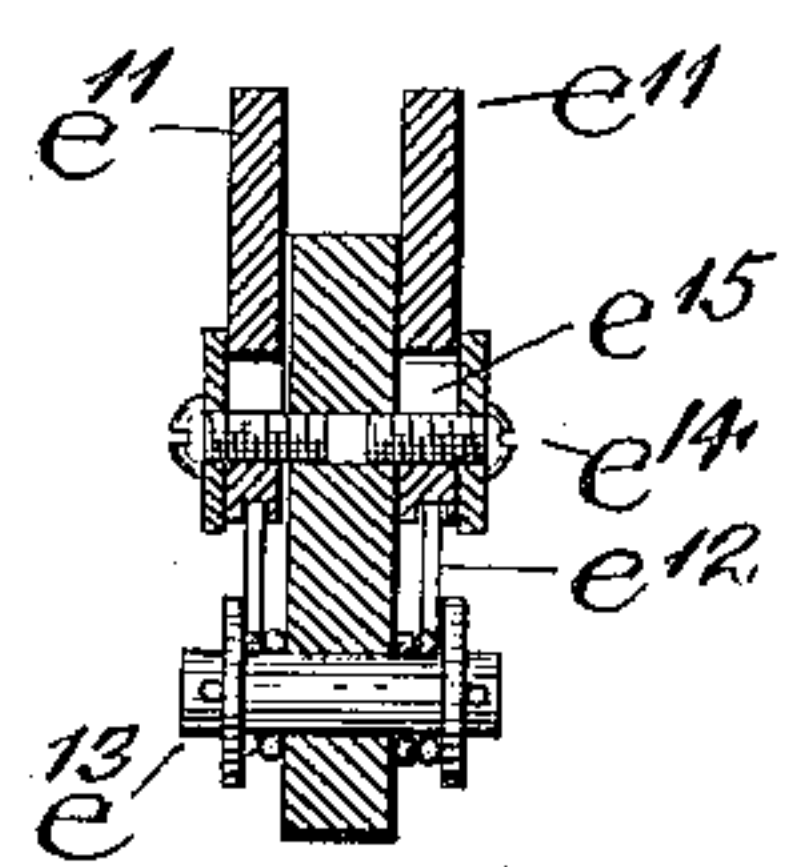


Fig. 27.

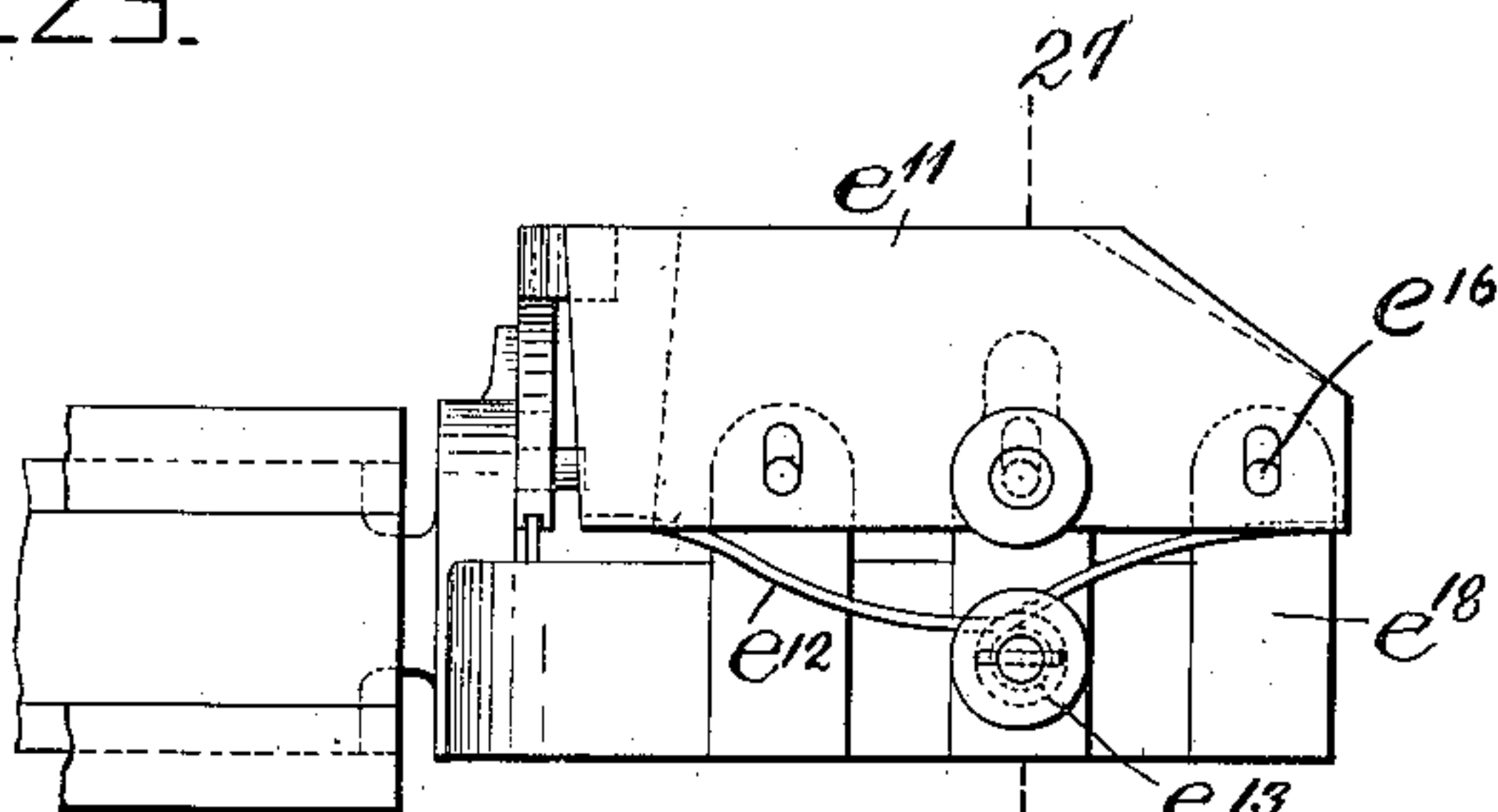


Fig. 26.

WITNESSES:

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MACHINE FOR MAKING PAPER BOXES.
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966,618.

Patented Aug. 9, 1910.

