

W. H. & J. Milliken. Sheet 1. 2 Sheets.
Paper Folding Mach.

N^o 574
31578.

Patented Feb. 26. 1861.

Fig. 1.

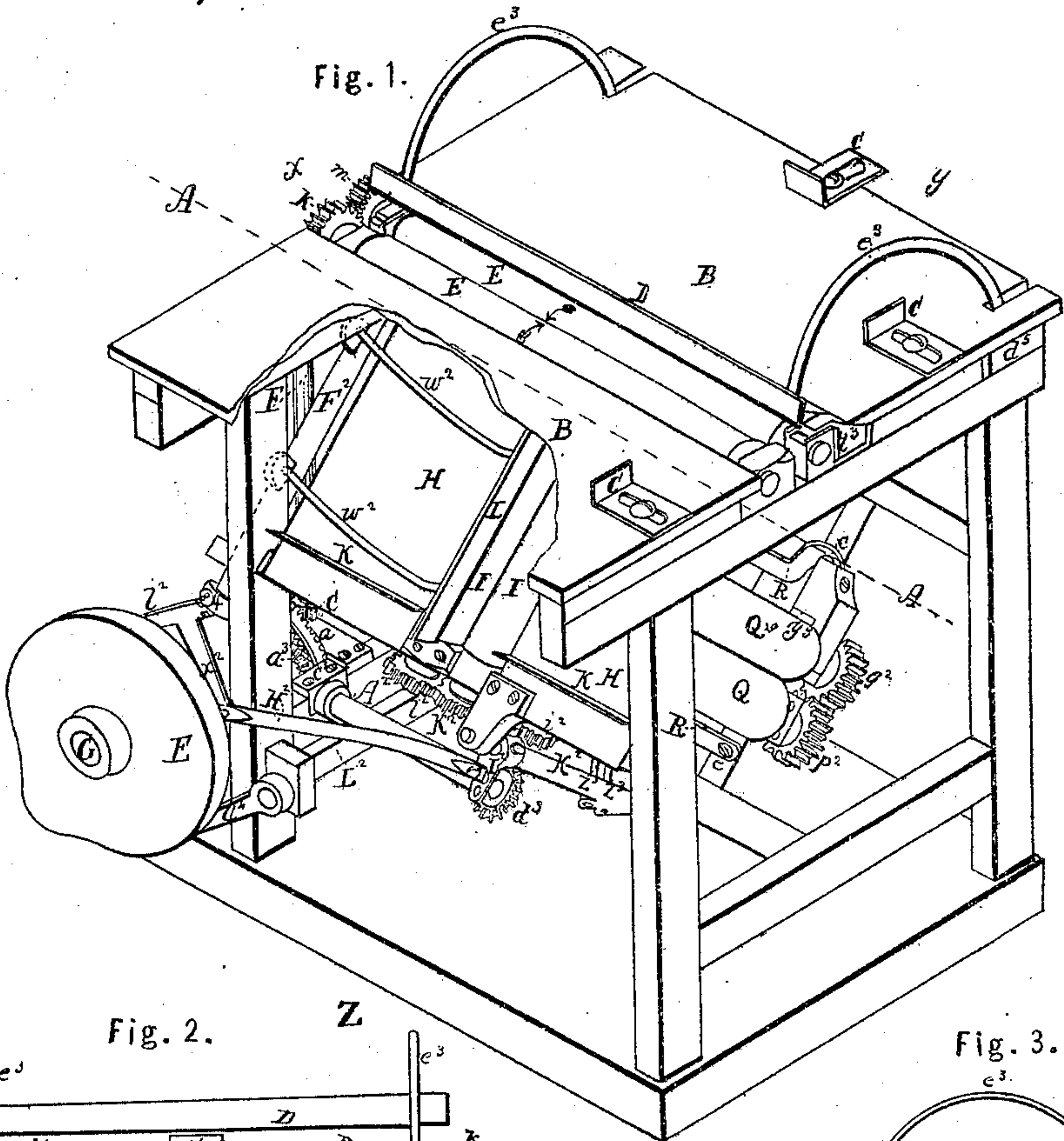


Fig. 2.

