

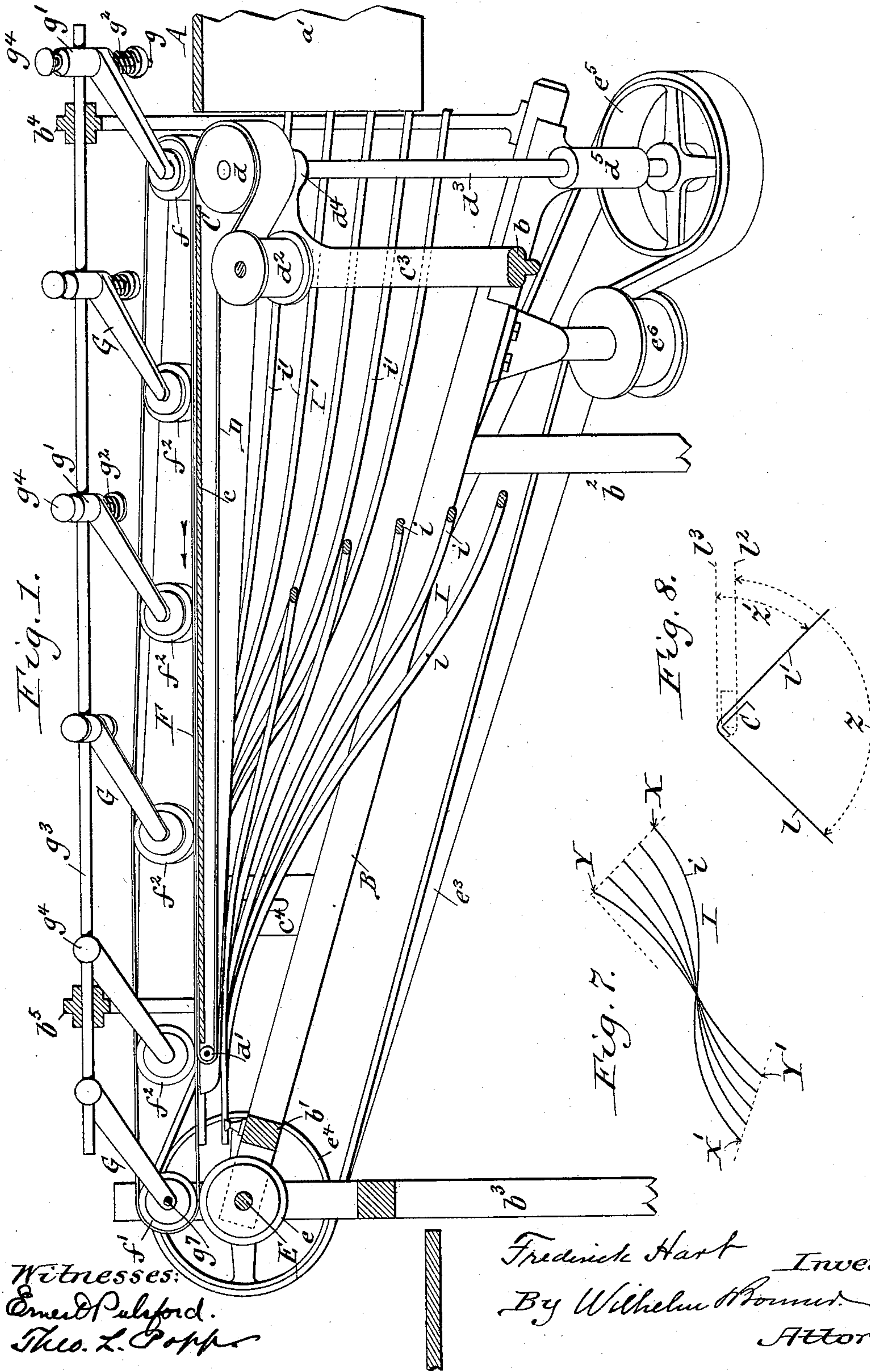
(No Model.)

3 Sheets—Sheet 1.

F. HART.  
FOLDING MACHINE.

No. 589,083.

Patented Aug. 31, 1897.