17 SHEETS—SHEET 17.

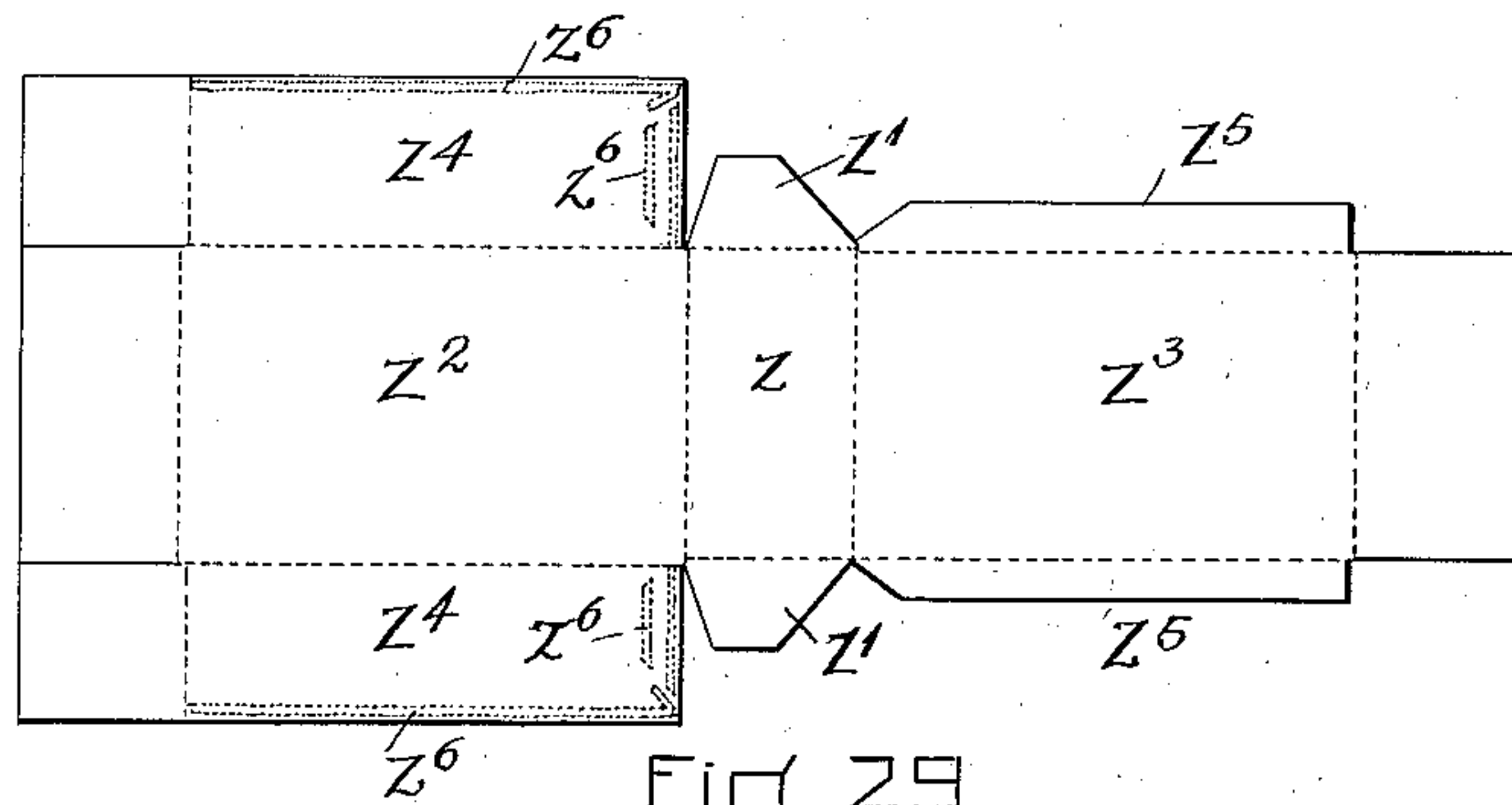


Fig. 29.

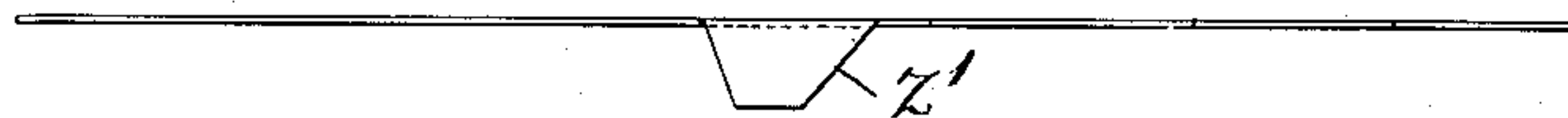


Fig. 30.

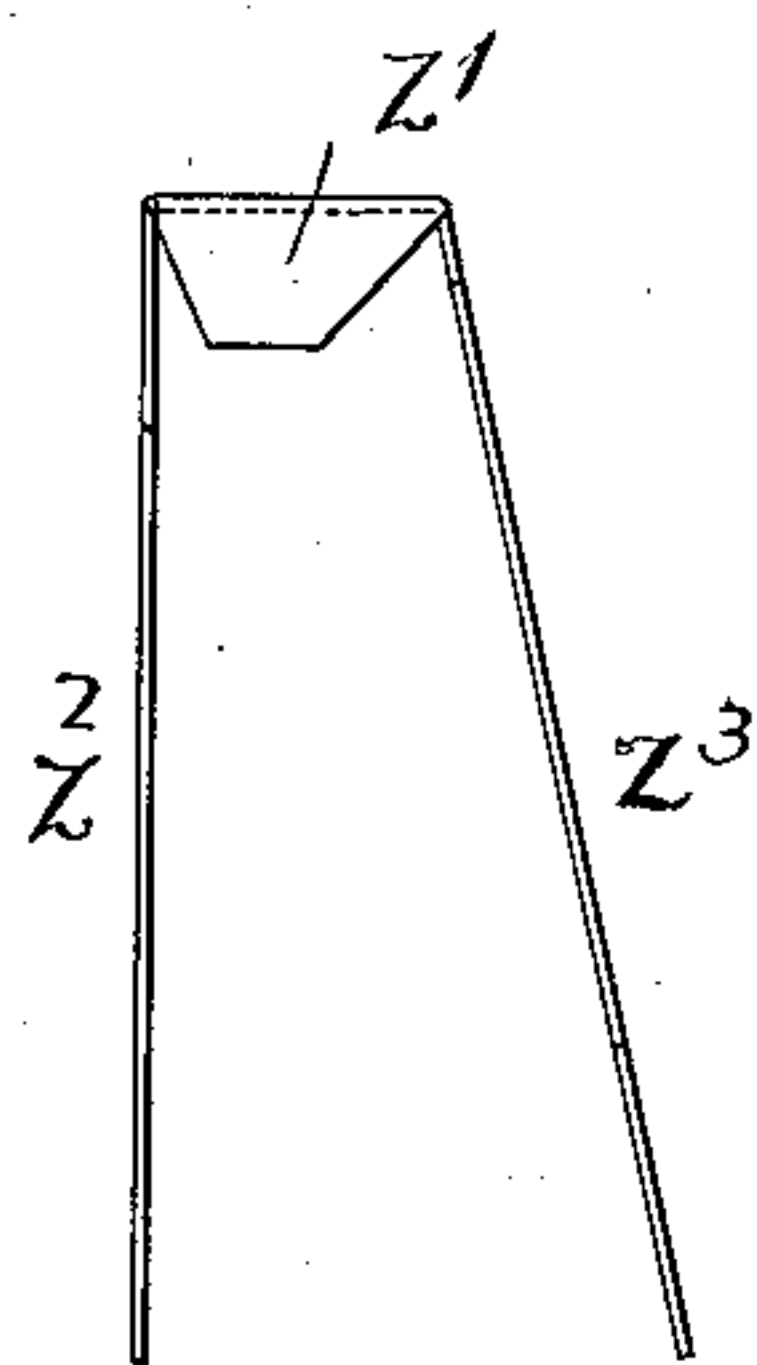


Fig. 31.