Z

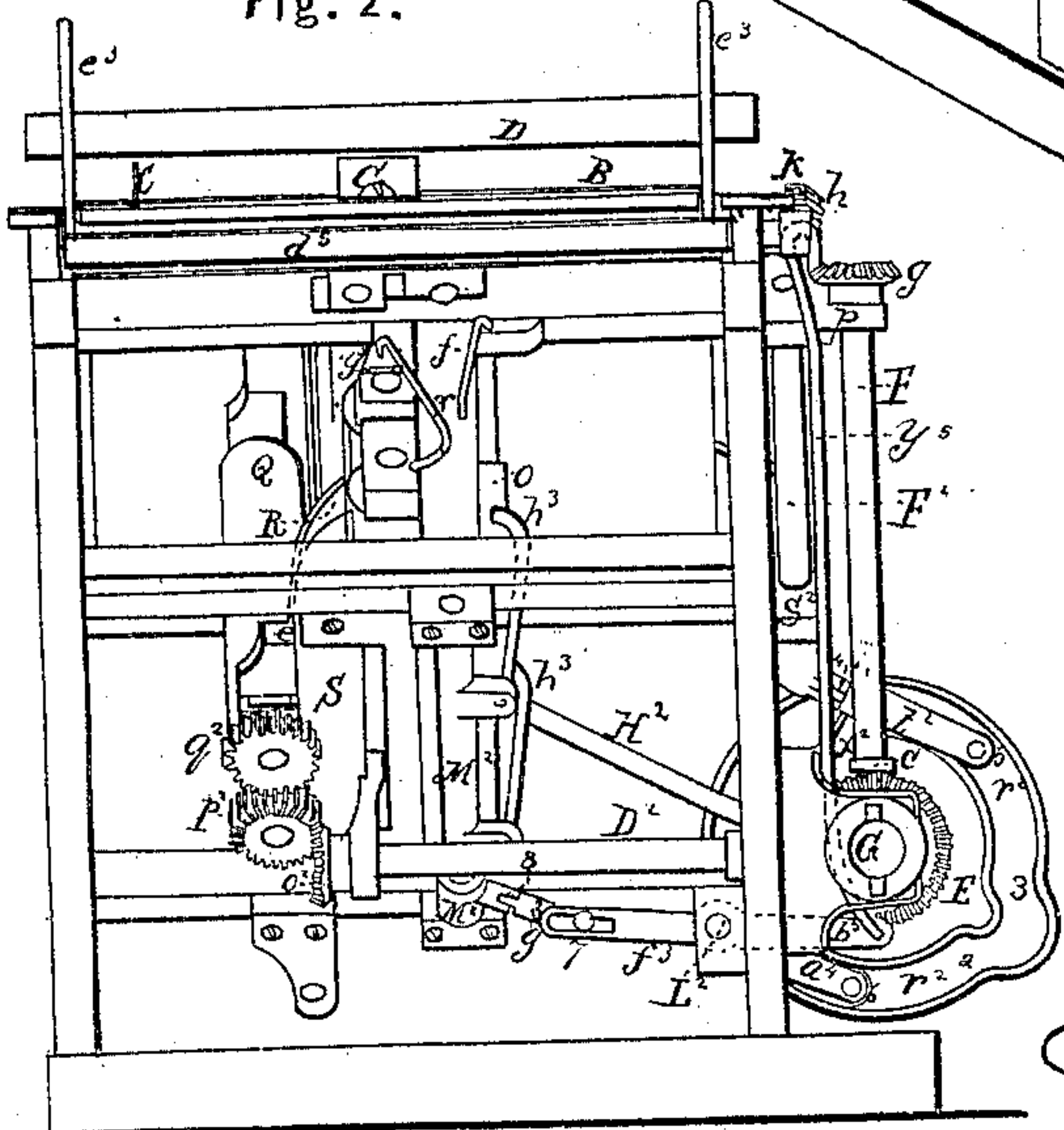
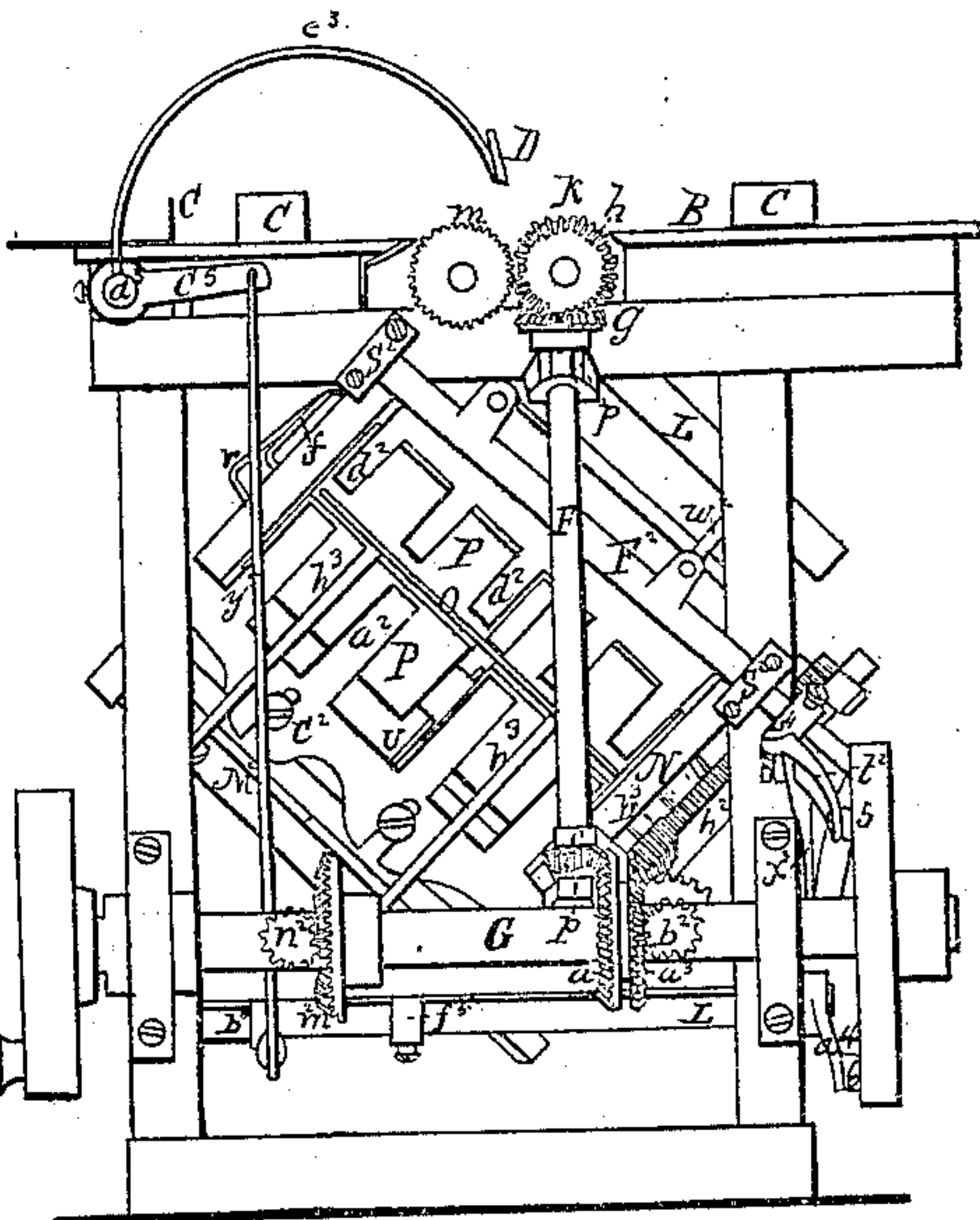


