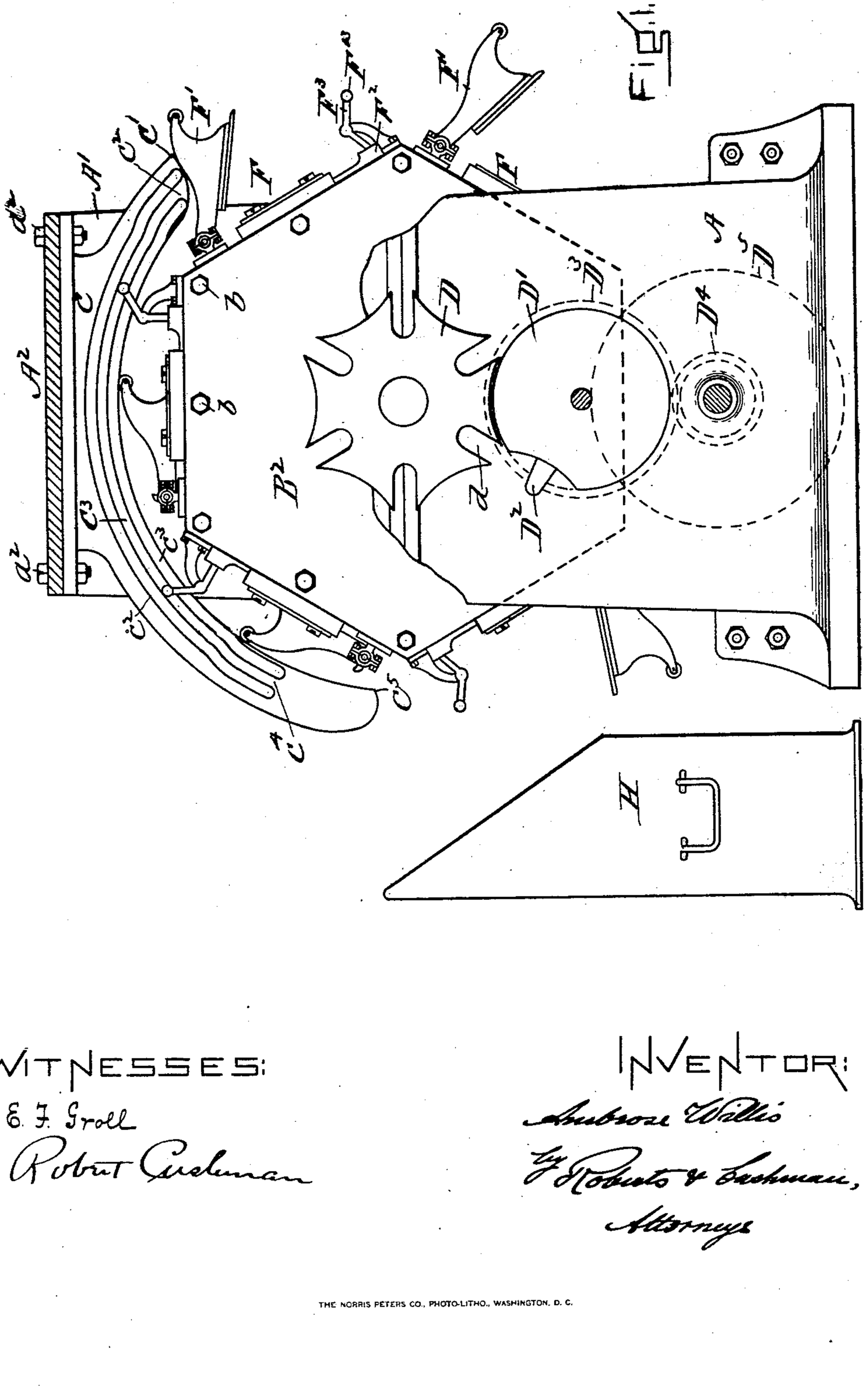
No. 677,301. Patented June 25, 1901.

A. WILLIS.

FOLDING MACHINE FOR COLLAR BLANKS, &c.

(Application filed June 6, 1900.)

(No Model.) 6 Sheets—Sheet 1.



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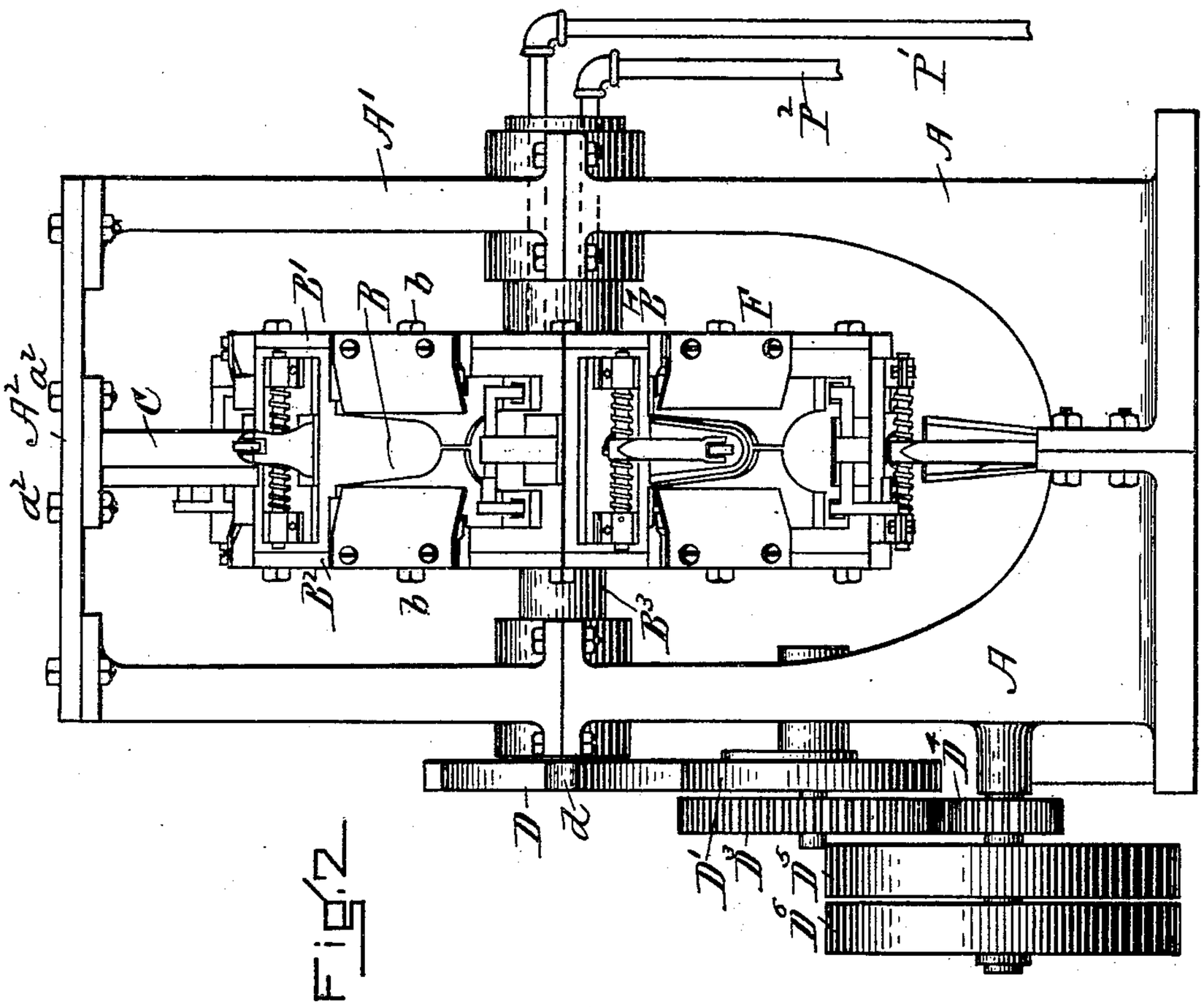