Witnesses:  
Emmet P. Lyford.  
Theo. L. Popp

Fredrick Hart Inventor.  
By Wilhelm Hornum.  
Attorneys

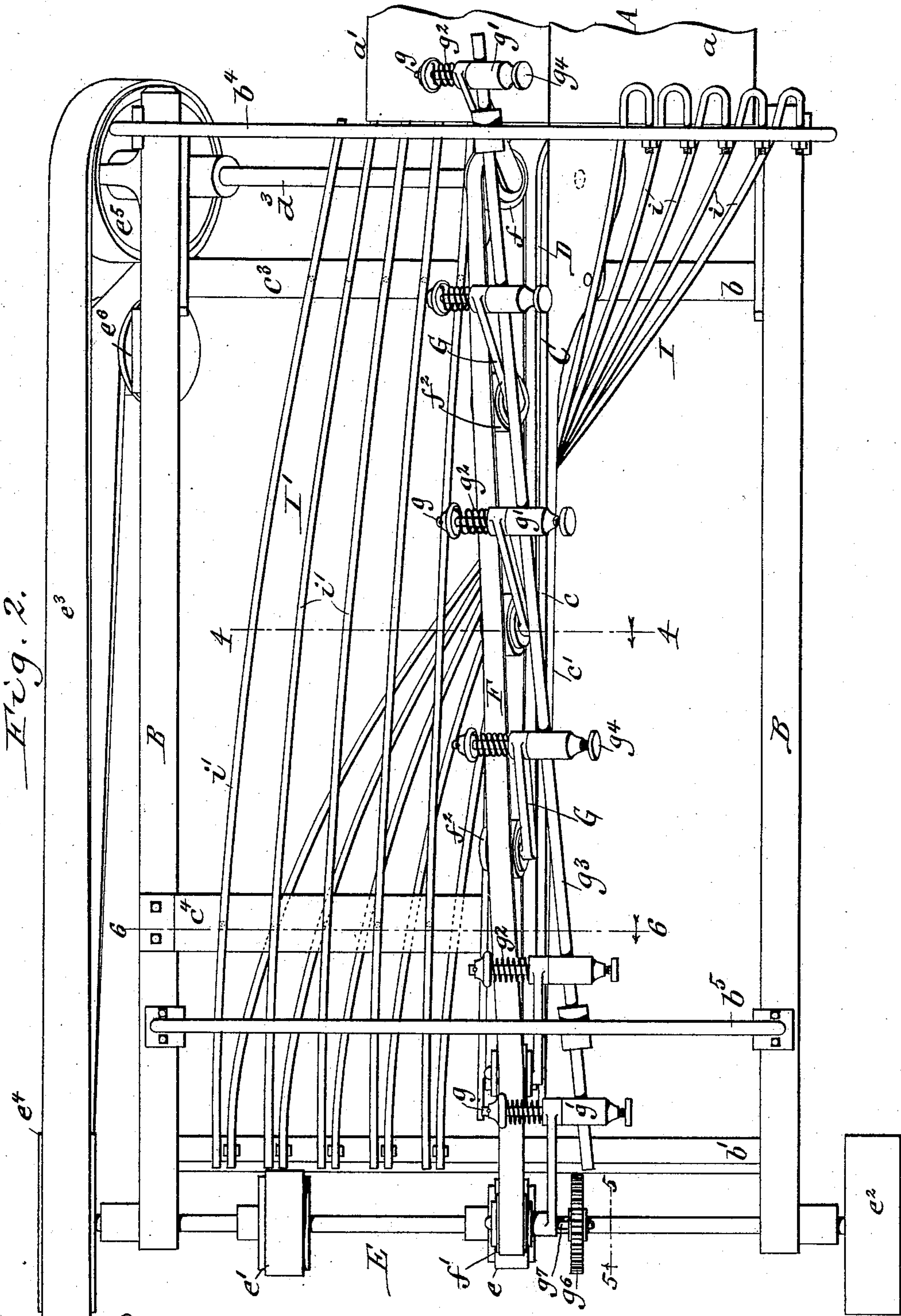
(No Model.)

3 Sheets—Sheet 2.

F. HART.  
FOLDING MACHINE.

No. 589,083.

Patented Aug. 31, 1897.



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FOLDING MACHINE.

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Fig. 4.