Fig. 3.



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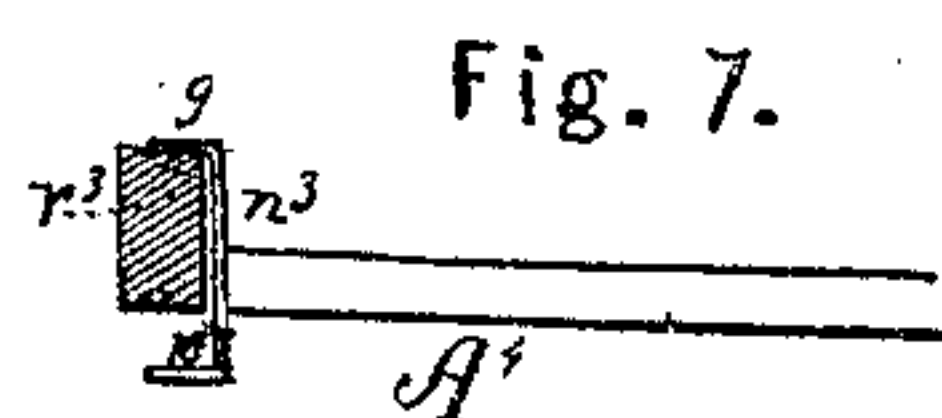