Fig. 2.

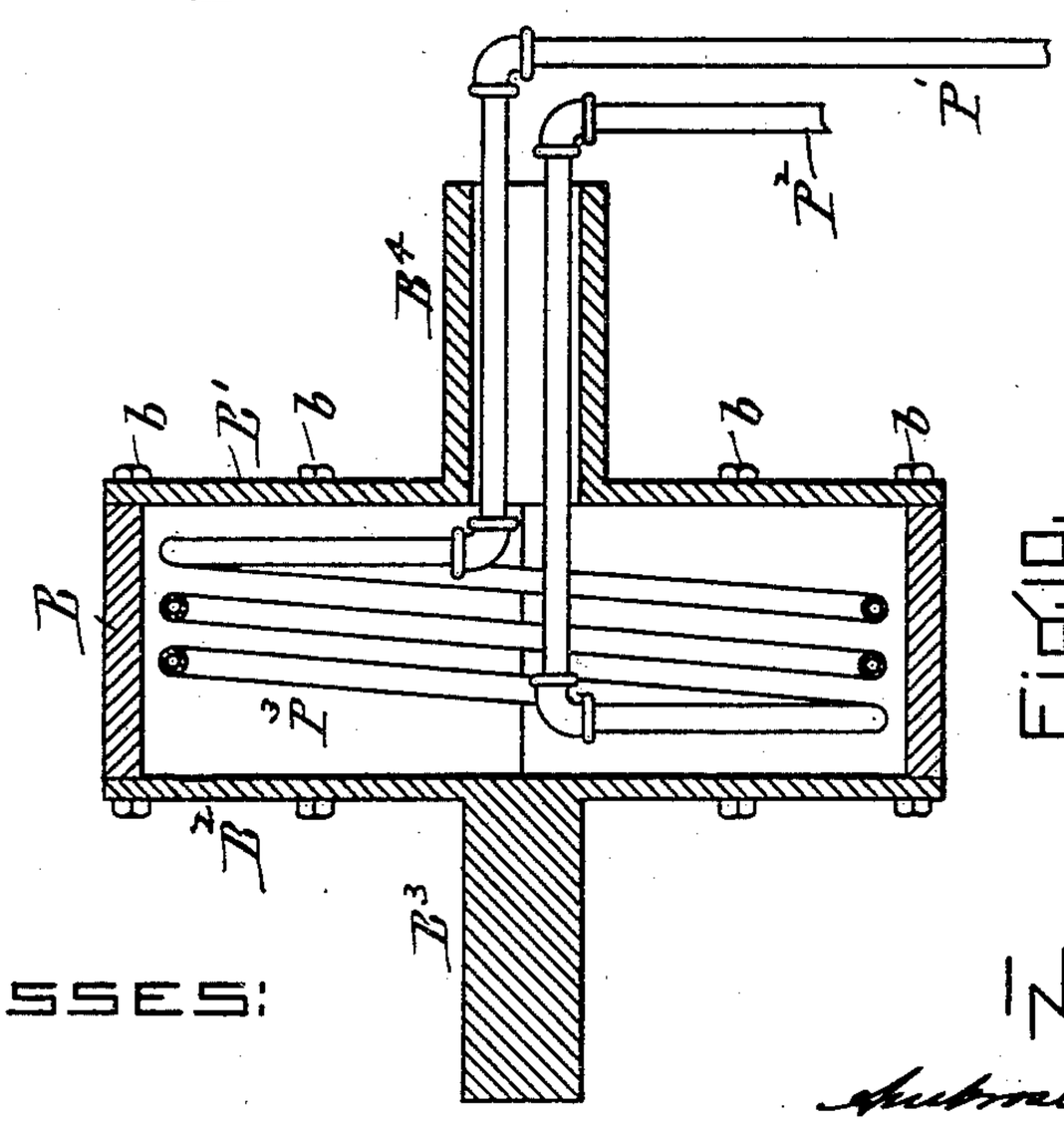

Fig. 10.