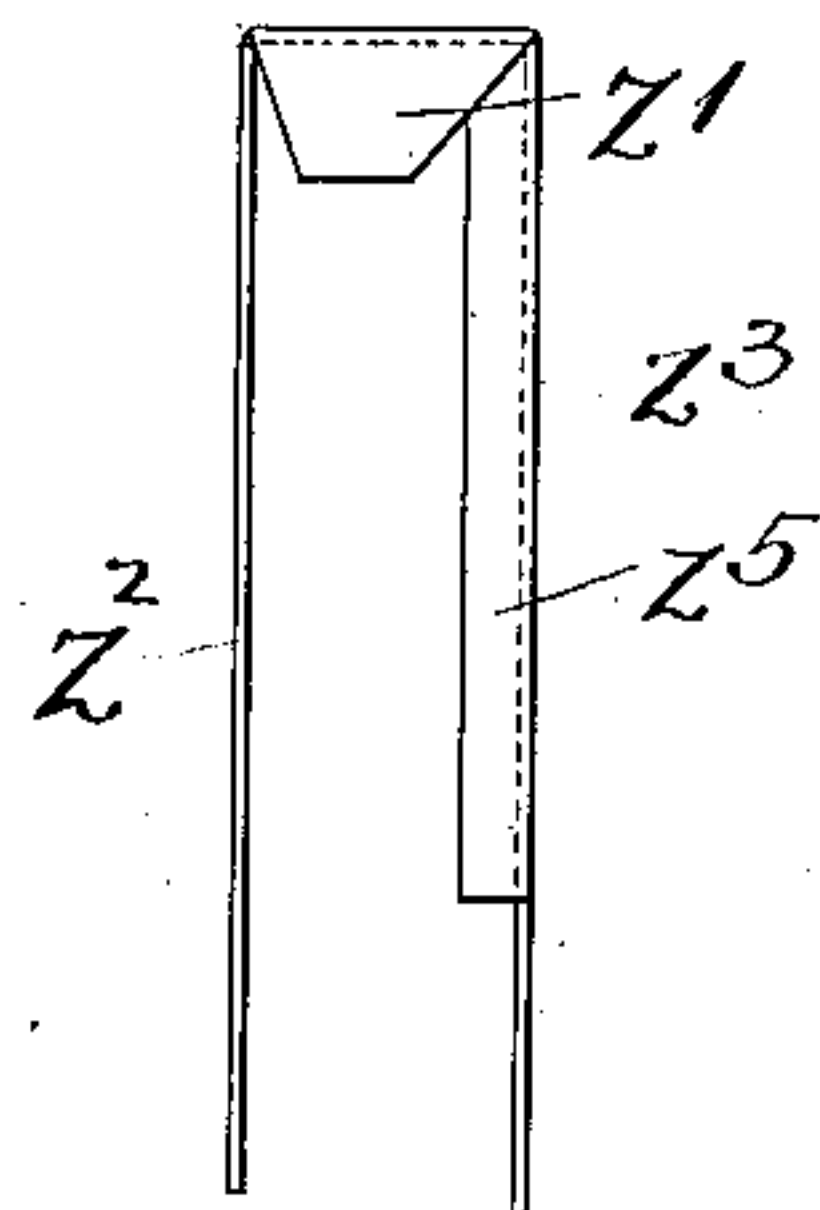


Fig. 32.

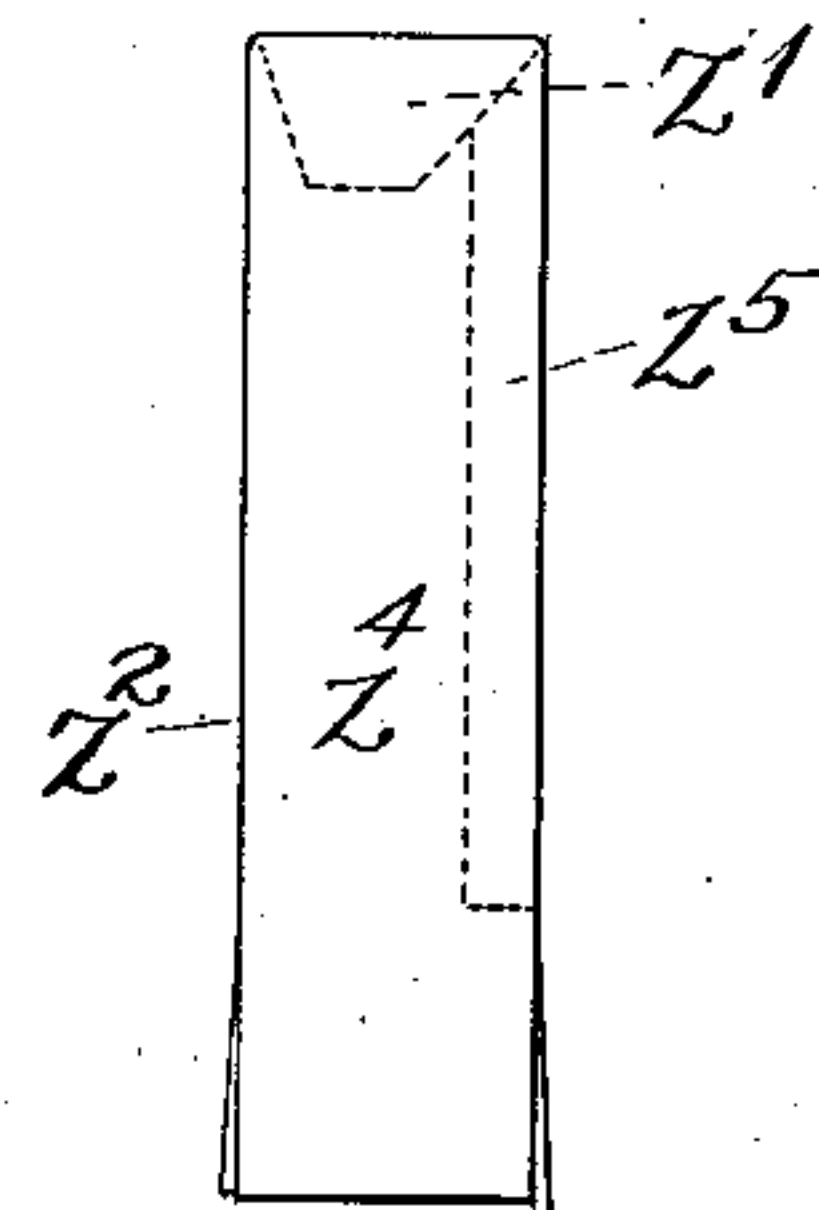


Fig. 33.

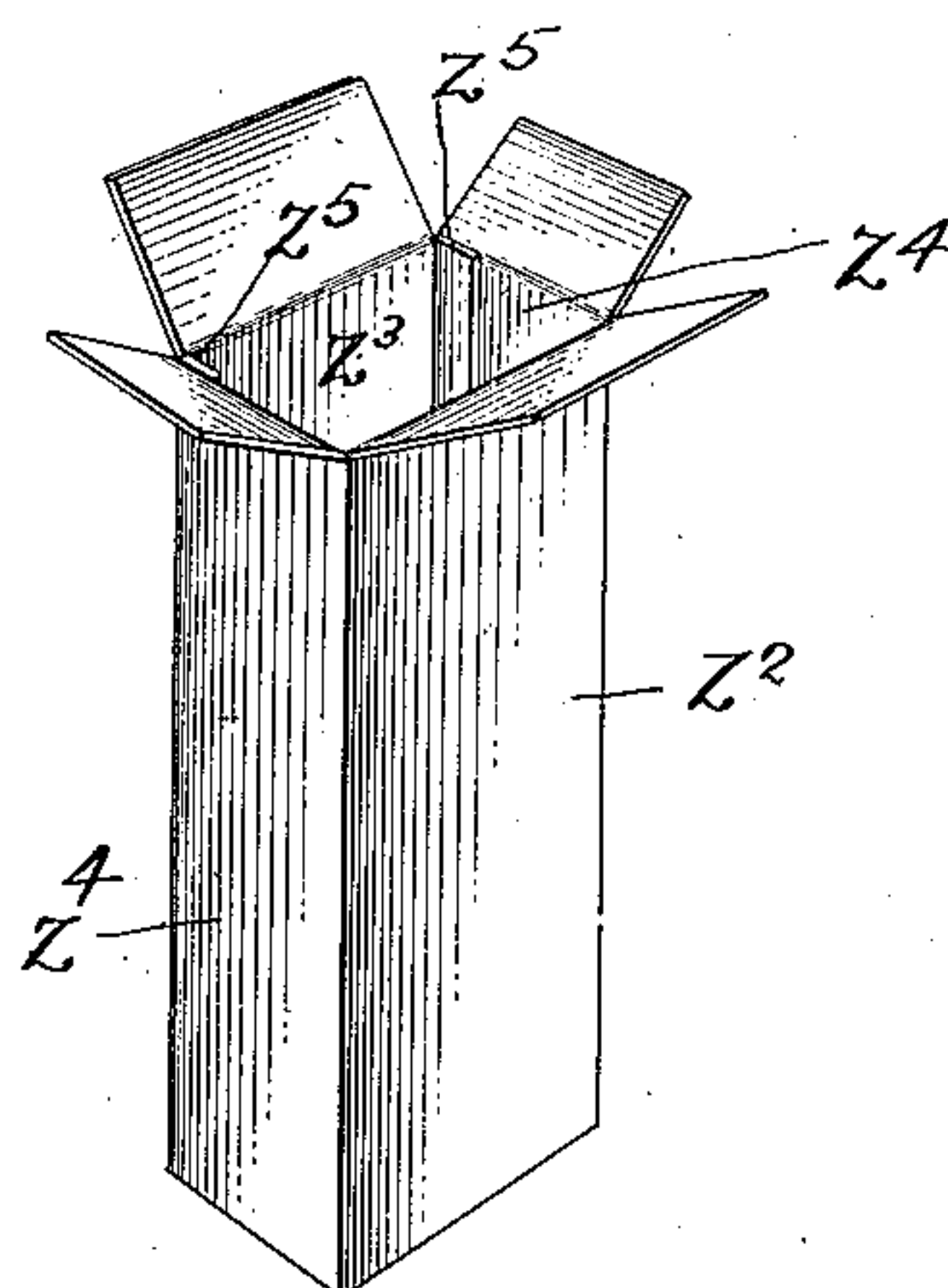


Fig. 34.