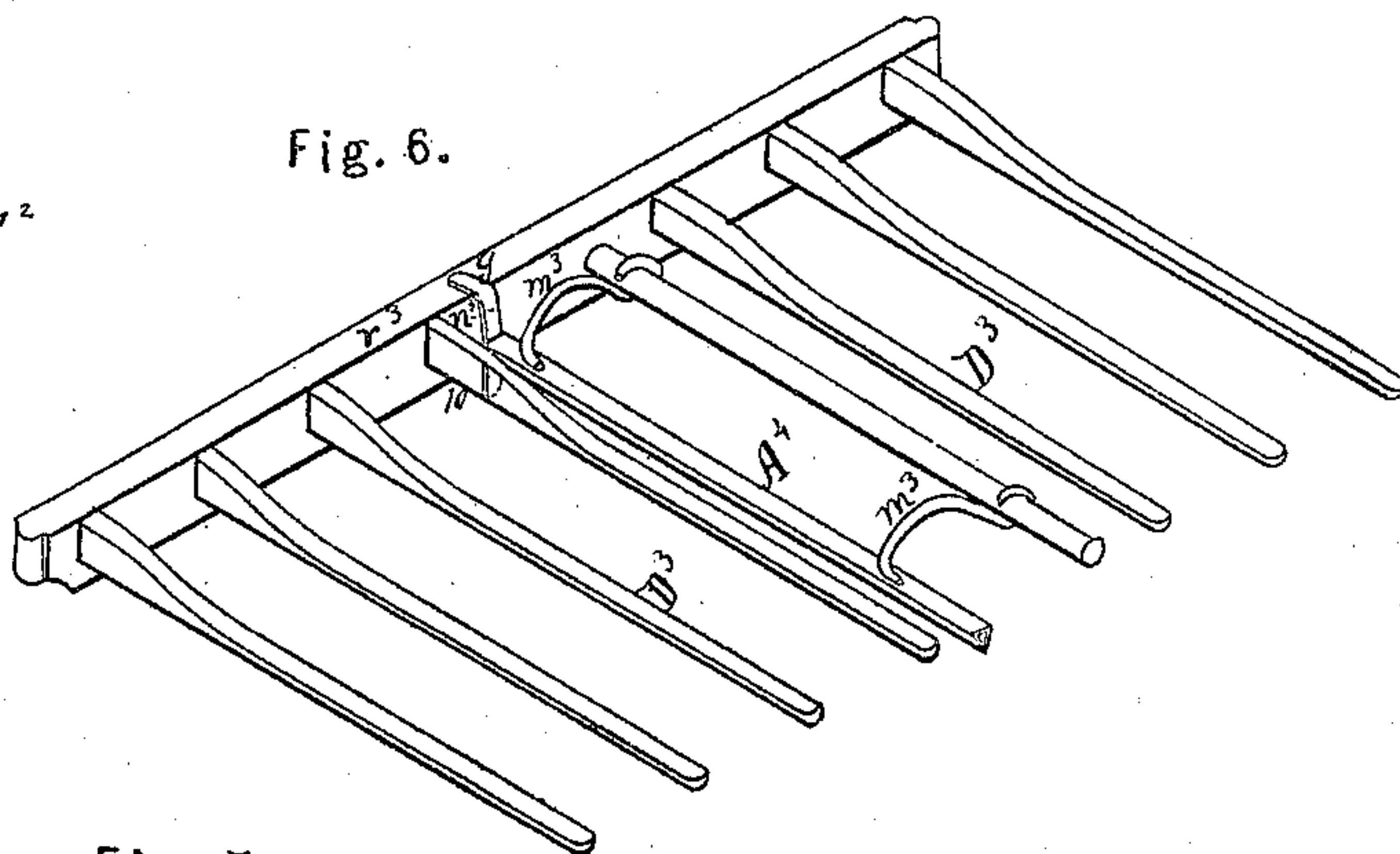
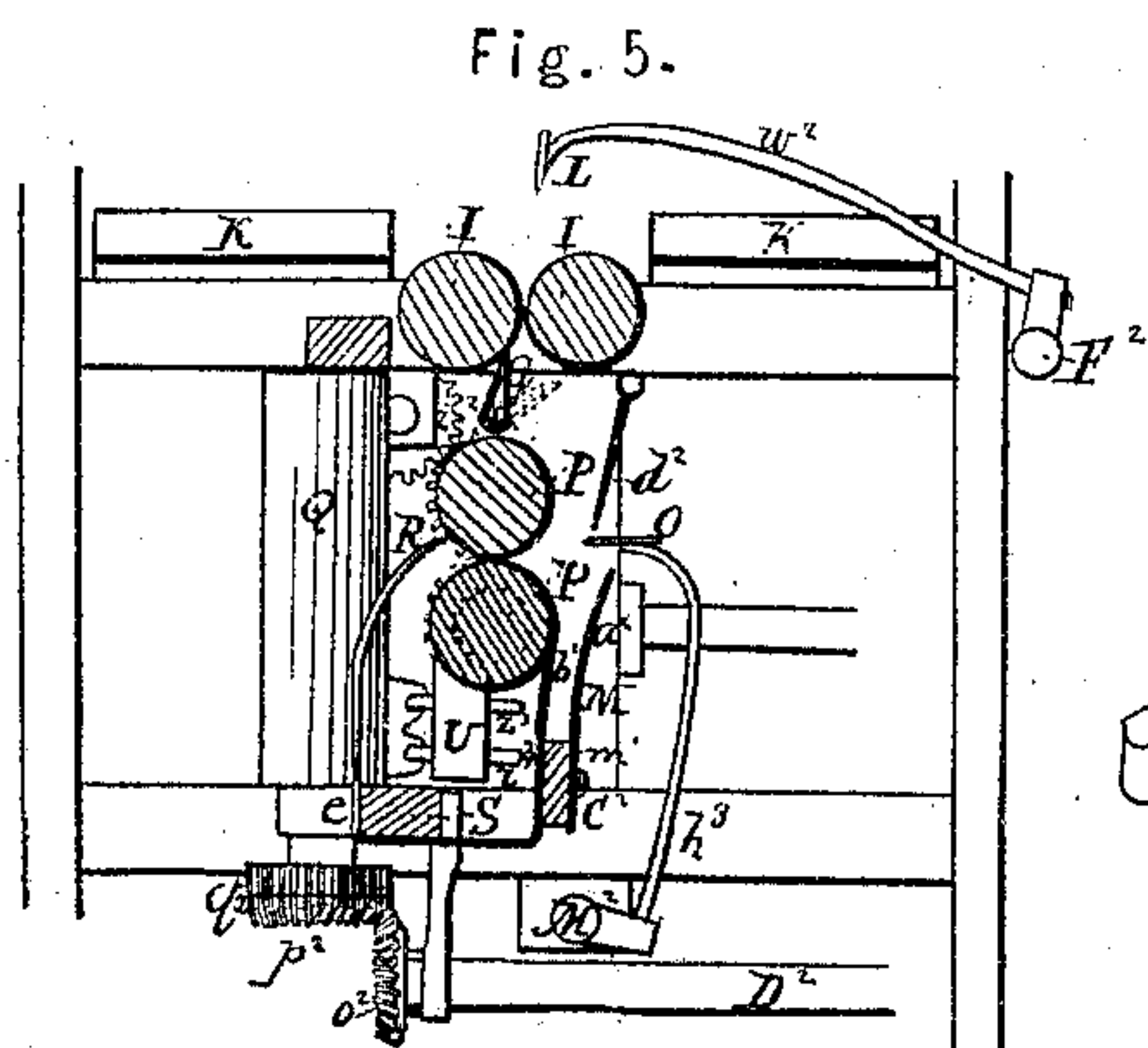