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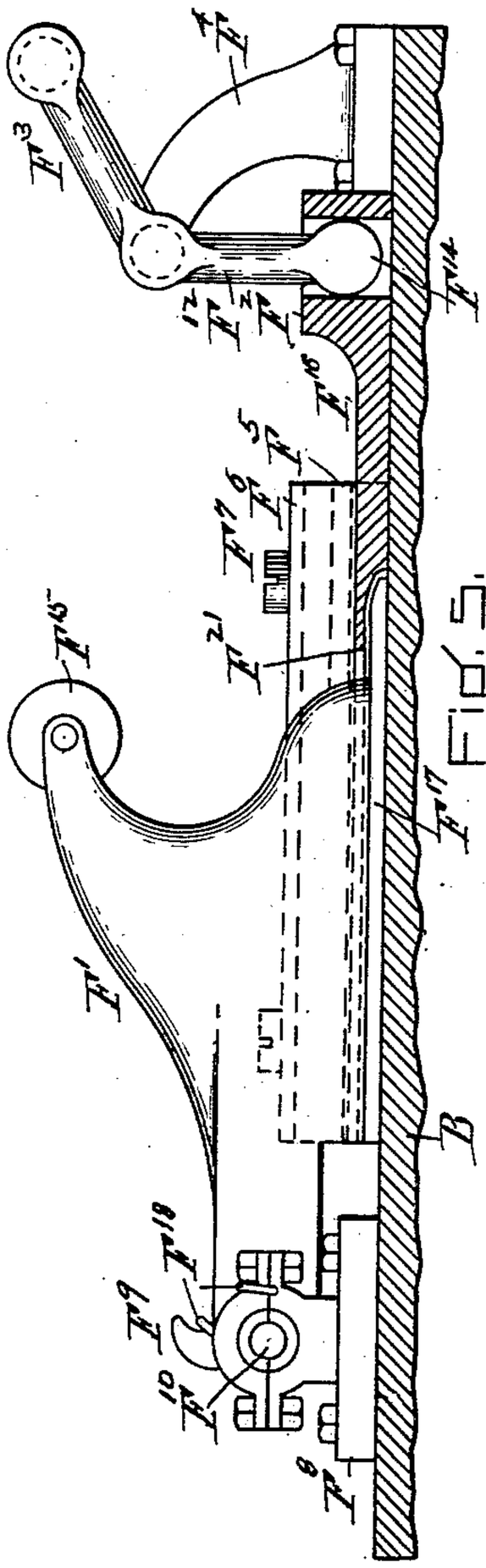

Fig. 5.

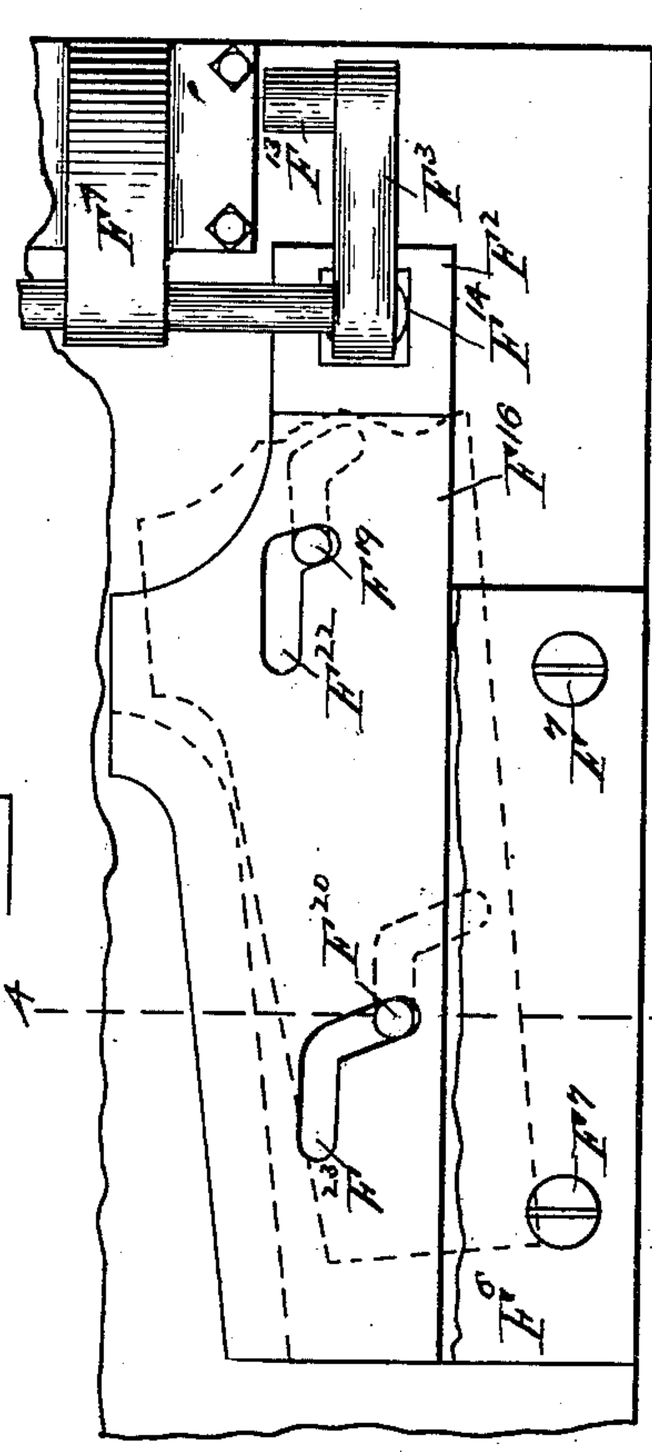

Fig. 3.

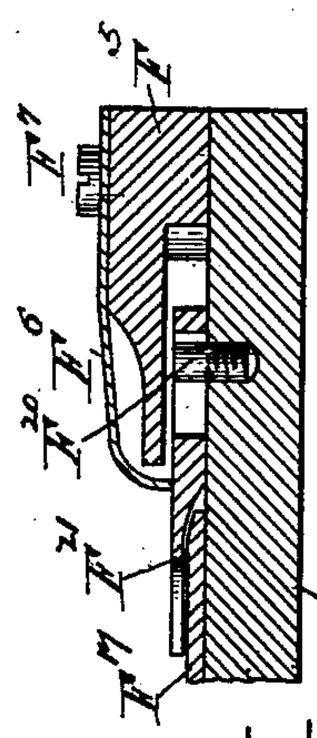

Fig. 4.