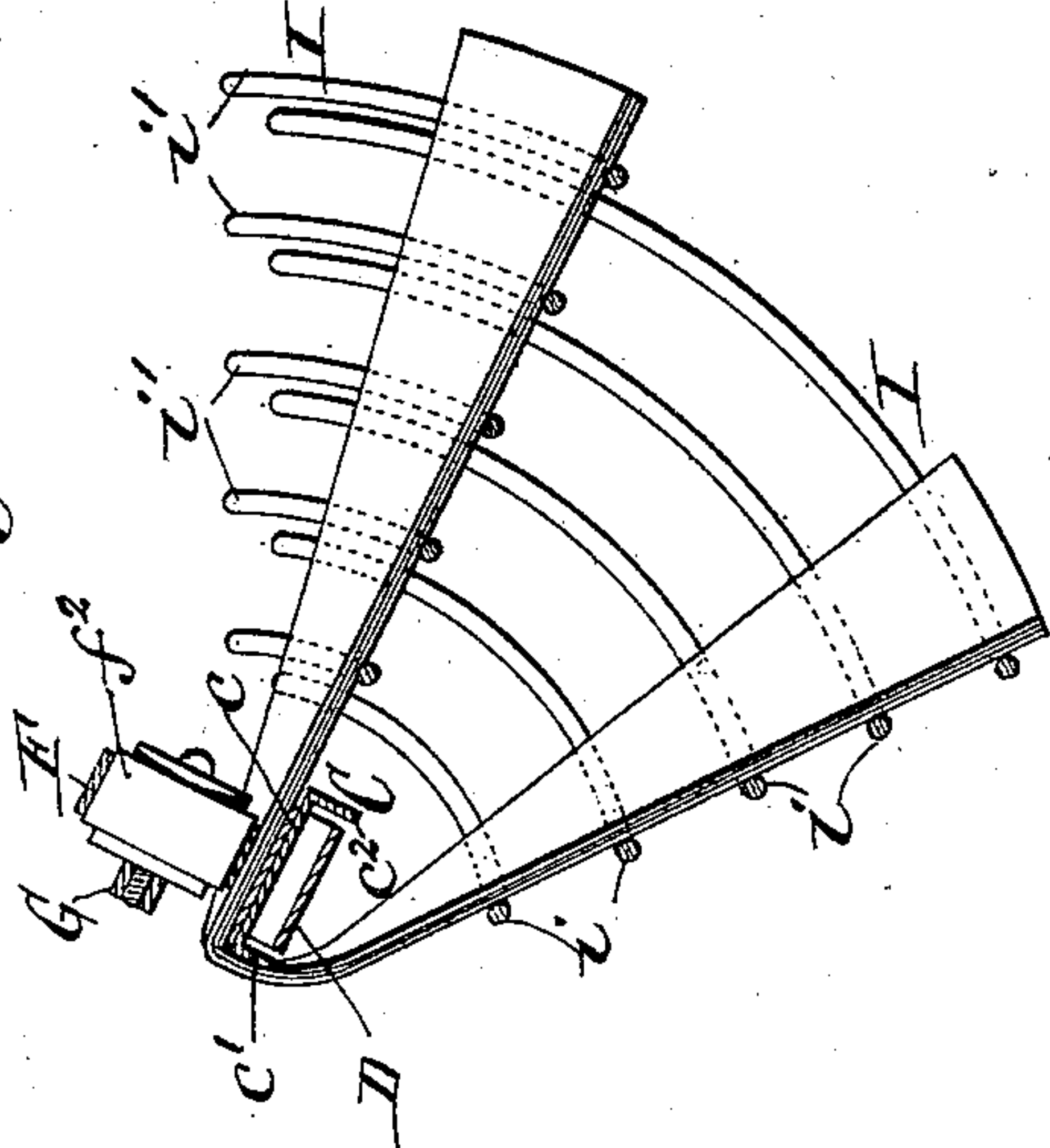


Fig. 6.

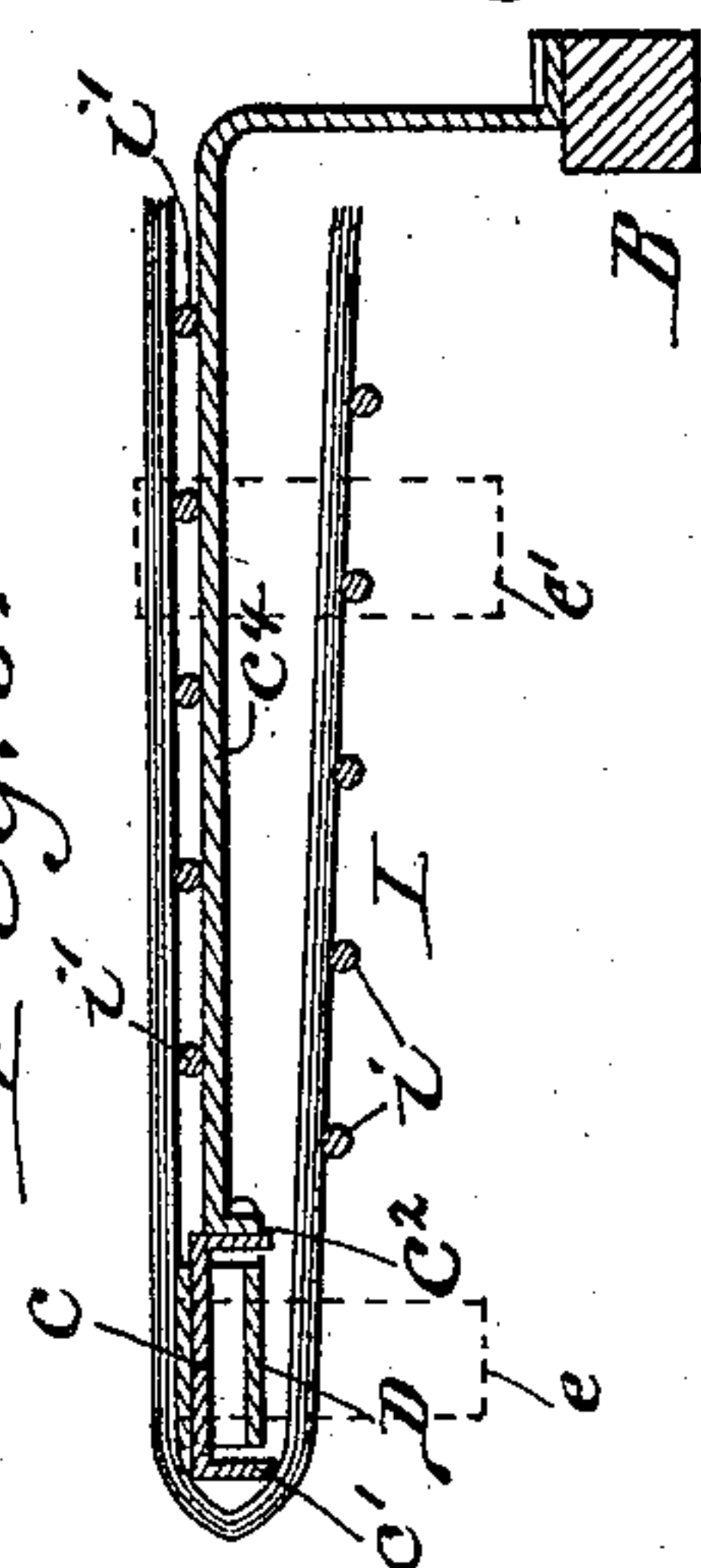


Fig. 3.