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INVENTOR:

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By
Charles E. Taylor
his attorney

UNITED STATES PATENT OFFICE.

EUGENE H. TAYLOR, OF HYDE PARK, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CUSHMAN PAPER BOX MACHINE COMPANY, A CORPORATION OF MAINE.

MACHINE FOR MAKING PAPER BOXES.

966,618.

Specification of Letters Patent.

Patented Aug. 9, 1910.

Application filed June 9, 1906. Serial No. 321,031.

To all whom it may concern:

Be it known that I, EUGENE H. TAYLOR, of Hyde Park, county of Norfolk, State of Massachusetts, have invented a new and useful Improvement in Machines for Making Paper Boxes, of which the following is a specification.

In machines heretofore designed for making paper boxes various problems have been presented which have not been heretofore satisfactorily solved. These problems have related to the gumming mechanism, the feed of the paper, and the folding mechanism, etc.; and in general the arrangement of parts so that the machine will accomplish its work quickly and with but little friction. In a machine of this kind simplicity is a desirable feature.

My machine is an improvement upon a line of machines, one of which is shown in Letters Patent No. 541,953, granted to me July 2, 1895, and an examination of my present application in connection with that patent will show that the machine has been very much simplified and rendered available to do a different class of work accurately and well.

Among the features of my present invention is the blank feed whereby the blank is delivered from the bottom of the hopper to be caught with absolute register on the upper surface of the former on which it finally rests to be folded. Moreover, unlike other machines of which I have knowledge, the blank has two distinct movements between the hopper and its folding position, one a short movement to release its edge from the hopper, and the other a long movement to carry it by its front edge to the folder. For this purpose two feeding mechanisms are provided, one strictly a delivery mechanism to deliver it to the feed, and the other a feeding mechanism which grips the edge of the blank projecting from the hopper and carries it to the folding apparatus. This is very desirable because while the blank is supporting the pile of blanks above it there is no projecting edge by which it may be seized and pulled forward into place; and yet only by positively gripping the blank can absolute register be obtained. The necessity for the absolute register of the blank on the former and with the folding mechanism will be apparent when it is considered that a box like that shown in Figure

34, to make which the particular embodiment of my invention shown in the drawings is constructed, is perhaps six or eight inches high, or with the flaps possibly ten or twelve inches high, and a very slight error in register at the bottom of the box is multiplied many times at the top of the box. In this connection means which it is believed are new are provided for moving and operating the grippers which constitute the feed, and also for adjusting the length of movement of the gripper feeding mechanism without stopping the machine in its operation.

My improvement also relates to a peculiar mechanism for folding the various parts of the blank against the former, also to the means whereby the same cam is enabled to operate both the follower and the former although these two parts have movements of different lengths. These together with other improvements to be described below result in a machine which it is believed is simpler than other machines heretofore built.

My invention will be understood by reference to the drawings, in which—

Fig. 1 is a plan of a machine embodying my invention; Fig. 2 being a front elevation thereof. Fig. 3 is a side elevation. Fig. 4 is a section on line 4—4 of Fig. 2. Fig. 5 is an enlarged detail showing the relation of the folding mechanism and former to the feed and showing also the feed somewhat in detail and the ejector for the finished box. Fig. 6 shows in detail, partly in section, the ejector and the gripper which forms part of the feed, the gripper being closed. Fig. 6^A is a detail of means for adjusting the movement of the grippers. Fig. 7 is a plan view of the gripper and ejector as shown in Fig. 6, and Fig. 8 is an edge view thereof. Fig. 9 shows in detail, partly in section, the follower together with the means for folding down the ears of the box blank. Fig. 10 is a side elevation of the follower. In these views the supporting rod and inclosed shaft are shortened for convenience. Fig. 11 is a plan of the corner turning mechanism and the means for operating it. Fig. 11^A is a section on line 11^A—11^A of Fig. 11. Fig. 12 is a front elevation thereof. Fig. 13 is a side view of the blank delivery mechanism; Fig. 14 being a plan thereof. Fig. 15 is a side view of the former, and Fig. 16 a vertical section thereof; Fig. 17 is a front

view; Fig. 18 a top view; Fig. 19 a cross section on line 19—19 of Fig. 17; and Fig. 20 an inverted plan. Figs. 21, 22, and 23 are details, Fig. 22 being in section, of a frictional connection to be described below. Fig. 24 is a detail of the paster in plan; Fig. 25 being a side elevation, and Fig. 26 being a front elevation. Fig. 27 is a section on line 27—27 of Fig. 26, and Fig. 28 a section on line 28—28 of Fig. 25. Figs. 29 to 33, inclusive, show the box blank and the various steps in its folding, Fig. 34 being the finished box.

While a machine like that shown in the drawings may be rendered capable of making boxes of different shapes, sizes, and proportions by changing the former and otherwise adjusting the machine, it is particularly adapted to make a box such as is shown and described in Letters Patent to Wilson Fiske, No. 712,434, dated October 28, 1902, from the blank also described in that patent. Such a blank is shown in Fig. 29 of the present drawings. The blank consists of what may be termed a bottom piece z , from each end of which project ears z^1 . The sides of the box are formed by the parts z^2, z^3 , the ends by the parts z^4, z^5 being what may be termed paste strips against which the ends z^4 are pasted in the process of manufacture. In addition, the blank has continuations of the two sides z^2, z^3 , and of the ends z^4 , which, however, are not specifically referred to, as in the operation of folding they may be considered with the parts to which they are attached. They are used to close the top of the box when it has been filled. It will be noted that the various parts referred to in Fig. 29 are separated by dotted lines which indicate the lines upon which the box is folded either in the machine or when it is to be used.

In the operation of the machine the blank having been gummed on its under side along the surface z^6 and having been laid and clamped upon the former, the first operation is the folding down of the ears z^1 as shown in Fig. 30. The next operation is the folding down of the sides z^2, z^3 against the former (see Fig. 31), the paste strip z^5 being turned in (see Fig. 32) by the same mechanism which folds the side z^3 , the ends z^4 being the last part folded, after which the gummed surfaces of the box are pressed between the former and end plates against the sides z^4 to insure sticking and the former is then withdrawn from the box, the box when completed being as shown in Fig. 34. The working parts of the machine by which these operations are accomplished are mounted upon a table A, the side supports or frame of the table being marked A^1 , and forming bearings for the shafts, etc.

B is the driving shaft carrying a freely running pulley B^1 , which is engaged with

the said driving shaft by a suitable clutch mechanism. The clutch mechanism shown is one well known in which the movable member of the clutch is thrown by a rocker arm B^2 on a rock shaft B^3 which carries another rocker arm B^4 connected by a connecting rod B^{41} , with a rocker arm B^5 on the shaft B^6 which also carries a rocker arm B^7 . This last rocker arm B^7 is connected by connecting rod B^8 with a lever B^9 hung under the platform B^{10} , and operated by depressing one of the rods B^{11} . A hand lever B^{12} pivoted to the connecting rod B^{41} in front of the machine enables the clutch to be operated from that point. On the shaft B is a pinion b , which, engaging a gear b^1 on a shaft b^2 carrying a pinion b^3 , transmits power to the gear b^4 on the cam shaft C.

In the operation of the machine blanks are placed in a hopper D, having an opening d in front to allow the lowest blank to be delivered through it. In fact the delivery of the blank to the feeding mechanism first takes place in the form of my invention shown in the drawings, but I will postpone the description of the delivery mechanism and describe it in connection with the feeding mechanism.