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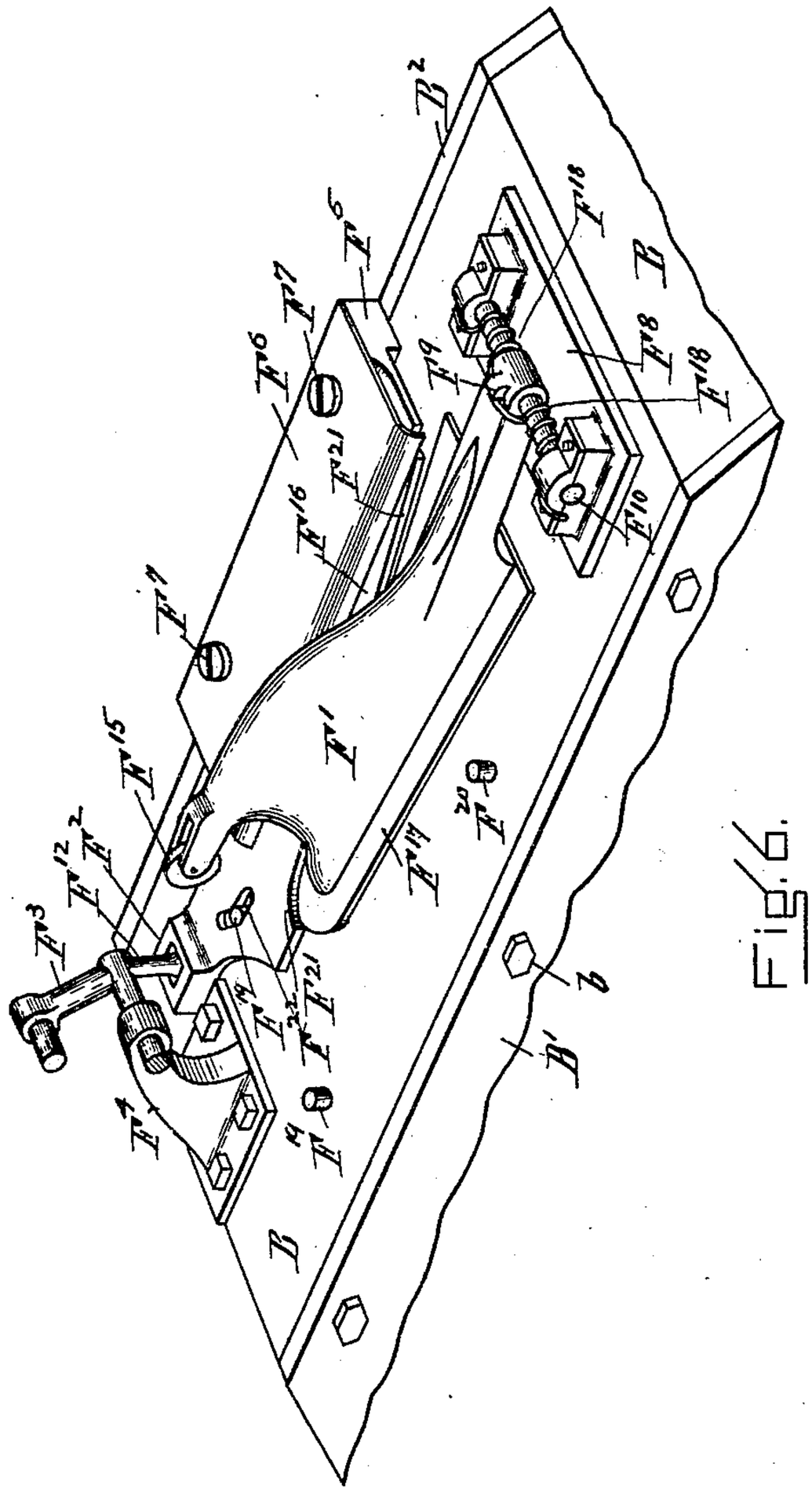

Fig. 6.

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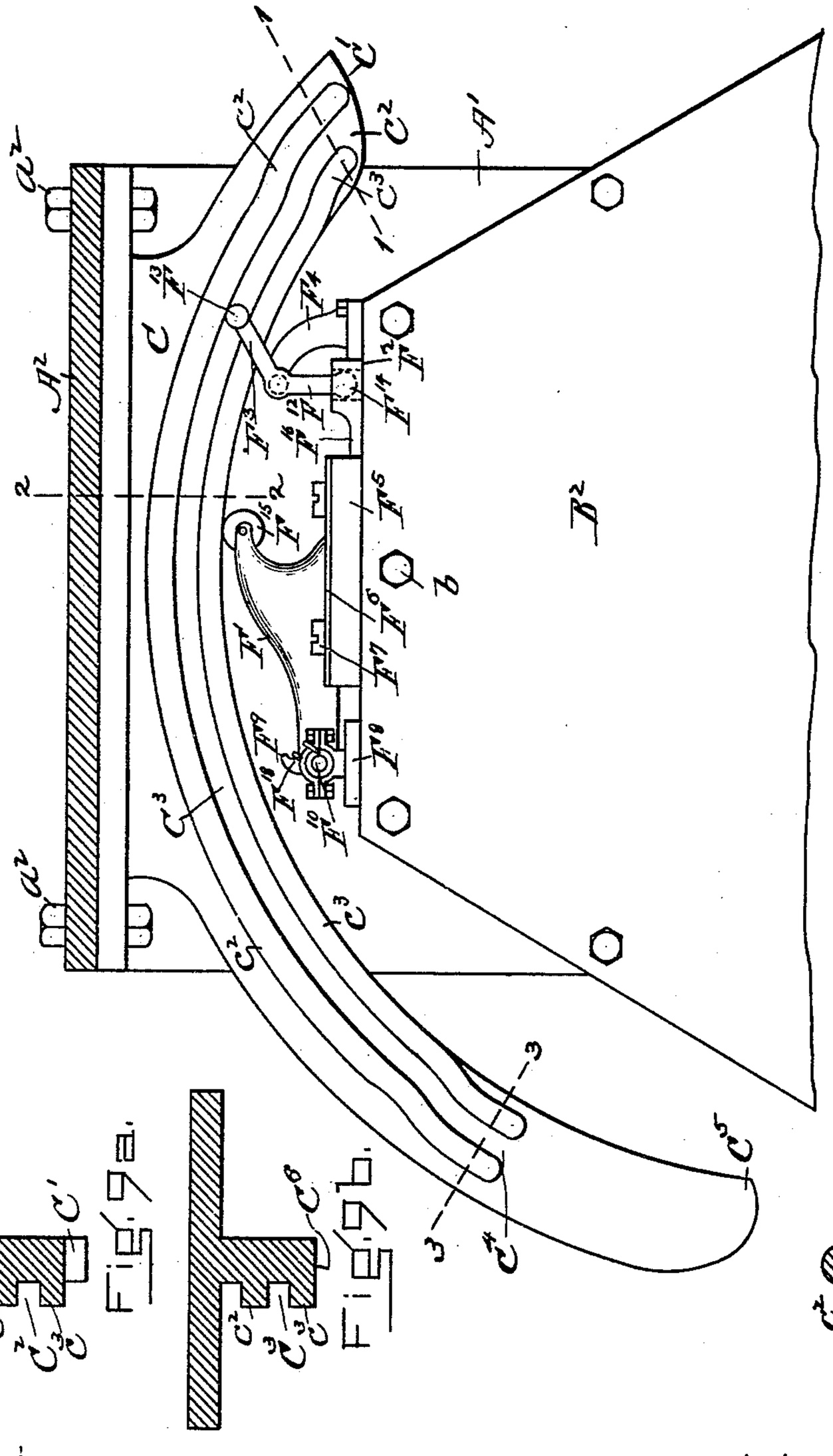

Fig. 7.