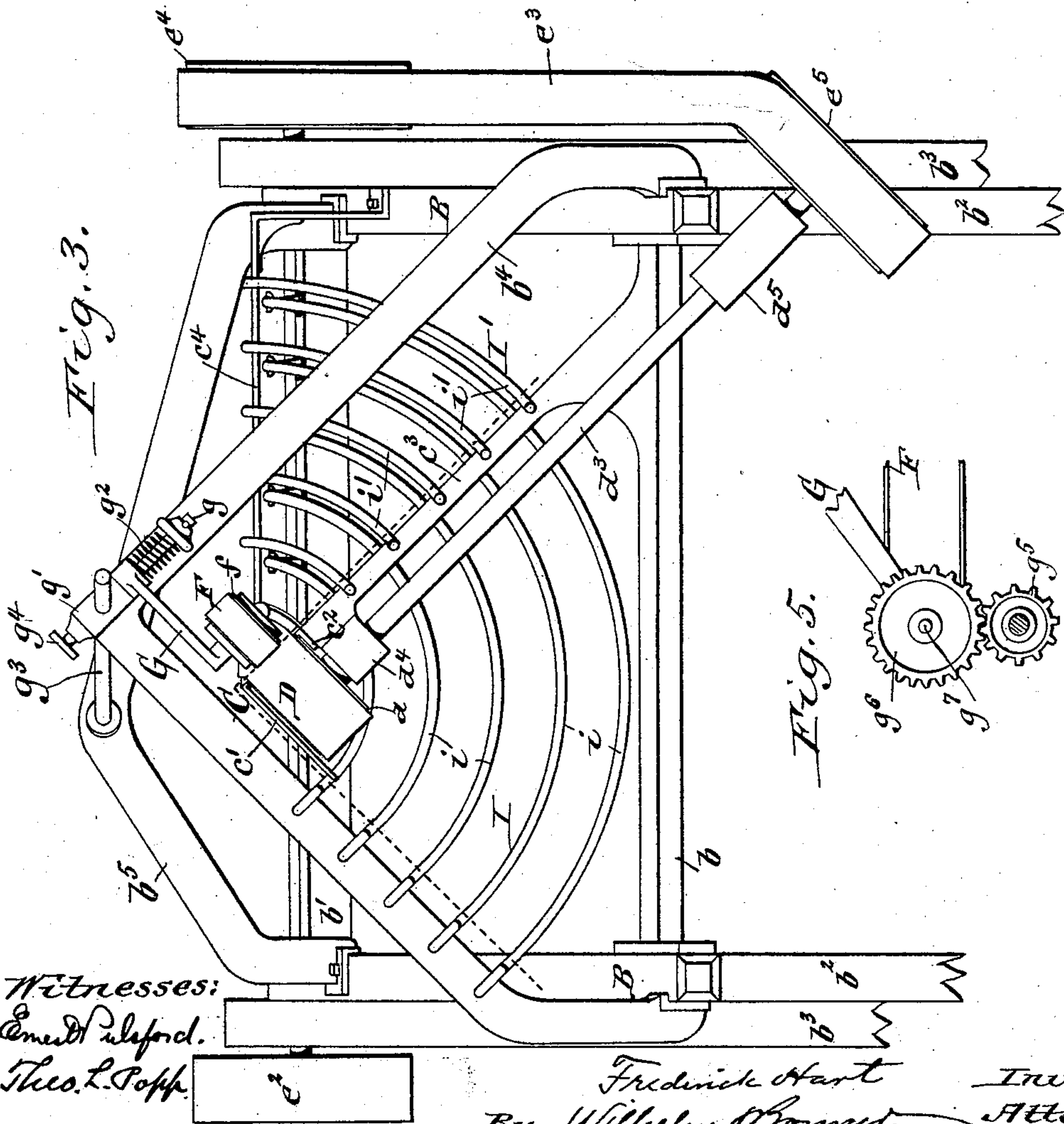
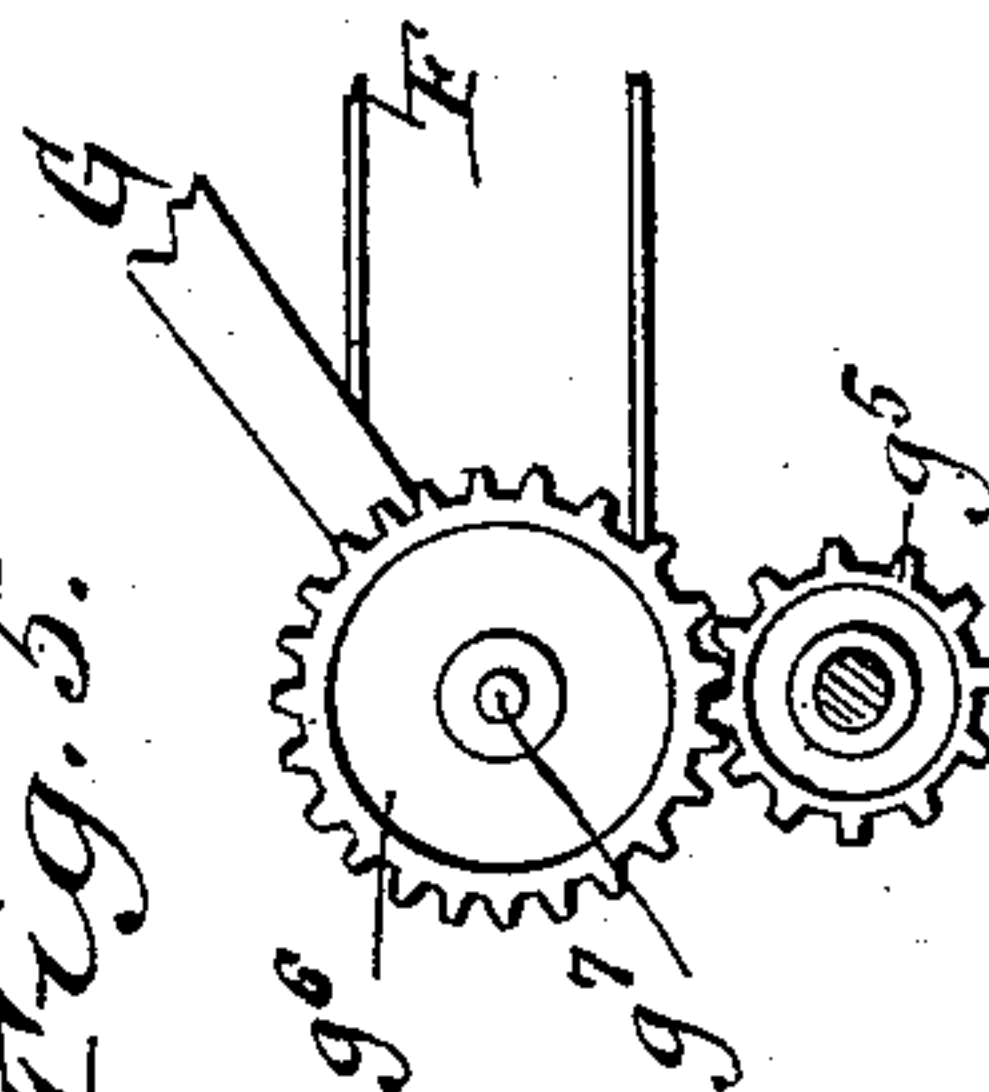