The operation of gumming the blanks will first be described. For this purpose I have provided a gum box E, its rear edge being supported on suitable hinged supports e of a character such that the gum box may be easily removed for cleaning purposes, its front edge resting on a ledge on the support F^2 . Normally lying within the gum box E, but movable upwardly to gum the under surface of the under blank in the hopper, are two gummers E^1 , each of which is constructed in detail as shown in Fig. 24. They are, however, reversed in shape, as shown in Fig. 1. Each gummer comprises an angular frame e^1 suitably braced at the corner as at e^2 and mounted on the end of a dove-tailed arm e^3 . This arm slides in a corresponding groove in a right-angled piece e^4 . One arm of this right-angled piece e^4 slides in like manner in a suitable groove in a hub e^5 which is adjustably attached to the rod e^6 by means of a set screw e^7 . These two arms slide at right angles to each other so that the position of each gummer may be accurately adjusted with relation to the blank. An adjusting screw e^8 , the rim of which runs in a groove in the arm e^3 , causes that arm and the frame e^1 as a whole to be moved broadside in a direction crosswise of the machine, and an adjusting screw e^9 similarly arranged with relation to one arm of the right-angled piece e^4 will cause an adjustment of the frame e^1 endwise and lengthwise of the machine. After adjustment the several parts are clamped in place by set screws e^{17} .

The frame itself carries yielding gum-

ming pieces e^{10} , e^{11} , the edges of which are shaped to gum a surface of proper shape, z^6 , on the end pieces z^4 of the blank. These gumming pieces are supported upon springs e^{12} which are held in place by pins e^{13} projecting from the frame e^1 . The yielding pieces e^{10} , e^{11} are connected to the frame e^1 by screws e^{14} passing through slots e^{15} in the gumming pieces and are supported laterally by fingers e^{18} . It is desirable also that other pins e^{16} be provided which pass through similar slots so as to form guides for the movement of the gumming pieces e^{10} .

I prefer to make these gumming pieces in parts in order that they may conform readily to any irregularity in the surface of the blank.

I will now describe the mechanism whereby the gummers are operated. Each rod e^6 passes up through bearings E^2 mounted on the side of the hopper D. To the side of the hopper is also attached a depending rod E^3 which serves as a guide to the movement of the rod e^6 , the rod e^6 for this purpose being provided with a forked arm E^4 , the fork of which straddles the rod E^3 . In the operation of the gumming frames they are given a vertically reciprocating movement upward to gum the under blank in the hopper and downward into the gum box where they normally remain. To give each its vertical movement I have shown rocker arms e^5 each pivotally connected to its rod e^6 and projecting from a rock shaft E^6 suitably mounted in bearings mounted on suitable supports A^2 . This rock shaft extends across the machine and the operating mechanism is duplicated on both sides of the hopper D, but movement is given to the rock shaft E^6 by means of a single rocker arm E^7 and connecting rod E^8 , which rod is connected with a cam lever E^9 mounted on the fulcrum A^4 supported on supports A^5 carried by the frame of the machine. The other end of this cam lever E^9 is provided with a cam roll and runs in a groove of suitable shape in the cam E^{10} mounted on the cam shaft C.

I will next describe the means for delivering the blank to the feeding mechanism. As suggested above, I prefer to deliver the blank (*i. e.*, push it out a short distance from the hopper) before gumming it, and the operation of gumming therefore occurs between the delivery and the feeding operation. This is best in a machine which may be adjusted for blanks of different lengths. This delivery mechanism will be understood more particularly by reference to Figs. 1, 4, 13, and 14, and it consists in two arms, one located on each side of the machine and under the hopper, and each so located that when at rest in its rear position its pusher will be behind but ready to engage the edges z^7 of the end pieces z^4 of the blank as will be seen from Fig. 4. As shown in Fig. 1 a

slide F is mounted in bearings f on the upper ends of supports F^1 , F^2 , carried by the table A. An arm F^3 projects from each side of the slide F and is slotted near its end as shown at f^1 . To each arm F^3 is adjustably attached a cross arm F^4 . For this purpose a block F^6 is provided with a shallow groove on its under surface, which enables it to straddle the arm F^3 and it is clamped to the arm F^3 by a bolt f^{11} (passing through the slot f^1), and nuts f^{12} , the upper nut f^{12} also holding the cross arm F^4 in position in a corresponding shallow groove in the upper side of the block F^6 . The front end of each cross arm F^4 is beveled at f^2 and near its front end it carries a pusher F^5 adapted to engage the proper edge of the blank at the proper time and push it forward a proper distance. The upper surface of this pusher projects slightly above the upper surface of the cross arm F^4 so as properly to engage the blank. The beveled edges of the cross arms guide the edge of the blank to the pusher. The grooves in the blocks F^6 guide the direction of adjustment of the pushers. It will be seen that the cross arms F^4 may be adjusted toward and from the middle line of the machine according to the width of the blanks as above described. To adjust the pushers lengthwise of the machine I provide each block F^6 with a screw f^3 on which turns a grooved nut f^4 , the disk f^5 of which fits into a groove in the cross arm F^4 , the other portion being available as a thumb nut. The groove in the nut receives the end of the cross arm F^4 . To adjust the pusher lengthwise of the machine the upper nut f^{12} is loosened and the proper adjustment is made by turning the nut f^4 , after which the nut f^{12} is again tightened. It will be noted that the cross arm F^4 is slotted as at f^7 in order that this adjustment may be made. In like manner the arms F^3 are provided with slots f^1 to enable the cross arms F^4 to be adjusted toward and from the center of the machine. The purpose of this delivery mechanism is not to feed the blank but to place the blank within reach of a gripping mechanism which shall serve as a positive feed, and it is unnecessary that this delivery mechanism shall have more than a short stroke. The weight of the pile of blanks causes and maintains the engagement between the bottom blank and the delivery mechanism or pusher which is moving with it, until the completion of the stroke of the pusher which leaves it in reach of the gripping mechanism.

To move the delivery mechanism I have provided a lever F^7 connected by a link f^8 with an eye f^9 connected to the under surface of the strip F, this lever being fulcrumed at f^{10} in a projection above the table, the lower end of the lever passing down

through the table and being connected by a connecting rod F^8 with a cam lever F^9 which rocks on the fulcrum A^4 and has a suitable cam roll running in the cam F^{10} .

5 After the blank has been delivered to the feeding mechanism and gummed the next step is the feeding of the blank to the folding mechanism. The feeding grippers are lettered in Fig. 4, G, and are shown in detail
10 in Figs. 5, 6, 7, and 8. There are two of these grippers, one on each side of the machine, as will be seen from Fig. 1, and in their rearward position they are located in position to receive the blank when delivered
15 by the delivering mechanism, the movement of the delivery and feeding mechanisms being proportioned and timed with relation to each other. From that position they are moved forward toward the outer edge of the
20 machine, where they are opened positively by mechanism provided for the purpose to release the blank at the proper time. The positive opening and closing of feeding gripper jaws I believe to be new with me. In
25 this connection I would say that in the manufacture of a box of the character shown in Fig. 34 where a very small error at the point of folding will be largely increased at the end of the box, it is very desirable, if not
30 necessary, for the perfect making of such a box, that after the blank is once in motion toward its place of folding, it shall never be released but shall be always held positively. For that reason, the blank having been once
35 seized by the grippers is held positively by the grippers until after it has been clamped between the former and follower. It is then released by the grippers but remains clamped by the former and follower until the fold-
40 ing and pressing operations have been concluded, in fact, until the time for stripping the box from the former.