Fig. 7a.

Fig. 7b.

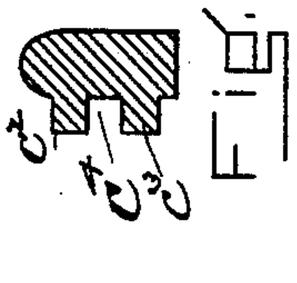

Fig. 7c.

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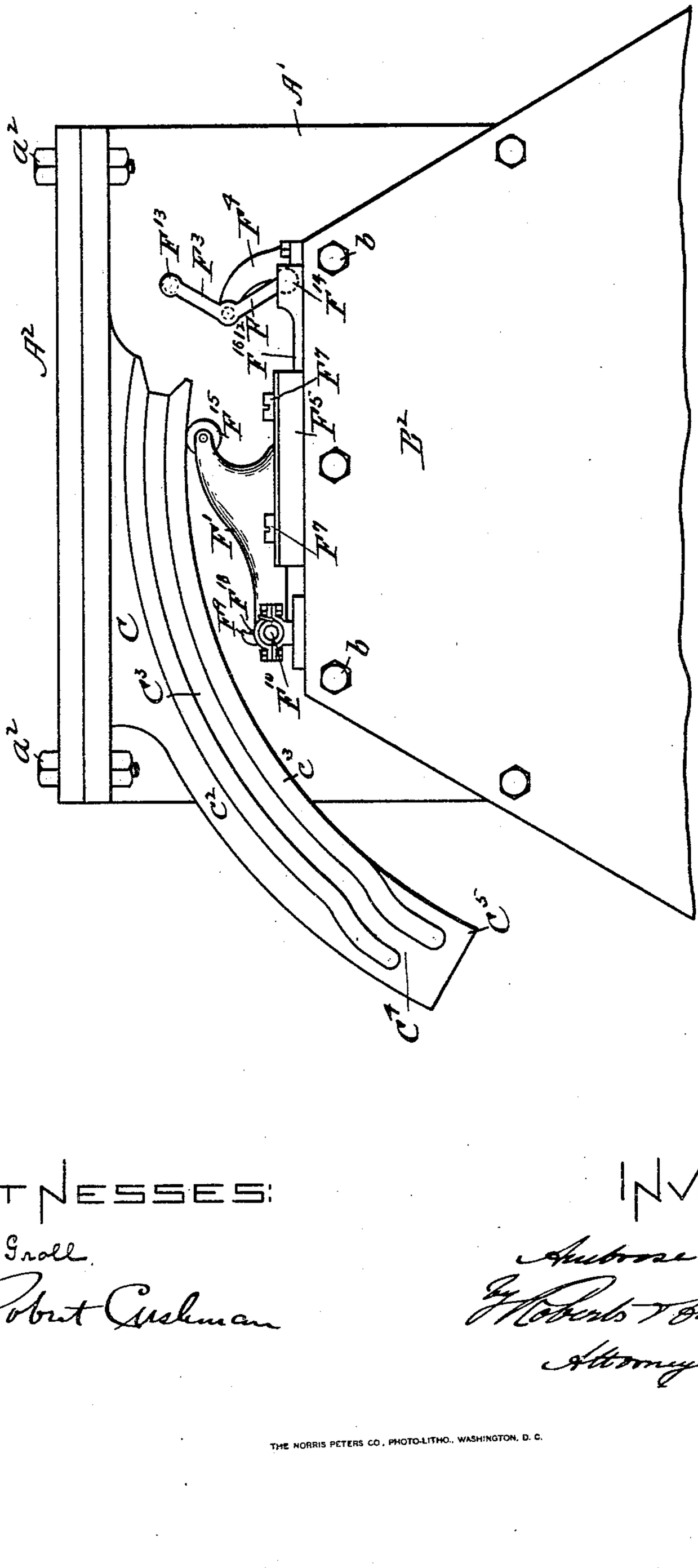

Fig. 6.

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UNITED STATES PATENT OFFICE.

AMBROSE WILLIS, OF TROY, NEW YORK, ASSIGNOR TO REECE FOLDING MACHINE COMPANY, OF BOSTON, MASSACHUSETTS.

FOLDING-MACHINE FOR COLLAR-BLANKS, &c.

SPECIFICATION forming part of Letters Patent No. 677,301, dated June 25, 1901.

Application filed June 6, 1900. Serial No. 19,216. (No model.)

To all whom it may concern:

Be it known that I, AMBROSE WILLIS, a citizen of the United States, residing at Troy, in the county of Renssalaer and State of New York, have invented a new and useful Improvement in Automatic Folding-Machines, of which the following is a specification.

My invention relates to automatic folding-machines such as are adapted to fold the edges of blanks for collars, cuffs, bindings, tabs, and the like; and the object of my invention is to facilitate and expedite the work of folding blanks and delivering them from the folding-machine. I employ for these purposes a movable bed upon which the folding mechanism or folding mechanisms are mounted. The movements of the bed cause the folding mechanism first to be presented to the operator in a convenient situation for him to apply the unfolded blank. Then the moving bed conveys the folding mechanism, with the blank placed thereon, into a position of operative relationship with devices which actuate the several movable parts of the folding mechanism to fold the blank, and then, after the folding has been completed, carries the folding mechanism to a further position, where the devices which have actuated the folders to fold the blank cease so to operate upon the folding mechanism and either cause the same to unfold or by cessation of positive action permit the folding mechanism to unfold. The blank is thereupon automatically removed from the machine and delivered to a suitable receptacle. The movements of the movable bed are such as to carry the folding mechanism through a cycle of movements, so that after the folding and automatic delivery of a blank have been accomplished the folding mechanism is again returned to position for the operator to apply another blank, when the cycle of movements is repeated. The movement of the bed enables me to employ the bed itself or a device which is mechanically associated with the movement of the bed to accomplish the folding and delivery of a blank by the aid of contrivances which are stationary with relation to the bed or which, if themselves movable, are mounted upon the frame of the machine, which is stationary with relation to the bed.