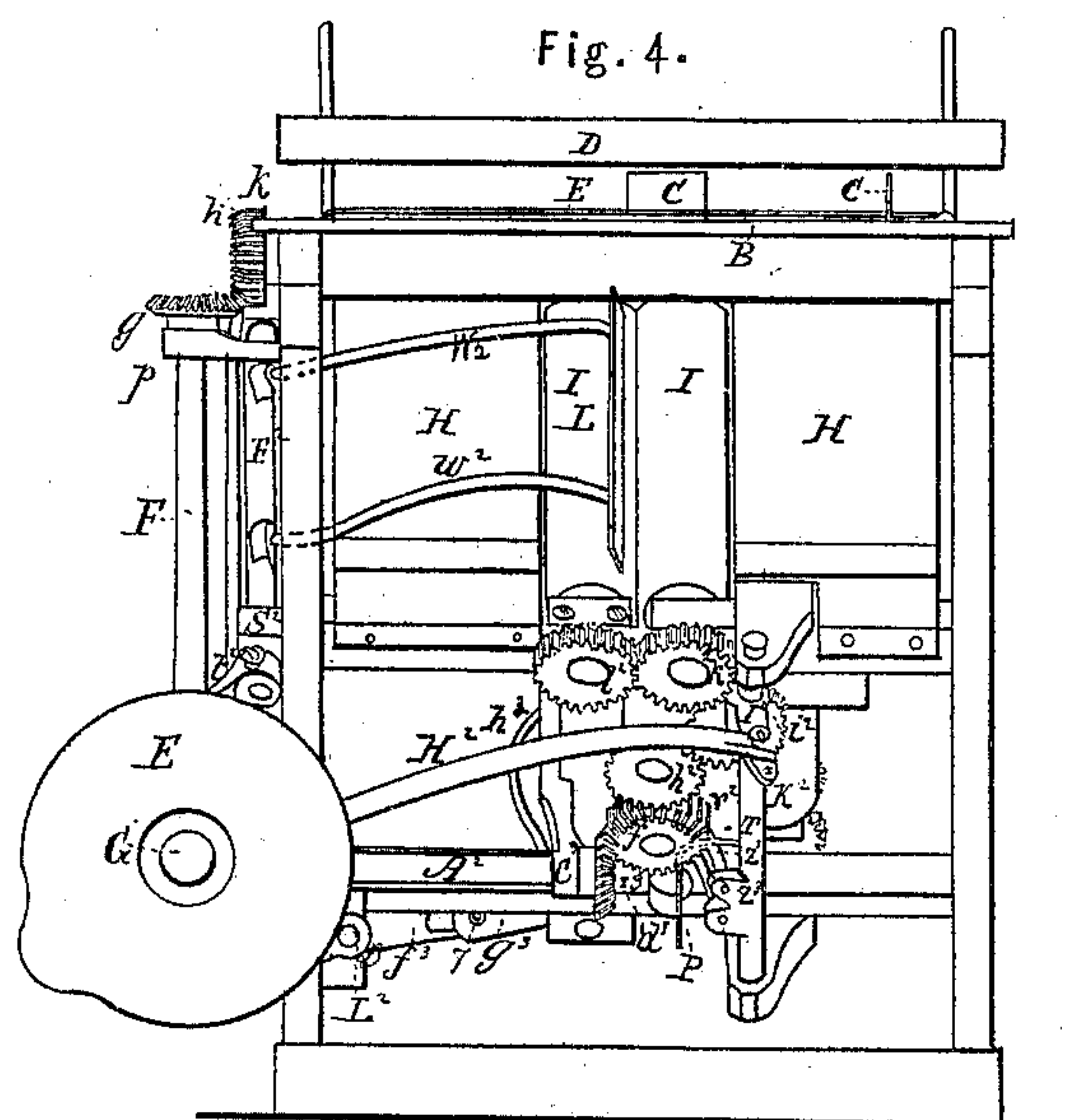
W. H. & J. Milliken *Sheet 2. of 5 Sheets.*