Turning now to Figs. 5, 6, 7, and 8, it will be seen that the gripper comprises an upper
45 jaw G^1 , which while it is moved with the other parts connected with it for the purpose of conveying the blank from one position to another, may be considered stationary in its relation to the other parts of the gripper. This jaw G^1 is attached to a support
50 projecting laterally from a rack bar G^2 , which rack bar is engaged by a gear G^3 supported and operated in the manner to be described below. The movable jaw of each
55 gripper is shown at g and is pivoted to the jaw G^1 by the pin G^{120} . It is connected by two arms g^1 to sleeves g^2 turning on the toggle pin g^3 . The movable jaw g is in fact a lever, the rear ends of which are pivotally
60 connected as at g^8 by links g^5 (forming toggle arms) with a sliding sleeve g^6 running upon a rod G^4 which screws into and forms a part of the rear of the stationary gripper G^1 . The outer end of this rod G^4 is thread-
65 ed and it carries a collar G^5 and set nuts G^6 ,

and it also carries a bearing G^7 which engages the rear end of the sleeve g^6 and between this bearing and the collar G^5 is a spring G^8 which tends to keep the movable jaw g in engagement with the stationary jaw G^1 . The jaw g is also provided with
70 latches g^7, g^8 , pivoted on pins g^{71}, g^{81} . It will be noted that each latch is normally held against a stop g^{10} by means of a spring g^9 . Each latch is movable in a direction
75 opposite to the movement of the other, and looking at Fig. 5 it will be noted that if the latch g^7 is pushed by any suitable mechanism it will tend to open the gripper, while if the latch g^8 is pushed the gripper will be
80 closed, and it will also be noted that if the latch be pushed in the opposite direction to that stated it will yield to the part engaging it. The rack bars G^2 slide in ways in the bars G^9 supported above the table A. 85

In order to open and close the grippers I have provided fingers H, H^1 , each adjustably attached to the end of a rod h, h^1 (see Figs. 2 and 5), these two rods being clamped
90 together to move as one. There are two pairs of these rods, one pair on each side of the machine to engage and operate one of the grippers. The main reason for providing two rods on each side rather than one, is to economize space. Each pair of rods h, h^1 ,
95 is moved by means of a rocker arm H^2 connected by a link H^3 with an eye H^4 on the rod h . The rocker arm H^2 is carried by a rock shaft H^5 and from this rock shaft projects another rocker arm H^6 which is con-
100 nected by means of a connecting rod H^7 with a cam lever H^8 supported on the fulcrum A^4 , the other end of this lever being provided with a suitable cam roll running in the groove in the cam H^9 . 105

The gear G^3 above referred to is mounted in bearings carried by a cross bar mounted on the supports F^2 and on the shaft G^{31} with it is a pinion G^{10} which engages and is operated by a rack bar G^{11} running in an open-
110 ing in the table A, and operated by means of a cam lever G^{12} pivoted to the fulcrum A^4 , which lever is moved by means of the cam G^{13} . The two cams G^{13} and H^9 are set with relation to each other so that after the
115 blank has been pushed between the open jaws the fingers H move toward the rear so as to strike the latch g^8 and push it to break the toggles, thus allowing the spring G^8 to close the lower jaws g against the upper
120 jaws thus clamping the blank between the jaws. The grippers then start back to feed the blank to the folding mechanism. In this movement the latches g^7 strike the fingers H^1 but yield and slide over them.
125 When they have reached the end of their stroke, the rods h, h^1 are moved toward the front and the fingers H^1 engage the opposite side of the latches and straighten the toggles, thus separating the movable jaws from 130

the stationary jaws and releasing the blank, this taking place after the blank has been clamped between the former and the follower as below described. The grippers
 5 later return to their rearward position passing the fingers H and the operation is repeated. In addition to the gripping mechanism each rack bar also carries means for ejecting the completed box which means
 10 comprise an arm J attached to the rack bar G² and having a hub j on its end. Held in place in this hub by a set screw j¹ is the ejector J¹. The end of this ejector is provided with spring fingers by means of which
 15 the box may be pushed without injury. It will be seen from Fig. 6 that this piece is slightly in advance of the gripper carried by the same rack bar so that it will remove the box which has just been made just prior
 20 to the moment when the blank reaches its forward position.

The former is of peculiar construction and will be understood from Figs. 15 to 20, inclusive. Roughly speaking, it comprises
 25 a hollow metal form of the size of the interior of the finished box. It is marked K and two of its sides and its top are grooved as shown at k. It contains a chamber as shown at k¹, with openings in the top as
 30 shown at k² and also in the bottom as shown at k³. It has been found by experience that in the folding of a box of this character it is necessary that air have free access to the interior of the box in order that suction
 35 shall not prevent the ready removal of the box from the former. The former also is provided with a groove near the edges on two of its sides as shown at k⁴, where the
 40 edges at k⁵ are slightly thicker than the body of the former in order to compensate for the double thickness of the material on the opposite edge. Thus the end folders
 45 when in their folding position will be parallel and exert equal pressure on the portions of the ends of the folded box near the sides and the portions near their edges to which
 50 gum has been supplied. The former is mounted on the end of a rack bar K¹ which extends down through a suitable slide toward the base of the machine and is caused
 55 to reciprocate by means of a segment gear K² mounted on the shaft K³ carried in suitable bearings in the frame and getting its motion from a rack bar K⁴ engaging with a
 60 pinion K⁵ on the same shaft K³ and operated by cam K⁴¹. This shaft K³ also serves to move the follower L in the following manner. The purpose of the follower is
 65 two-fold. Primarily its duty is to clamp the blank against the top of the former before it is released by the grippers, and hold it in place thereon during all the subsequent operations of folding the blank, etc. For
 this purpose it must have a movement abso-

lutely uniform with that of the former during the time when they are both engaged with the box blank, but during a large part of the movement of the former the follower is inoperative. In addition to this primary
 70 function of the follower there is the secondary function of carrying the means whereby the ears z¹ of the box blank are turned down. This secondary function will be described later. 75

In order to enable the follower to perform its first described function it is mounted on a hub L² held to the end of a rack bar L¹ by the spring pin l, which passes through
 80 a hole in the hub and into an opening in the rack bar (see Fig. 9). The rack bar contains within it a shaft M to operate the ear turning means as will be described below. This rack bar L¹ is reciprocated by means of
 85 a segment gear L³ on a rock shaft L³¹, mounted in bearings in the upper frame A⁶ of the machine. This rock shaft L³¹ carries a rocker arm L⁴ connected by a connecting rod L⁵ with a rocker arm L⁶ mounted on the
 90 end of a sleeve L⁷ carried on the shaft K³ and turning in bearings L⁸ carried by one of the side supports A¹. This sleeve L⁷ forms part of a friction connection between the shaft K³ and its segment gear K² and the segment gear L³ which operates the fol-
 95 lower L. The preferred form of friction connection for this purpose is as follows. The shaft K³ is reduced in size as at K⁶ and there is keyed to the end of its bearing a cam ring k⁶ which engages a corresponding
 100 ring k⁷ pinned to a threaded sleeve k⁸ so that it will turn therewith. This threaded sleeve k⁸ screws into a split nut k⁹ held together by a binding screw k¹⁰ and against the farther end of this nut is a friction cone
 105 K⁷ which is chambered at its center and within the chamber lies a spring K⁸ which tends to separate the friction surfaces. This friction cone engages a corresponding concave surface in the corresponding cone piece
 110 K⁹ which forms part of the sleeve L⁷. Between the coned surfaces preferably is a leather lining l¹. It will be seen that while the cam surfaces of the rings k⁶, k⁷, are in engagement as shown in Fig. 22, the friction
 115 surfaces will engage and the sleeve L⁷ and through the various connections the segment L³ and follower will be operated.

I have stated above that the secondary function of the follower is to carry the
 120 mechanism for turning down the ear pieces z¹ of the blank and that for this purpose a shaft M is mounted within the rack bar L¹. To the lower end of the shaft is attached a bevel gear M¹ which engages with bevel
 125 pinions M², M³; upon the shaft M⁴. The pinion M³ is loose on shaft M⁴, the pinion M² being keyed thereto. The shaft M⁴ carries two hubs M⁵ upon each of which is a folding finger M⁶, this construction being
 130

such that at the proper time just after the follower has clamped the blank on the former these folding fingers will turn down and in their movement fold the ears z^1 against the former K and hold them there a sufficient time to enable them to be caught by the end pieces z^4 when they are folded into place. Movement is given to these fingers by means of a short segment gear m mounted on a hub m^1 at the upper end of the shaft M. This segment gear is engaged and operated by a segment gear m^2 on a hub m^3 on a rock shaft m^4 operated by a rocker arm m^5 and connecting rod m^6 carrying at its lower end a cam roll running in a cam groove m^7 , this cam groove being so timed as to give the necessary movements to these folding fingers.