By employing a rotating bed I am enabled also conveniently to mount thereon a plurality or series of folding mechanisms, which may or may not be adapted to fold similar blanks, the said folding mechanisms being arranged upon the bed about its center of rotation. By giving either a constant or intermittent rotation to the bed always in one direction the folding mechanisms may be moved through a sector of coöperation with the folder-actuating devices and return successively to the point where the workman in charge of the machine applies the unfolded blanks.

In order to render the movements of this machine entirely automatic after the application of a blank, I prefer to arrange the devices which actuate the folding mechanism so that they cause the moving parts of each folding mechanism to fold the blank and then cause or permit the folding mechanism to unfold and deliver the blank from the machine, or I may construct a machine in which the movements of the folding mechanism to fold a blank are performed by the workman himself, the machine being relied on to release the folding mechanism and to deliver the blank automatically after it has remained folded a proper length of time.

The machine presently to be described comprises folding mechanisms which are carried upon a bed through the above-described cycle of operations and back to the workman who feeds work to the machine. Specific variations and departures from this mechanism may occur to the mechanic, but if adopted will not obviously alter the general character and capacity of my machine or depart from my invention. I may also, in order to serve the functional utilities contemplated by my invention, construct a machine wherein a number of hand-operated folding mechanisms disposed at intervals upon a moving bed are automatically brought in series back to the workman, who thus is enabled to remove folded blanks from the machine and insert others to be folded as fast as he is conveniently able to do the work, and nevertheless each blank will remain in the grasp of the folding mechanism long enough to set the crease firmly.

My invention is not restricted to any spe-

cific or peculiar kind of folding mechanism, and as folding mechanisms differ greatly in the complication of their parts I will for the sake of simplicity in describing my invention show it in connection with a comparatively simple folding mechanism.

The drawings annexed to this specification show an embodiment of my invention, and therein—

Figure 1 is a side view of a folding-machine with its frame partially broken away to show the working parts. Fig. 2 is a front elevation of the machine shown in Fig. 1. Fig. 3 is a detail showing one-half of a folding mechanism which is mounted on the machine. Fig. 4 is a section at the dotted line 4 4 in Fig. 3. Fig. 5 is a longitudinal elevation in part section of a folding mechanism. Fig. 6 is a perspective view of a folding mechanism with one of the blades of the infolder removed. Fig. 7 is a side elevation, on an enlarged scale, of part of the bed, a folding mechanism, and actuating devices for the folding mechanism. Fig. 8 is a view similar to Fig. 7, showing a modification of the folding-mechanism-actuating devices. Figs. 9^a, 9^b, and 9^c are sections of the folding-mechanism-actuating devices along the dotted lines 1 1, 2 2, and 3 3 in Fig. 7; and Fig. 10 is a sectional elevation of the movable bed, showing the manner in which it is heated.

The frame of the machine shown in Figs. 1 and 2 consists of a cast-iron base A, upon which the standards A′ are mounted by flange or other suitable connections. A top plate A^2 joins the upper ends of the standards A′ and serves to stiffen the frame, as well as to afford a suitable basis of attachment for some of the operating parts presently to be described. The bed upon which the blanks are folded consists in this instance of a drum or box mounted to rotate in bearings in the frame of the machine. The bed B itself is a symmetrical six-sided hollow prism, to which on either side is bolted a six-sided plate, the right-hand plate being marked B′ and the left-hand plate being marked B^2. Bolts *b* secure the hexagonal bed-plate B and side plates B′ B^2 firmly together. At the center of the side plate B^2 and integral therewith, if desired, the trunnion B^3 projects, and in the same central line the trunnion B^4 projects from the plate B′. Either or both these trunnions may be cast hollow, if desired, the opening, as shown in Fig. 10, serving for the admission of heating pipes to the interior of the bed. The bed itself is divided into six equal faces upon its periphery, and upon each of these faces there may be mounted a folding mechanism, as shown at F, Figs. 1 and 2. The workman is supposed to face the front of the machine, (shown in Fig. 2,) which is the right-hand side of the machine as shown in Fig. 1. The bed B rotates from below up toward the workman and is driven by suitable driving mechanism. (Shown in Figs. 1 and 2.) A practiced workman will be enabled to feed blanks to the rotating bed B without requiring any pause in its movement, but for the sake of giving the workman ample opportunity for accurately placing the blanks upon the bed of the machine I have applied a driving mechanism which gives the bed an intermittent movement always in the same direction. Keyed or otherwise secured to the trunnion B^3 there is a star-wheel D, intermittently actuated by the engagement of its notches *d* with the pin D^2 upon the pin-wheel D′, the pin-wheel D′ being regularly rotated by a train of gears D^3 D^4, which are driven by an ordinary driving-shaft, upon which are mounted fast and loose pulleys D^5 D^6. The engagement of the rim of the pin-wheel D′ with the faces of the star-wheel D in the well-known manner holds the rotating bed B perfectly still during the greater part of the rotation of the pin-wheel D′. Then when the pin D^2 engages one of the radial slots *d* the bed B is turned one-sixth of a complete revolution. The intermittent movement of the bed is made to correspond with the intervals or spaces between the folding mechanisms which are placed upon the bed. These intervals in the case described are angular spaces of sixty degrees. The rotation of the bed B is correspondingly an angular movement of sixty degrees at a time.

For purposes of illustration I show the bed B as provided with folding mechanisms which are adapted to receive, fold, and deliver a shirt-tab. Folding mechanisms adapted to fold other articles may be substituted for these with appropriate changes in the shape of the templet and folding-blades and in the mechanism for actuating the same.

Figs. 3, 4, 5, and 6 show in detail the tab-folding mechanism, which is less elaborately shown in Figs. 1, 2, 7, and 8. A templet F^{17}, consisting of a thin blade tapered to an edge, is secured to the pivoted templet-arm F′. This arm is secured to a pivoted shaft F^{10}, mounted in bearings on a suitable base-plate F^8, so that the templet may be moved down upon the bed B and lifted up therefrom. The trundle F^{15}, pivoted in the end of the templet-arm F′, serves as a cam-follower and coöperates with mechanism presently to be described. This templet F^{17} is given the proper outline so as to define the fold to be made in the tab. The infolder, whose blades coöperate with the templet F^{17} to make the infold in a tab-blank, consists of two blades F^{16}, corresponding in outline at their edges F^{21} with the outline of the templet F^{17}. These folding-blades F^{16} and their associated parts are made in pairs, and a description of one member of a pair will suffice for both. A cover-plate F^5 (shown in section in Fig. 4 and in perspective in Fig. 6) and a depressing-spring F^6 are firmly secured to the bed B above the folding-blade F^{16} by means of stout screws F^7. The cover-plate F^5 forms the upper member of a sliding bearing for the folding-blade F^{16}, the lower member being the