Paper Folding Mach.

Nº 574.

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UNITED STATES PATENT OFFICE.

WILLIAM H. MILLIKEN AND JOHN MILLIKEN, OF MANCHESTER, NEW HAMPSHIRE, ASSIGNORS TO THEMSELVES AND D. F. BUCKLEY, OF SAME PLACE.

IMPROVEMENT IN MACHINES FOR FOLDING PAPER.

Specification forming part of Letters Patent No. 31,578, dated February 26, 1861.

To all whom it may concern:

Be it known that we, WILLIAM HENRY MILLIKEN and JOHN MILLIKEN, of Manchester, in the county of Hillsborough and State of New Hampshire, have invented certain Improvements in Machines for Folding Sheets of Paper, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a perspective view of our machine, a portion of the table being broken away to show the parts beneath; Fig. 2, an elevation of the side Y of the machine; Fig. 3, an elevation of the side X of the machine; Fig. 4, an elevation of the side Z of the machine; Fig. 5, a section upon the line A A of Fig. 1 in a plan perpendicular to the second and third pair of rolls and parallel with the fourth pair; Figs. 6 and 7, views of the fly of a printing-press with the dropping-finger or folding edge, which will be more particularly referred to hereinafter.

The attempts heretofore made to dispense with the tapes in paper-folding machines working with straight edges and rollers have thus far failed, as the paper after it escaped from the first or horizontal pair of rolls had nothing to prevent it from falling over against the second knife, and if this knife was placed sufficiently near to assist in sustaining the paper it would interfere with it as its doubled edge emerged from the preceding pair of rolls and destroy the sheet. The sheet also as it passed through the rolls would hang in them until its upper edge escaped from them, and owing to the irregularities which occur in the form of the sheets one corner would often become disengaged from the rolls before the other, and the sheets would not fall square upon the stop below, which would entirely destroy the register. On these accounts it has not been found practical thus far to make a knife and roller machine operate without tapes.

Our invention has for its object to dispense with the tapes in machines of this class, and also to adapt the folder directly to the printing-press, so that it may take the printed sheets and fold them as they issue therefrom;

and our invention consists in various details, which we will now proceed to describe.

The paper to be folded is placed upon the first table B with its central line through which the first fold is to be made directly over the line of contact of the first pair of rolls E with each other, and with its central line in the opposite direction perpendicularly over the line of contact of the second pair of rolls I with each other. The rolls E are arranged in the customary manner in the center of the table B, and with their upper convex surfaces slightly above the plane of its upper surface. These rolls are revolved by suitable mechanism, and the sheet is entered between them by the first knife or folding edge D, which descends at the proper moment and is operated in a manner that will be presently described.

Beneath the table B, and placed at an angle of forty-five degrees thereto, is a second table H, in the center of which are placed the second pair of rolls I, Fig. 1. The sheet of paper having disengaged itself from the first pair of rolls slides down the inclined table H until its folded edge strikes against the stationary gages K, when immediately the second knife L strikes it and it is again doubled and carried through between the rolls I. Immediately between the latter rolls is a guide-plate *q*, which is capable of being vibrated upon its axle 1, so as to bring it into one or other of the positions indicated in full and red lines in Fig. 5, into either of which it may be placed by shifting the bent rod *r*, Figs. 2 and 3, attached to its axle.

When the sheet is to receive four folds, the guide-plate is placed in the position seen in full lines, Fig. 5, and the sheet, as it emerges from the rolls I, drops into a gage-trough M, the bottom *m'* of which is parallel with the rolls I and is also capable of adjustment more or less near to these rolls, so as to bring the folded edge of the paper at the required distance beneath the line of contact of the third pair of rolls with each other. The front and back of the trough M is formed of sheet-metal fingers *a*² *b*², secured to the frame-work, between which the bottom *m'* is adjusted by means of screws *c*². The bottom of the trough