The next step in the formation of the box after turning down the ears z^1 is the folding in of the sides, paste strips, and ends. For this purpose the mechanism shown is somewhat similar to that described in Letters Patent No. 541,953, the parts being in general operated in the same manner, viz:— by parallel shafts n , p , each carrying a bevel gear n^1 , p^1 , engaging a bevel gear n^2 , p^2 , on the end of a shaft Q, which shaft carries a pinion Q^1 operated by a rack bar Q^2 on the rod Q^3 suitably guided and connected to and operated by means of a cam Q^4 . I prefer to make the rod Q^3 in two parts, one part carrying a cylinder Q^5 the farther end of which slides over the other part and the other part carrying on its end a disk which slides within the cylinder. Surrounding the end of this latter part and lying between said disk and the opposing interior end of the cylinder is a spring of sufficient tension to cause the two parts of the rod to be moved normally as one piece, but allowing a slight motion between the two parts should occasion require. Such occasion is referred to below. I do not describe this mechanism with more particularity as it is an old and well known means of allowing the elongation of a connecting means of this character and in fact any other mechanism sufficient for the purpose will answer.

The shaft n carries two folders n^3 which turn down the side z^3 of the blank, these folders being rectangular in cross section, that is, each having a slight projecting rib n^4 on its folding face adapted to turn the narrow paste strips z^5 around the former. (See Fig. 11^A.) The folders upon the shaft p , however, are differently constructed, and the construction shown in the drawing is such that the offset on the former rod K^4 will not strike the folder during its upward movement and before the folders have been turned up ready for the next blank. In operation these folders first turn down the side piece z^2 and then fold the ends z^4 around the ends of the former. For this

purpose there are keyed to the shaft p two hubs p^3 each carrying a bevel gear p^{13} . Free upon the shaft p are hangers p^4 which are arranged in pairs, each pair carrying the portions of the folder adapted to fold the side piece z^2 , which portion of each folder also carries bearings p^5 through which passes a shaft p^6 carrying at its upper end a bevel gear p^7 in engagement with a gear p^{13} on one of the hubs p^3 . Each shaft p^6 carries an end folder p^8 which is kept normally in the position shown in Fig. 11 by means of a heavy spring p^9 , one end of which is attached to the said folder and the other to the end folder p^8 . This spring is of considerable strength such that it will prevent the gear p^7 and its shaft from turning under ordinary conditions, the turning of the shaft p causing the folder as a whole to rotate with it from a horizontal to a vertical position, and fold the side z^2 of the blank to engage the former. When this portion of the folding operation has taken place, the continued rotation of the shaft p will now begin to rotate the shaft p^6 and so cause the end folders p^8 to turn around with the shaft p^6 and fold the end pieces against the ends of the former. This mechanism, it is believed, will be understood from Figs. 11 and 12.

From the above description it will be understood that the end folders p^8 have in fact two parts, one the part farthest from the shaft p which only assists in turning down the side z^2 of the box, the other the part alongside of the shaft p^6 which turns the ends of the box. By this construction the means for folding the side z^2 is reduced in size after the side z^2 has been folded and the former with its offset rack rod K^4 is enabled to economize time in starting to carry the box into the pressing mechanism without waiting for the folders to be turned up out of the way. In fact it would be undesirable that they should let go their hold on the box until it had been carried pretty well between the pressers. These operations above described having been completed the next movement is the carrying of the box so folded with the former and follower up into the head of the machine where the box is pressed between pressers which are controlled by the screws R and R^1 , and are operated by means of a double rack R^2 on the end of a rod R^3 moved by a suitably shaped cam at the bottom of the machine. Pinions R^4 on the same shafts R, R^1 , engage the rack R^2 and get motion therefrom. These pressers are shown in Fig. 1 at R^5 . I do not describe this mechanism in detail as in view of the Patent No. 541,953, its operation will be readily understood.

After a slight dwell between the pressers the former drops into the position shown in Fig. 4, the follower leaving it at about the

position also therein shown. The box is stripped from the former as it passes through the table by engagement with plates upon the floor of the table A which are preferably ribbed as shown at a , and provided with an opening a^1 only sufficiently large to allow the former to pass down through them. The box being thus left upon the plates is ejected by the ejector J^1 upon the next forward movement of the grippers in pulling a new blank into position over the former.

It is believed from the above that the operation of this machine will be understood. At the same time, to prevent any misunderstanding it may be again stated as follows. The machine being at rest in approximately the position shown in Fig. 4, the first operation is the pushing of the lower blank out a short distance until its front edge projects say two inches or less, from under the pile of blanks, when its front edge will be within reach of the open gripper jaws, this pushing being accomplished by engagement between the pusher F^5 and the edge z^7 of the blank. Then the blank is gummed. This is accomplished by means of the gumming pieces which move out of the gum box and up against the under surface of the lower blank in the hopper and adjust themselves to the level of the under surface of the bottom blank. The gummers having retired the grippers now being closed pull the blank forward positively until it is in position to be clamped between the former and the follower, and this clamping having been effected the folding operation takes place, the ears z^1 having been folded almost simultaneously with the act of clamping, the side z^3 being folded next, the side z^2 last and with it the ends z^4 which are then turned about the ends of the former. The box is then pressed and the former is then withdrawn from it and it is left standing on the plates, to be moved out of the way upon the next advancement of the gripper by the ejector finger attached thereto. The various air channels in the former allow the air to fill the box freely as the former is withdrawn from it. They also serve to permit the free and rapid egress of air during the folding down of the sides z^2 and z^3 , thus allowing the blank to be closely folded against the former and prevent any buckling of any part of the blank. The value of this improvement for use in other machines of this character will be easily understood.

As it is sometimes desirable that the stroke of the grippers be adjusted while the machine is in operation, I prefer to so connect the rack bar G^{11} with the lever G^{12} that the pivotal connection between these two parts may be moved nearer to or farther from the cam roll by means of which these parts are

operated. Such connection is shown in detail in Fig. 6^A where the end of the cam lever G^{12} is forked to form ways between which the nut G^{14} slides. The lower end of the rack bar G^{11} is pivotally connected to the nut G^{14} . A cross piece G^{15} connects the prongs of the cam lever, and held within the cross piece G^{15} by suitable collars is an adjusting screw G^{16} which passes through the threaded opening in the nut G^{14} . By turning the screw the nut G^{14} with the end of the rack bar G^{11} may be moved nearer to or farther from the end of the cam lever G^{12} . It will be understood that a slight adjustment at this point is all that is necessary in the ordinary use of the machine. Such an adjustment is not ordinarily necessary but is very useful after the machine has been roughly adjusted to take a blank of given size after which it becomes necessary to adjust it more accurately while the machine is in operation in order that the effect of the new adjustment may be watched.

It is of course quite difficult to operate a machine as large as this by hand in order to adjust it, and for this reason I have shown a handle Q^5 by means of which the folding mechanism may be operated independently while the machine is at rest. This handle is pivoted to the frame of the machine at Q^6 as shown in dotted lines in Fig. 3, and its inner end is pivotally connected by the link Q^7 with the two part rod Q^3 so that by moving the handle the folders will operate. When the machine is at rest, therefore, the folders may be operated by this handle either to test any adjustment or for cleaning or to remove any waste which may have got into the machine. I have also shown the longer pasting piece in two sections, and have mounted each section upon a pivot so that it may rock slightly as occasion may require, as well as have a yielding motion against the supporting spring. These and various other details of the construction above described may be varied without departing from my invention.

What I claim as my invention is:

1. In a box making machine, in combination with a hopper and means for supporting blanks therein, a vertically reciprocating gummer and a blank feed, a blank delivery comprising a sliding frame carrying one or more pushers adapted to engage the rear edge of the lower blank and push it out of registration with said hopper and into registration with said gummer, as described.

2. In a box making machine, in combination with a hopper and means for supporting blanks therein, a vertically reciprocating gumming mechanism, a blank delivery and feeding mechanism comprising means for pushing the lower blank out of registration with said hopper and into registration with said gummer, and means operable after the

reciprocation of said gummer for conveying said blank clear from said hopper.