Fig. 5.



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# UNITED STATES PATENT OFFICE.

FREDERICK HART, OF POUGHKEEPSIE, NEW YORK.

## FOLDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 589,083, dated August 31, 1897.

Application filed October 2, 1896. Serial No. 607,654. (No model.)

*To all whom it may concern:*

Be it known that I, FREDERICK HART, a subject of the Queen of England, residing at Poughkeepsie, in the county of Dutchess, in the State of New York, have invented a new and useful Improvement in Folding-Machines, of which the following is a specification.

This invention relates to a folding-machine which is particularly designed for folding together or closing the flaps of blanks or pamphlets as the same are discharged from a stapling or stitching machine which fastens the leaves of the pamphlet together along the back or fold by a line of staples, stitches, or similar fastenings. The blanks or pamphlets are discharged from the saddles of these machines in such a way that the halves of each blank or pamphlet on opposite sides of the line of staples or stitches are spread apart, in which condition the blanks or pamphlets cannot be stacked or piled. It is now customary to close these stitched blanks or pamphlets by hand.

The object of this invention is the production of a machine whereby the pamphlets are automatically closed or folded, so that they can be readily collected or stacked in a pile.

In the accompanying drawings, consisting of three sheets, Figure 1 is a central longitudinal sectional elevation of my improved folding-machine. Fig. 2 is a top plan view of the same. Fig. 3 is a front elevation thereof. Fig. 4 is a cross-section in line 4 4, Fig. 2. Fig. 5 is a fragmentary longitudinal section in line 5 5, Fig. 2. Fig. 6 is a cross-section in line 6 6, Fig. 2, looking rearward. Fig. 7 is a diagram showing the form of the lower guide. Fig. 8 is a diagram illustrating the manner of closing the pamphlets.

Like letters of reference refer to like parts in the several figures.

A represents the saddle or inverted-V-shaped table of a stapling-machine, upon which the partly-folded pamphlets are placed so as to straddle the saddle and be fed past the stapling mechanism, which places a row of staples along the fold of the pamphlet, after which the pamphlets are discharged from the rear end of the saddle, the front and rear sides  $a a'$  of which are usually arranged at

an angle of forty-five degrees and inclined equally on opposite sides of its center.

The main frame of the folding-machine consists, essentially, of two longitudinal side bars B B, inclined so as to ascend from the receiving end to the delivery end of the machine, two cross-bars  $b b'$ , connecting, respectively, the front portions and the rear portions of these side bars, supporting-legs  $b^2 b^3$ , and two transverse angular bridges or supports  $b^4 b^5$ , secured, respectively, upon the front and rear portions of the longitudinal bars.

C represents a narrow longitudinal folding-table or guide-bar, to which the pamphlets are delivered from the stapling-saddle and over which the pamphlets are carried in the direction of the arrow in Fig. 1 during the operation of folding. This table, as shown in Figs. 3 and 4, has the form of an inverted channel, consisting of a web or body-plate  $c$  and depending upper and lower flanges  $c' c^2$ , arranged along the longitudinal edges of the web. The front or receiving end of this table is arranged adjacent to the delivery end of the stapling-saddle and has its web and its upper flange arranged at the same angle and in line with the two parts of the saddle, so as to form at that point practically a continuation of the saddle. This folding-table is twisted longitudinally from its front to its rear end in the form of a long spiral and to such an extent that the rear end of the web is horizontal and its flanges vertical, as shown in Fig. 6.

$c^3$  represents a front bracket, and  $c^4$  a rear bracket, whereby the front and rear ends of the folding-table are connected with the main frame and which are arranged on the lower or depressed side of the table. The front bracket is inclined substantially at the same angle as the front end of the web of the table and is secured at its lower end to the front cross-bar  $b$  of the main frame preferably by casting it in one piece therewith, while its upper end is connected with the lower flange of the web, as shown in Figs. 2 and 3. The rear bracket  $c^4$  is arranged horizontally or substantially so and secured with its inner end to the lower flange of the web and with its outer end to the adjacent longitudinal bar of the main frame, as shown in Figs. 2 and 6.