surface of the bed B. The pressure-spring F^6 overhangs the cover-plate F^5 and exerts a strong downward pressure upon the folding edge of the blades F^{16} whenever the latter are moved inward over the templet F^{17}. The proper movement of the blade F^{16} is secured by slots F^{22} F^{23} and pins F^{19} F^{20}. The pins are secured to the bed B, as shown in Fig. 6. The infolding-blade F^{16} is actuated to slide toward and from the templet F^{17} by means of a bell-crank lever, which has arms F^{12} F^3, and a rocking bearing in the bracket F^4. The lower arm F^{12} of this bell-crank lever is provided with a knob-shaped end F^{14}, which fits in the hollow block-shaped end F^3 of the infolder-blade F^{16}. When the bell-crank lever is rocked so as to move the infolder-blade toward the templet, the pins F^{19} F^{20} and slots F^{22} F^{23} give the infolder-blade the proper advancing and closing movement, so that the fold is made evenly over the entire edge of the templet. As the infolding-blade advances and closes the pressure-spring F^6 squeezes the infolder tightly over the templet and sets the fold in the blank. The infolders are so proportioned that when they are withdrawn from the templet their edges stand clear, so that the templet is released and free to move on its pivot away from the bed B so far as the infolders are concerned. The manner in which this movement is accomplished in this described embodiment of my invention is as follows: Near the pivot of the templet there projects a stop F^9, (see Figs. 5 and 6,) and a spring F^{18} is coiled around the short pivot-shaft F^{10} and hooked over the stop F^9 and also is secured to the base-plate F^8 in such manner that the spring constantly strains the templet away from the bed B. Therefore when the infolder has unfolded and its plates are withdrawn from over the templet-plate F^{17} the templet is free to respond to the stress of this spring F^{18} and will snap quickly up from the bed unless restrained by some other agency. When the templet flies up, the stop F^9 presently comes in contact with the plate F^8 and arrests the movement of the templet. This movement, however, is sufficiently abrupt to snap the folded blank off the templet-plate F^{17} and away from the machine, when it can be caught by a suitable receptacle, such as is shown at H, Fig. 1.

I will now describe a device whereby the folding mechanisms are actuated.

A crescent-shaped cam-plate C, Figs. 1, 2, 7, and 8, is secured to the machine-frame by bolts a^2. This cam-plate lies in the plane of rotation of the bed B and is centrally placed over the bed. The cams which are cut on this plate are shown in detail in Figs. 7, 8, 9^a, 9^b, and 9^c. One of the cams is a surface-cam and is shown beginning at C′. This cam lies directly in the path of the cam-follower F^{15}, which forms part of the templet-carrying device above described. Another cam cut in the cam-plate C is a path-cam, which begins at C^2 and continues through C^3 to C^4. This path-cam is formed between ribs or ridges c^2 c^3 and is adapted to receive a cam-follower F^{13}, which is secured to the arm F^3 of the bell-crank lever described in connection with the infolders. As the bed B rotates the templet-carrier F′, which has been released from the confinement of the infolder and subjected to the action of the spring F^{18} and stands up from the bed B, as shown at F′ in Fig. 1, passes into contact with the surface-cam at C′ on the cam-plate C. Further rotation of the bed draws the templet-carrier F′ under the projecting nose of the cam-plate C, and the cam-surface C′, operating in conjunction with the cam-follower F^{15}, depresses the templet until its plate F^{17} comes in contact with the bed B or with the tab-blank which has previously been placed in position on the bed by the workman. The rotary movement of the bed also brings the cam-follower F^{13} of the bell-crank lever into the entrance C^2 of the path-cam, which immediately after the descent of the templet rocks the bell-crank lever F^3 F^{12} and slides the infolder-blades in, around, and over the templet-blades by the movement above described in connection with the detailed description of the folding mechanism. Both the surface and path cams of the cam-plate now dwell until by the rotation of the bed B the cam-surface C^4 is reached by the cam-follower F^{13}. This cam-surface by an action the reverse of that of the cam C^2 unfolds the infolder-blades, and so far as they are concerned the templet is released.

In Fig. 7 I have shown the surface-cam which coöperates with the templet cam-follower F^{15} as prolonged to the point C^5, which is so located with reference to the outlet of the path-cam at C^4 that the depression of the templet by the cam continues until just after the infolder-cam C^4 has operated to unfold the infolder-blades. Then when the cam-follower F^{15} passes the point C^5 the spring F^{18} asserts itself and the templet snaps away from the bed B and throws the folded tab out of the machine and into the receptacle H. (Shown in Fig. 1.) Then the continued rotation of the bed brings this folding mechanism again before the workman, who places a tab again upon the bed in the right position for another operation.

Figs. 9^a, 9^b, and 9^c indicate in cross-section the shape of the cam-plate C at the points 1 1, 2 2, 3 3. (Shown in dotted lines in Fig. 7.)

The foregoing description of the operation of one folding mechanism applies to all the members of the series or group of folding mechanisms which are placed upon the bed B at intervals about its center of rotation.

As each folding mechanism comes up and faces the workman he places a blank upon the bed between the infolding-blades. The machine, as above described, takes care of all the remaining operations, automatically folding and delivering the blanks with the same regularity with which they enter into the ma-

chine. The fold in each blank is set by the mode of operation, which retains the infolding-blade in closed position over the templet for a few seconds before the infolding-blades are withdrawn and the templet released. The setting of the fold is also assisted by heating the bed and its connected parts, so that the blanks, which are usually slightly moist when placed in a folding-machine, are folded and dried under pressure. I have shown a convenient method of heating the machine by steam-pipes P′ P², which enter the hollow trunnion B⁴, Fig. 10, and are connected with the coil P³ inside the rotary bed B.

As above described, the machine is adapted to perform all the operations of folding and delivery automatically. This operation may be modified and a substantial and material part of my invention retained by so designing a machine that the workman is required to actuate the folding mechanisms to fold the blank, leaving the machine to deliver the blank automatically after it has been thus folded. Hand operation of the folders would hardly be necessary with so simple a folding operation as the tab-folder above described, but might conceivably be desirable with folding mechanism designed to fold other and more irregularly shaped blanks.