3. In a box making machine, in combination with a hopper and means for supporting blanks therein, a vertically reciprocating gumming mechanism, a blank delivery and feeding mechanism comprising means for pushing the lower blank out of registration with said hopper and into registration with said gummer, and means for holding said blank in place during the reciprocation of said gummer and thereafter conveying said blank clear from said hopper.

4. In a box making machine, in combination with a hopper and a folding mechanism comprising a former and a follower, a delivery mechanism whereby the lower blank in said hopper is pushed out of registration with the said hopper, a reciprocating gummer adapted to gum the blank after it has been so pushed out of registration, and a feeding mechanism comprising a pair of grippers adapted to receive and grip said blank and convey it to said folding mechanism, means for causing said former and follower to grip the blank, and means whereby said grippers are thereafter opened, as and for the purposes described.

5. In a box making machine, in combination with a hopper and a folding mechanism, a delivery mechanism whereby the lower blank in said hopper is pushed out of registration with said hopper, a gumming mechanism adapted to act upon said blank when so pushed out of registration and while the portion of the blank to be gummed is still in engagement with the other blanks of the hopper and a feeding mechanism comprising a pair of grippers adapted to receive and grip said blank and hold it stationary during the gumming operation and after it is gummed convey it to said folding mechanism, and means whereby said grippers are thereafter opened as and for the purposes set forth.

6. In a box making machine, in combination with a hopper and a folding mechanism, a delivery mechanism whereby the lower blank in said hopper is pushed out of registration with said hopper, a gumming mechanism adapted to act upon the under side of said blank when so pushed out of registration and while the portion of the blank to be gummed is still in engagement with the other blanks of the hopper and a feeding mechanism comprising a pair of grippers adapted to receive and grip said blank and hold it stationary during the gumming operation and after it is gummed convey it to said folding mechanism and means whereby said grippers are thereafter opened as and for the purposes set forth.

7. In a box making machine, in combination with a hopper, a delivery mechanism, a

reciprocating gumming mechanism and a feeding mechanism comprising grippers, said gumming mechanism being located in substantial alinement with said hopper, and the contents of said hopper serving as a platen against which said gummer presses the blank when gumming it and said feeding mechanism holding the blank during said gumming operation.

8. In a box making machine, in combination with a hopper, a delivery mechanism, a reciprocating gumming mechanism and a feeding mechanism, said gumming mechanism being in substantial alinement with said hopper, the contents of said hopper serving as a platen against which the gummer presses the blank when gumming it, and said feeding mechanism comprising one or more gripping jaws, means for opening said jaws positively while said jaws are at rest, and means for closing said jaws positively while said jaws are at rest, and means for moving said jaws from a receiving to a releasing position, all as and for the purposes set forth.

9. In a box making machine, in combination a delivery mechanism, a gumming mechanism and a feeding mechanism, and means for operating it, comprising a rack bar, a lever and a pivotal connection between said rack bar and said lever, and means for adjusting the position of said pivotal connection whereby the stroke of said rack bar may be changed, as set forth.

10. In a box making machine, in combination a rack carrying a gripper mechanism, means whereby said gripper mechanism is opened and closed positively to engage and release the blank, said opening and closing mechanism being located at different ends of the travel of said grippers, and a box ejector mechanism also connected with said rack, and located with relation to said grippers, as described, whereby a finished box will be ejected during the movement of a fresh blank toward the forming mechanism, and means whereby said rack is operated.

11. In a box making machine, a blank delivery, a gumming mechanism, a box-forming mechanism and a feeding mechanism comprising reciprocating grippers and means for opening them at one end of their movement and closing them at the other end thereof, comprising fingers suitably mounted and means whereby they are moved to engage portions of said grippers, whereby said feeding mechanism will grip said blank when in position to be gummed and will release it when in position to be formed as and for the purposes set forth.

12. In a box making machine, a reciprocating gumming mechanism and means for supporting the blank against the action of the gummer during the gumming operation,

a box forming mechanism comprising a former and a follower and a reciprocating feeding mechanism located between said gumming mechanism and said box forming mechanism and comprising gripping jaws and means whereby they are opened when at rest at one end of their movement, means whereby they are closed when at rest at the other end of their movement, and means whereby the blank is delivered to the gripping jaws when open operable just prior to the closing of said jaws and to the action of the gumming mechanism to gum the blank, as described.

13. In a box making machine, in combination with means for feeding a blank comprising grippers and means whereby they are reciprocated, a box folding mechanism comprising a former, means whereby it is reciprocated across the path of movement of the blank, a follower adapted to clamp a blank on top of said former, means adapted to be operated after said blank has been clamped to positively open said grippers and release the blank from the feeding mechanism, and means for so operating it all as and for the purposes set forth.

14. In combination with mechanism for gumming a blank, folding the blank against the former and pressing the blank when so folded to cause its gummed surfaces to unite a former having along the edge of one of its sides a strip approximating in thickness the thickness of the material to be folded against the other edge of the same side, whereby the folding mechanism during the operation of folding one or more portions of a box blank against the said side of the former will be maintained in position parallel to the rest of said side, as described.

15. In combination with mechanism for gumming a blank, folding the blank against the former and pressing the blank when so folded to cause its gummed surfaces to unite a former having a thickened portion along an edge of two opposite sides, each located to compensate for a double thickness of material along the parallel edge of the same side, whereby any mechanism adapted to press the blank against the former will engage parallel surfaces on opposite sides thereof composed in part of said thickened portion of the former and in part of the thickness of the blank.

16. In a box making machine, in combination with mechanism for folding a blank upon a former and mechanism for pressing said blank when so folded a former provided with grooves adapted to register with the gummed edge of the blank to be folded thereon, whereby gum pressed from the overlapping edges of the box folded thereon will not engage with the surface of said former.

17. In a box making machine, a reciprocating former, a follower adapted to engage therewith, and clamp the blank thereon, and oscillating means mounted on said follower whereby portions of said blank will be folded against said former, and means carried by said follower to operate said folding means as described.

18. In a box making machine, in combination with a blank feed, a reciprocating former, a follower adapted to engage therewith, and clamp the blank thereon, and oscillating means mounted on said follower whereby portions of said blank will be folded against said former, and means carried by said follower to operate said folding means as described.

19. In a box making machine, in combination with a former, a follower adapted to clamp the blank against said former, means whereby portions of said blank may be turned down against said former, said means being mounted upon said follower and comprising a shaft carrying at each end folding arms and means whereby said shaft is rocked.

20. In a box making machine, in combination with a former, a follower, a rack bar, and means whereby said rack bar is reciprocated, said follower being mounted on the end of said rack bar, a shaft mounted within said rack bar, a countershaft mounted near the end of said rack bar and above said follower, suitable gears connecting said shafts, said counter shaft carrying folding mechanism and said vertical shaft being provided with suitable connections whereby it is rocked, as and for the purposes described.

21. In a box making machine, in combination a former, and a follower, and means whereby each is reciprocated, comprising a single cam and connections between said cam and said follower and former respectively, whereby said follower is given a shorter reciprocation than the former, as and for the purposes set forth.

22. In a box making machine, a former, a cam, and means positively connecting said former and said cam, whereby said former will be reciprocated positively, a follower connected with said cam and means whereby a portion only of the throw of said cam will operate said follower, as and for the purposes described.

23. In a box making machine, in combination with a former, a follower adapted to clamp a blank upon the top of said former, a cam and means whereby it is caused to operate both follower and former, and give to said follower a restricted movement with relation to said former, said means comprising a rock shaft and means for connecting said cam with said rock shaft, a friction clutch mounted on said rock shaft, one portion of said clutch being keyed to said shaft,

the other portion being free thereon, and means connecting said free portion of said clutch with said follower, whereby the rocking of said free portion of said clutch will
5 actuate said follower, as set forth.

24. In a box making machine, a follower, and a former, and means whereby each is given a movement from the same source of power, but different in extent, comprising a
10 rock shaft, and means whereby it is oper-

ated, said rock shaft carrying a cam disk and a friction mechanism free to turn thereon, and adapted to be temporarily connected therewith, and turn therewith during the engagement of said cam ring with said frictional mechanism. 15

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Witnesses:

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