D represents the endless traveling tape whereby the pamphlets are carried along the folding-table and through the folding mechanism of the machine. This tape passes with its receiving portion around a receiving-roller  $d$ , arranged at the receiving end of the folding-table, thence forwardly over the spiral surface of the web of the table to the rear end thereof, thence downwardly around a delivery-roller  $d'$ , arranged at the delivery end of the table, thence downwardly and backwardly around a guide-roller  $d^2$  to the place of beginning. The receiving-roller  $d$  is arranged with its upper portion parallel and in line with the top of the web, as shown in Figs. 1 and 3, and is mounted on the upper end of an inclined shaft  $d^3$ , which is journaled in bearings  $d^4$   $d^5$ , arranged, respectively, on the front bracket  $c^3$  and the front cross-bar  $b$ . The delivery-roller  $d'$  is journaled transversely on the rear portion of the folding-table with its upper portion in line with the horizontal rear end of the web. The intermediate or guide roller  $d^2$  is journaled obliquely on the under side of the folding-table near the receiving-roller.

E represents the driving-shaft, which is journaled transversely in bearings on the rear portion of the main frame and which is provided with inner and outer discharge-rollers  $e$   $e'$ , respectively. The inner roller  $e$  is arranged in rear of the folding-table with the upper portion of its face in line, or nearly so, with the carrying-tape, as shown by dotted lines in Fig. 6 and in full lines in Figs. 1 and 2. The outer discharge-roller  $e'$  is arranged on that side of the inner roller toward which the front end of the folding-table inclines. Power is applied to the driving-shaft E by a driving-pulley  $e^2$  at one end of this shaft, and motion is transmitted from the latter to the front inclined shaft  $d^3$  by a belt  $e^3$ , passing around pulleys  $e^4$   $e^5$ , secured to these shafts, and around a guide-pulley  $e^6$ , journaled on the main frame.

F represents an upper presser-tape, whereby the pamphlet is pressed against the carrying-tape D and the inner discharge-roller  $e$  for compelling the pamphlet to move therewith. The presser-tape passes, with its receiving and delivery portions, around front and rear presser-rollers  $f$   $f'$ , which press the upper tape, respectively, against the receiving portion of the lower table and the upper portion of the inner discharge-roller  $e$ . The intermediate lower portion of the upper tape is pressed against the lower tape by intermediate presser-rollers  $f^2$ , and the returning portion of the upper tape passes over the intermediate presser-rollers, as represented in Figs. 1 and 2. The several presser-rollers are arranged at the proper angles to press the operative portions of both tapes flat against the web of the folding-table, the receiving and delivery rollers of the lower tape, and the inner discharge-roller. Each of the presser-rollers is yieldingly supported as follows:

G represents a rock-arm which pivotally supports one of the presser-rollers at its free outer end and which is pivoted at its inner end on a transverse pin  $g$ , arranged on a sleeve or bracket  $g'$ . The presser-roller is yieldingly held in a depressed position by a spring  $g^2$ , which surrounds the pivot-pin  $g$  and is secured with its ends to said arm and a thumb-piece on the pivot-pin.

$g^3$  is a longitudinal supporting-rod which is secured with its end portions to the transverse bridges of the main frame and upon which the supporting-sleeves of the several presser-rollers are adjustably secured by means of set-screws  $g^4$ , so as to be capable of longitudinal and transverse adjustment thereon. The upper tape may be positively driven at the same speed as the lower tape by means of intermeshing gear-wheels  $g^5$   $g^6$ , secured, respectively, to the main driving-shaft and the spindle  $g^7$  of the delivery-roller of the upper tape, as shown in Figs. 2 and 5.

If desired, the upper presser-tape and its driving gear-wheels  $g^5$   $g^6$  may be dispensed with, in which case the pamphlets would be pressed by the presser-rollers directly against the lower tape and the inner discharge-roller. A larger number of presser-rollers is preferably employed in this case, in order to properly control the movement of the pamphlets, which are comparatively short.

I represents a lower spiral or twisted guide, and I' a somewhat similar upper guide, whereby the two flaps of the blank or pamphlet are turned from the downwardly-diverging position in which they leave the stapling-table to a substantially horizontal position, in which position the pamphlet is delivered from the folding-machine, so that the pamphlets will readily stack themselves on a suitable receiving-board, platform, or lay-boy as fast as they are delivered. Each of these guides consists, preferably, of several bent or curved longitudinal rods, (marked  $i$   $i'$ ,) respectively arranged side by side to form a twisted or spiral guide, as shown.

I prefer to construct each guide of separate rods, because this construction renders the guides light and affords ready access to the different parts of the machine, so that any defect in the operation of the machine can be readily detected, but nevertheless each guide may be constructed of sheet metal, if desired.

The front ends of both guides I I' are arranged adjacent to the delivery end of the saddle of the stitching-machine, the front end of the lower guide I being inclined in line with the front portion of the saddle and the front portion of the upper guide I' being inclined in line with the rear portion of the saddle, which angles are usually about forty-five degrees from the horizontal.