M is also parallel with the third pair of rolls P, which, like the rolls I, are inclined at an angle of forty-five degrees to the horizon. The stationary gages K near the lower edge of the second table H are placed slightly above the plane of the side N of the trough, so that the sheet, on reaching the bottom of the trough M, has but a short distance to slide before it comes in contact with the side N, when it stops. The knife O now strikes it and enters it between the third pair of rolls P, where it receives its third fold, this third fold being parallel with the second, as the second and third pairs of rolls are parallel with each other. On emerging from the third pair of rolls the folded edge of the sheet strikes against the curved metal guides R, which deflect it and conduct it down onto the bar S. This bar being inclined at an angle of forty-five degrees and parallel with the rolls P, the sheet on reaching it slides down it until it reaches the adjustable gages T, where it is arrested in the proper position to be struck in the middle by the fourth knife U, which now forces it between the fourth pair of rolls Q, where it receives its fourth and final fold, and is delivered out of the machine. The knife U is let into the lower roll P, which has a groove turned in it to receive it. It will be seen from the relative position of the rolls to each other that the second fold is at right angles to the first, the third parallel with the second, and the fourth at right angles to the third. If it be required to dispense with the third fold, the guide-plate q is shifted into the position seen in red lines in Fig. 3, and the curved guides R are swung around the point e out of the way, a longer knife being substituted for the short knife U. The sheet now passes, after leaving the rolls I, directly in front of the rolls Q, its folded edge striking against the inclined bar S, as before, down which it slides until it is arrested by the adjustable stops T with its center opposite to the knife U, which strikes it between the rolls Q, where it receives its third and final fold and passes out of the machine. When the sheet is to receive four folds, the guide-plate q , as before stated, is placed in the position seen in blue in Fig. 5, and the sheet on emerging from between the rolls I is guided by the fingers d^2 into the trough M and prevented from striking the knife O as it descends.

The details of the mechanism by which the moving parts are actuated will now be described.

All the motions of the machine are derived from the main driving-shaft G. The first pair of rolls E are driven in the direction of their arrows by means of the bevel-gear g upon the top of a vertical shaft F, which engages with a gear h upon the shaft of one of the rolls. The two rolls are caused to run together by the gears k and m . The vertical shaft F runs in brackets p , secured to the frame-work, and receives a rotary motion from a gear a upon the main driving-shaft G, which engages with

a gear c on the bottom of the shaft. The second and third rolls are driven as follows: The bevel-gear a^3 engages with a pinion b^3 on a shaft A^2 , which runs in suitable bearings c^3 , secured to the frame-work. Upon its inner end the shaft A^2 carries a bevel-gear d^3 , which engages with a similar gear f^2 on the arbor of one of the third pair of rolls P. This arbor also carries a gear g^2 , which engages with a similar gear h^2 upon the arbor of the other roll P, and the two are thus caused to revolve together. The gear h^2 engages with the intermediate gear i^2 on a short shaft projecting from the frame-work, and this gear engages with a similar gear k^2 upon the arbor of one of the second pair of rolls I. The gear k^2 engages with the gear l^2 upon the other roll, by which the two are caused to run together. The fourth pair of rolls Q are actuated as follows: A bevel-gear m^2 upon the driving-shaft G gives motion to a pinion n^2 on a shaft D², which revolves in bearings attached to the frame-work and carries at its inner end a bevel-gear o^2 , which drives a bevel-gear on the arbor of one of the rolls Q, the other roll being actuated therefrom through the gears p^2 and q^2 . The folding edges or knives are actuated and caused to enter the opening between their rolls for the purpose of forcing the paper between them, as follows: The cam E upon the shaft G has a groove r^2 , which is concentric, with the exception of the portion from 2 to 3. This cam-groove gives motion to all the straight edges, as follows: F² is a shaft which is vibrated a short distance in its boxes S² by an arm t^2 , which is hinged thereto at 4, and carries a roller at its other end 5, that plays in the cam-groove r^2 . From the shaft F² project the arms w^2 of the knife L. When the roller 5 is running in the concentric portion of the groove r^2 , the knife L is elevated at its greatest distance from the rolls I. During this interval the sheet, having been struck in between the first pair of rolls, is running down the inclined table H, and as the roller 5 passes through the portion 3 to 2 of the cam-groove the knife is suddenly depressed and again raised. The fourth knife is actuated with the second one, as follows: To the arm t^2 is attached another arm x^2 , which is connected by means of the rod H² with a short arm I², projecting from a shaft K², to which are attached the arms z^3 of the fourth knife U. This knife is thus vibrated simultaneously with the second knife L. The first and third knives are actuated as follows: An arm A⁴, projecting from the end of a shaft L², carries a roll 6, which plays in the cam-groove at a distance of one hundred and eighty degrees from the roll 5, and by means of the same cam-groove r^2 the shaft L² is vibrated a short distance in its bearings, once for every complete revolution of the driving-shaft. An arm b^5 , projecting from the shaft L², is connected by means of the rod y^5 with an arm c^5 , projecting from the shaft d^5 , to which are attached the arms e^3 of the first

knife D. From the opposite side of the shaft L^2 projects an arm f^3 , which is jointed at 7 to an arm g^3 , which is hinged at 8 to a short stud projecting from the vibrating shaft M^2 , to which are attached the arms h^3 of the folding edge O. The joints at 7 and 8 form a universal joint, which is rendered necessary by the fact that the shafts M^2 and L^2 vibrate in planes inclined forty-five degrees the one to the other.