To illustrate the operation of my invention as applied merely to the automatic delivery of blanks, I have shown in Fig. 8 a device for actuating the folding mechanism for delivery of blanks from the machine, utilizing for purposes of description the same tab-folding mechanism which has already been illustrated. The cam-plate C in Fig. 8 is shorter than the one shown in Fig. 7 and is not provided with any folding-movement cams, such as C′ and C² in Fig. 7. Instead the templet and bell-crank-lever followers which have been depressed in the operation of closing the folding-machine by hand pass under and into the dwell-surfaces of the cams, which are effective only to hold the templet and folders until the delivery end is reached. The delivery end may be the same as that shown in Fig. 7 and described in connection therewith, or it may be as indicated in Fig. 8, where the point C⁵ is passed by the cam-follower F¹⁵ before the cam C⁴ lifts the follower F¹⁵ to withdraw the infolding-blades. In this case the withdrawal of the infolding-blades and the abrupt elevation of the templet will be simultaneous.

By the employment of this machine blanks can be folded and delivered from the machine as rapidly as the workman can place the blanks accurately upon the faces of the machine-bed.

In case it is not desired to have the folded blanks automatically delivered from the machine the cam-plate C and its cams may be dispensed with. The workman in charge of the machine then has the double duty of discharging the folded blanks as the folding mechanisms are successively presented to him and then of inserting a fresh blank, folding the templet and infolder upon it by hand. The machine would probably have to be run more slowly than when automatic folding or unfolding devices, or both, are employed. Nevertheless the movable bed, which returns each folding mechanism to the workman in succession, is in itself a useful improvement upon existing machines, for the reason that the workman is not delayed by having to wait for a folded blank to set before inserting another in the machine. He may work to his utmost capacity with my improved machine, and yet each blank will remain under the infolders while several others are being folded, so that when the blank is removed from the folding mechanism the creases are properly set.

What I claim, and desire to secure by Letters Patent, is—

1. In a folding-machine, the combination of a movable bed, a folding mechanism mounted thereon consisting of a movably-mounted templet and an infolder coöperating therewith, a spring connected with the templet in such manner as to strain the templet away from the bed, means for moving the infolder upon and away from the templet, and devices, movable with relation to the bed, whereby the infolder is withdrawn from the templet and the templet-spring permitted to snap the templet away from the bed.

2. In a folding-machine, the combination of a frame, a revolving bed mounted in the frame, a series of folding mechanisms mounted on the bed, each comprising a templet movable to and from the bed, a spring connected with the templet so as to strain the templet from the bed, and an infolder movable upon and from the templet, cams secured to the frame, cam-followers connected with the templets and infolders, respectively, and so disposed with relation to the cams that by the rotation of the bed the cams and cam-followers produce the following movements in succession, viz: close the templet upon the bed, move the infolders over the templet, and release the templet.

3. In a folding-machine, the combination of a frame, a movable bed mounted thereon, a plurality of folding mechanisms mounted on the bed, each comprising a templet movable to and from the bed, a spring connected with the templet so as to strain the templet away from the bed, an infolder, movable upon and from the templet and devices mounted on the frame whereby by the movement of the bed the following operations are successively performed by each folding mechanism, viz: close the templet upon the bed against the stress of the templet-spring, move the infolder over the templet and move the infolder off the templet.

4. In a folding-machine, the combination of a revolving bed, a plurality of folding mechanisms mounted on the revolving bed at intervals about its center of rotation means

whereby the folding mechanisms are successively automatically actuated to fold, then are held in folding position, means whereby the folding mechanisms are thereafter successively opened from folding position, and driving mechanism for the bed, whereby it is intermittently given a movement of rotation angularly equal to the spacing between the folding mechanisms.

5. In a folding-machine, the combination of a revolving bed, a plurality of folding mechanisms mounted on the bed at intervals about its center of rotation, each comprising a templet and an infolder, means controlled by the rotation of the bed whereby the folding mechanisms are automatically opened, and driving mechanism for the bed whereby it is intermittently given a movement of rotation angularly equal to the spacing between the folding mechanisms and is positively held motionless between the periods of rotation.

6. In a folding-machine, the combination of a frame, a movable bed mounted thereon, a plurality of folding mechanisms mounted on the bed, each comprising a templet movable to and from the bed, a spring connected with the templet so as to strain the templet away from the bed, an infolder movable upon and from the templet, driving mechanism for the bed, whereby it is intermittently given a movement substantially equal to the spacing between the folding mechanisms, and devices mounted on the frame whereby by the movement of the bed the following operations are successively performed by each folding mechanism viz: close the templet upon the bed against the stress of the templet-spring, move the infolder over the templet, move the infolder off the templet, and release the templet and its spring.

7. In a folding-machine, the combination of a frame, a revolving bed mounted in the frame, a series of folding mechanisms mounted on the bed at intervals about its center of rotation each comprising a templet, movable to and from the bed, and an infolder movable upon and from the templet, driving mechanism for the bed whereby it is intermittently given a movement of rotation angularly equal to the spacing between the folding mechanisms, cams secured to the frame, cam-followers connected with the templets and infolders, respectively, and so disposed with relation to the cams that by the rotation of the bed the cams and cam-followers produce the following movements in succession, viz: close the templet upon the bed, move the infolders off the templet, and release the templet.

8. In a folding-machine, the combination of a frame, a revolving bed mounted in the frame, a series of folding mechanisms mounted on the bed at intervals about its center of rotation, each comprising a templet movable to and from the bed, a spring connected with the templet so as to strain the templet from the bed, and an infolder movable upon and from the templet, driving mechanism for the bed whereby it is intermittently given a movement of rotation angularly equal to the spacing between the folding mechanisms, cams secured to the frame, cam-followers connected with the templets and infolders, respectively; and so disposed with relation to the cams that by the rotation of the bed the cams and cam-followers produce the following movements in succession, viz: close the templet move the infolders off the templet, and release the templet.

9. In a folding-machine, the combination of a frame, a revolving bed mounted in the frame, a series of folding mechanisms mounted on the bed at intervals about its center of rotation, each comprising a templet movable to and from the bed, an infolder movable upon and from the templet, and a spring whereby the infolder upon being moved upon the templet is pressed thereon, driving mechanism for the bed whereby it is intermittently given a movement of rotation angularly equal to the spacing between the folding mechanisms, cams secured to the frame, cam-followers connected with the templets and infolders, respectively, and so disposed with relation to the cams that by the rotation of the bed the cams and cam-followers produce the following movements in succession, viz: close the templet upon the bed, move the infolders over the templet, retain the infolders in folded position, and move the infolders off the templet.

Signed by me at Boston, Massachusetts, this 4th day of June, 1900.

AMBROSE WILLIS.

Witnesses:
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