The lower guide I begins at the front end of the folding-machine in the same oblique plane with the front portion of the saddle and extends toward the rear end of the folding-machine and toward the rear side thereof



with a spiral twist, so that this guide crosses underneath the folding-table to the opposite side of the folding-machine, as shown in Fig. 2, and then rises to a horizontal position, as shown in Figs. 1 to 4. The general form of this guide is indicated in the diagram Fig. 7, from which it will be seen that the lowest rod  $i$  of this guide starts at the lowest point X at the front end of the guide and terminates at the outermost point X' at the rear end of the guide, while its uppermost rod  $i$  starts at the highest point Y at the front end of the guide and terminates at the innermost point Y' of the rear end. This guide therefore has an angular twist of about one hundred and thirty-five degrees or three-eighths of a turn.

The upper guide I' begins at the front end of the folding-machine in the same oblique plane with the rear portion of the saddle and extends rearwardly on the same side of the machine with a spiral twist of about forty-five degrees or one-eighth of a turn, and terminates at the rear end in a horizontal position slightly above the horizontal rear end of the lower guide I, as shown in Figs. 2 and 6.

The front portions of the rods composing the lower guide I are bent outwardly, so as to direct the lower or front flaps of the pamphlets upon the inner side of the lower guide, and the front ends of these rods are secured to the front member of the front bridge  $b^4$ . The rear ends of the rods of the lower guide are secured to the rear cross-bar  $b'$  of the main frame. The front ends of the rods of the upper guide I' are secured to the front bracket  $c^3$ , and the rear ends of these rods are secured to the rear bracket  $c^4$ .

As the blank or pamphlet leaves the stapling-saddle the two flaps of the pamphlet diverge downwardly from the fold along which the pamphlet has been stitched or stapled and the folded portion passes upon the front end of the folding-table. The portion of the rear flap which is adjacent to the fold enters between the lower carrying-tape and the upper presser-tape, or presser-roller, if no upper tape be used, and the pamphlet is seized by these parts and carried over the folding-table. During this movement of the pamphlet the front flap of the same comes in contact with the inner or rear side of the lower guide I at a greater or less distance in rear of the front end of the guide, according to the greater or less flexibility of the pamphlet, and in being drawn along this guide the front flap is raised and turned into a horizontal position. The rear flap of the pamphlet comes in contact with the rear side of the upper guide, whereby the rear flap is also turned and raised to a horizontal position. When both flaps have reached the rear ends of the guides, the pamphlet has been folded around the folding-table, which acts as a core or mandrel for sustaining the pamphlet and retaining the fold thereof in its proper position, as represented in Fig. 6. The manner in which both flaps of the pamphlet are turned into a

horizontal position is indicated in the diagram Fig. 8, in which the full lines  $l$   $l'$  show the position of the flaps on entering the folding-machine, the dotted lines  $l^2$   $l^3$  the horizontal position of both flaps on leaving the machine, the arc  $z$  the angular movement of the front flap, and the arc  $z'$  that of the rear flap. When the folded blank emerges from the rear ends of the folding table and guides, it passes with its folded portion between the inner discharge-roller  $e$  and the overlying presser-tape and with its outer loose portion over the outer discharge-roller  $e'$ , whereby the pamphlet is delivered from the folding-machine in a horizontal folded position, so that the pamphlet can be stacked upon a suitable receiving-table or lay-boy which is arranged in rear of the machine for this purpose. The outer or free end of the front or lower flap has a tendency to lag behind as it leaves the lower guide, which would interfere with the proper piling of the pamphlets. This is overcome by making the outer discharge-roller  $e'$  somewhat larger in diameter than the inner roller  $e$ , whereby the peripheral speed of the outer roller is increased and the movement of the trailing or lagging outer portion of the lower flap is sufficiently accelerated to bring its front edge in line with that of the upper flap when the pamphlet is discharged.

The speed of the carrying mechanism of the folding-machine is preferably somewhat greater than the speed with which the blanks or pamphlets pass over the saddle of the stapling-machine, so as to enable the folding mechanism to take care of the product of the stapling-machine.

The principal function of the upper guide is to carry the upper flap over the rear bracket  $c^4$ , which supports the rear end of the folding-table. If the latter and the front support are made sufficiently rigid to enable this bracket to be dispensed with, the upper guide can be dispensed with either entirely or as to all that portion which extends rearwardly beyond the front bracket, in which case the upper flap is raised and turned into a horizontal position by the lower flap and the lower guide.

The frame of the machine is preferably so constructed that the end of the machine which is nearest the saddle A can be raised up out of the way when the stitching or stapling machine operates on flat work which does not require to be folded. In the machine shown in the drawings the side bars B of the frame are for this purpose hung at their rear ends on the shaft E, the front legs  $b^2$  are secured to the side bars B and rise and fall with the same, and the rear legs  $b^3$  are stationary and affixed to the floor or to some adjacent structure, such as the lay-boy, which receives the folded blanks.

I claim as my invention—

1. In a machine for closing folded blanks, the combination with a propelling mechanism which seizes each blank near its fold, of a



folding-guide having its receiving end arranged obliquely on one side of said propelling mechanism and extending from its receiving end underneath the propelling mechanism longitudinally and spirally to the opposite side thereof, substantially as set forth.

2. In a machine for closing folded blanks, the combination with a longitudinal folding bar or table, arranged to support on its upper side the upper flap of the folded blank, of a propelling-tape having its propelling portion arranged upon the upper side of said bar or table, and a folding-guide having its receiving end arranged on the under side of said bar or table to receive the lower flap of the blank and extending from its receiving end longitudinally and spirally to the opposite side of said propelling-tape, substantially as set forth.