When the folding-machine is to be used by itself and not in immediate conjunction with the printing-press, the sheet may be registered by the adjustable gages C or by any other suitable registering device. It is our intention, however, in the great majority of cases to apply the machine directly to the printing-press, the folder being run at such a rate as to fold the sheets as fast as they are printed.

The first folding-knife being removed, the paper is delivered upon the table B by the fly of the printing-press, and it is caused to enter in between the rolls E in the following manner: In Fig. 6 is seen the fly of a printing-press, the central finger of which is replaced by a movable finger A^4 , which is hung by means of arms m^3 to one of the stationary fingers or to a rod projecting from the back of the fly. The finger A^4 is attached to a short bar n^3 , the ends of which are bent up at right angles, forming projections both above and below the back bar r^3 of the fly, the distance between these bend ends or projections 9 and 10 of the bar n^3 being greater than the width of the bar r^3 , so that when the fly is up receiving the sheet the edge of the movable finger a^4 is upon a level with the other fingers D^3 , the projection 10 resting upon the under side of the back bar r^3 , and when the fly falls and lays the sheet upon the table B the finger A^4 , continuing to descend, strikes the paper between the rolls E, and the fly immediately rises for another sheet. It is manifest that the dropping-finger A^4 could not be made to work into the interstice between the rolls E with sufficient exactness to prevent it from being seized by the rolls if the edge were made thin and sharp, as is the case with the other folding edges. To prevent the dropping-finger from being thus seized by the rolls it is made triangular in section, as seen in Fig. 6, the two sides of the triangle, and not the edge, pressing the paper onto the rolls, to which it adheres sufficiently to be drawn in between them. Other forms besides that of a triangle in section may be employed for the dropping-finger A^4 . We have found that a round polished iron rod would answer every purpose, it being hung so as to drop back into the plane of the other fingers when the fly was up receiving a sheet, and to fall and force the sheet down upon the surface of the folding-rolls as the fly descended.

Recapitulation of operation: The sheet is delivered upon the table B, as described, by the fly, which is adjusted to fall with the

dropping-finger directly over the line of contact of the rolls E, by which means the rolls are caused to seize the paper and carry it through between them in a double fold. The doubled sheet now descends upon the table H as it passes through the first pair of rolls, and on escaping from the latter it continues to slide down until arrested by the stationary gages K, against which its folded edge rests. The roll 5, upon the arm t^2 , now enters the eccentric portion 2 to 3 of the cam-groove r^2 , by which the shaft F^2 is vibrated, and the knife L is caused to descend, by which the doubled sheet is forced between the second pair of rolls I, and the now twice-folded sheet, if it is to receive four folds, (the second and third being parallel to each other,) is guided by the plate q and the fingers d^2 down into the trough M and in front of the rolls P, the trough M being raised or lowered by means of the screw c^2 , so as to bring the sheet into the proper position to cause the third knife to strike it in the center. The sheet now slides down the trough M until it reaches the side N of this trough, where it is arrested. The rock-shaft M^2 being now vibrated by means of the connections already explained, the knife O forces the already twice-doubled sheet between the rolls P, which give to it its third fold. Emerging from these rolls it falls upon the bar S, which is parallel with the fourth pair of rolls, and down which it slides until arrested by the stops T, which have been previously adjusted so as to bring the center of the paper opposite to the fourth knife U, which now strikes it between the fourth and last pair of rolls Q, which finish the operation and deliver it out of the machine. If the sheet is to receive but three folds, the third fold being dispensed with, the guide-plate q is thrown into the position shown in red in Fig. 5, the guides R are swung out of the way, and the knife U is replaced by a longer one, and the operation continues, as already explained. To insure the seizing of the paper by the rolls and also to allow of the passage of two sheets should they be accidentally introduced together, the boxes of one of each pair of rolls are forced up to the others by springs y^3 , which allow them to yield slightly should an extra thickness be presented to pass through. The fingers d^2 may be swung out by means of the handle f whenever it is required to get at the rolls P or for any other purpose.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The combination of the horizontal rolls E, the inclined rolls I, and the table H, so arranged that the sheet of paper after passing through the first pair of rolls shall slide down the table to the gages which determine its position for receiving its second fold without loss of register and without the use of tapes, as set forth.

2. The combination of the inclined rolls I and P with the inclined trough M, with its

fingers $a^2 b^2 d^2$, so arranged that the sheet shall be guided into the trough after passing through the roll I, and then slide to the position for receiving its third fold.

3. The inclined rolls P and Q at right angles to each other, in combination with the knife U, working in a groove in the surface of the rolls, as set forth.

4. The guide-plate g , employed for deflecting the sheet in one direction or the other for giving it three or four folds without the necessity of unshipping or stopping the operation of either of the knives or rolls.

5. The dropping finger or folding edge upon the fly, operating as set forth, whereby the folding-machine may be applied directly to the printing-press and the folding be completed without the necessity of again handling the sheet.

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Witnesses:

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