3. In a machine for closing folded blanks, the combination with a propelling mechanism which seizes each blank near its fold, of a lower folding-guide having its receiving end arranged obliquely on one side of said propelling mechanism and extending from its receiving end underneath the propelling mechanism longitudinally and spirally to the opposite side thereof, and an upper twisted folding-guide arranged on the same side of the propelling mechanism on which the rear end of the lower folding-guide is arranged, substantially as set forth.

4. In a folding-machine, the combination with a longitudinal folding table or bar, and a blank-propelling mechanism, of a twisted folding-guide having its receiving end arranged obliquely below said table or bar and on one side thereof, and its delivery end arranged horizontally on the opposite side of said table or bar, substantially as set forth.

5. In a folding-machine, the combination with a longitudinal folding table or bar and a blank-propelling mechanism, of a twisted lower closing-guide having its receiving end arranged obliquely on one side of said table or bar and its delivery end horizontally on the opposite side thereof, and an upper twisted closing-guide having its horizontal discharge end arranged above that of the lower guide and its oblique receiving end arranged on the same side of said table or bar, substantially as set forth.

6. In a folding-machine, the combination with a twisted closing-guide, of a longitudinal folding table or bar having its receiving portion arranged obliquely and its delivery portion horizontally, of a blank-propelling tape having its upper propelling portion arranged upon said table or bar and means whereby the blanks are held down upon the tape, substantially as set forth.

7. In a folding-machine, the combination with a twisted closing-guide, of a twisted longitudinal folding table or bar, rollers arranged at the front and rear ends of said table or bar, a propelling-tape arranged with its upper carrying portion on said table or

bar and passing with its end portions around said rollers and means whereby the blanks are held down upon the tape, substantially as set forth.

8. In a folding-machine the combination with a twisted closing-guide, of a twisted longitudinal folding table or bar, rollers arranged at the front and rear ends of said table or bar, a propelling-tape arranged with its upper carrying portion on said table or bar and passing with its end portions around said rollers and presser-rollers whereby the blanks are held down upon the tape, substantially as set forth.

9. In a folding-machine, the combination with a twisted closing-guide, of a twisted longitudinal folding table or bar, rollers arranged at the front and rear ends of said table or bar, a propelling-tape arranged with its upper carrying portion on said table or bar and passing with its end portions around said rollers, presser-rollers whereby the blanks are held down upon the tape, rock-arms supporting the presser-rollers and springs whereby the presser-rollers are yieldingly held in a depressed position, substantially as set forth.

10. In a folding-machine, the combination with the twisted closing-guide, of a twisted longitudinal folding table or bar, a blank-propelling tape arranged with its upper carrying portion on said table or bar, and an upper presser-tape bearing with its lower portion against the upper portion of the lower tape, substantially as set forth.

11. In a folding-machine, the combination with the twisted closing-guide, of a twisted longitudinal folding table or bar, a blank-propelling tape arranged with its upper carrying portion on said table or bar, an upper presser-tape arranged above the lower tape and presser-rollers supporting the upper tape and pressing the lower portion of the latter against the upper portion of the lower tape, substantially as set forth.

12. In a folding-machine, the combination with the twisted closing-guide, of a twisted longitudinal folding-table, a blank-propelling tape arranged on said table, a discharge-roller arranged in rear of the folding-table and means whereby the blanks are held down on the tape and discharge-roller, substantially as set forth.

13. In a folding-machine, the combination with the main frame, the twisted longitudinal folding-table and the propelling mechanism whereby the blanks are carried over the table, of a lower guide extending in a curve or spiral from the front side of the receiving end of the table underneath the table to the opposite side of the rear end of the table, an upper guide extending in a curve or spiral from the rear side of the receiving end of the table to the rear end of the table on the same side and a bracket secured to the main frame and carrying the upper guide, substantially as set forth.



14. In a folding-machine, the combination  
with the twisted closing-guide, of a twisted  
longitudinal folding-table, a blank-propelling  
tape arranged on said table, an inner dis-  
5 charge-roller arranged in rear of the folding-  
table and an outer discharge-roller arranged  
in rear of the twisted guide and having a pe-  
ripheral speed greater than that of the inner  
discharge-roller, substantially as set forth.

10 15. In a folding-machine, the combination  
with the main frame, the twisted longitudinal  
folding-table and the propelling mechanism  
whereby the blanks are carried over the table,  
of a lower guide extending in a curve or spiral  
15 from the front side of the receiving end of the  
table underneath the table to the opposite  
side of the rear end of the table, an upper  
guide extending in a curve or spiral from the  
rear side of the receiving end of the table to  
20 the rear end of the table on the same side, a  
shaft journaled transversely on the rear por-  
tion of the main frame, an inner discharge-  
roller mounted on said shaft in rear of the

folding-table and an outer discharge-roller  
mounted on said shaft in rear of the guides 25  
and having a diameter greater than that of  
the inner discharge-roller, substantially as  
set forth.

16. In a folding-machine, the combination  
with a longitudinal folding table or bar, of a 30  
transverse bracket supporting the rear end  
of said table or bar, a lower closing-guide  
adapted to operate upon the lower flap of the  
blank and having its front end arranged on  
one side of said table or bar and extending 35  
rearwardly to the opposite side of said table  
or bar underneath said bracket, and an up-  
per closing-guide arranged in front of said  
bracket and adapted to carry the upper flap  
over said bracket, substantially as set forth. 40

Witness my hand this 28th day of Septem-  
ber, 1896.

FREDERICK HART.

Witnesses:

E. M. MEEKS,  
J. N. RUST.