

P. D. HEDDERWICK.  
Printing Machine.

No. 231,316.

Patented Aug. 17, 1880.

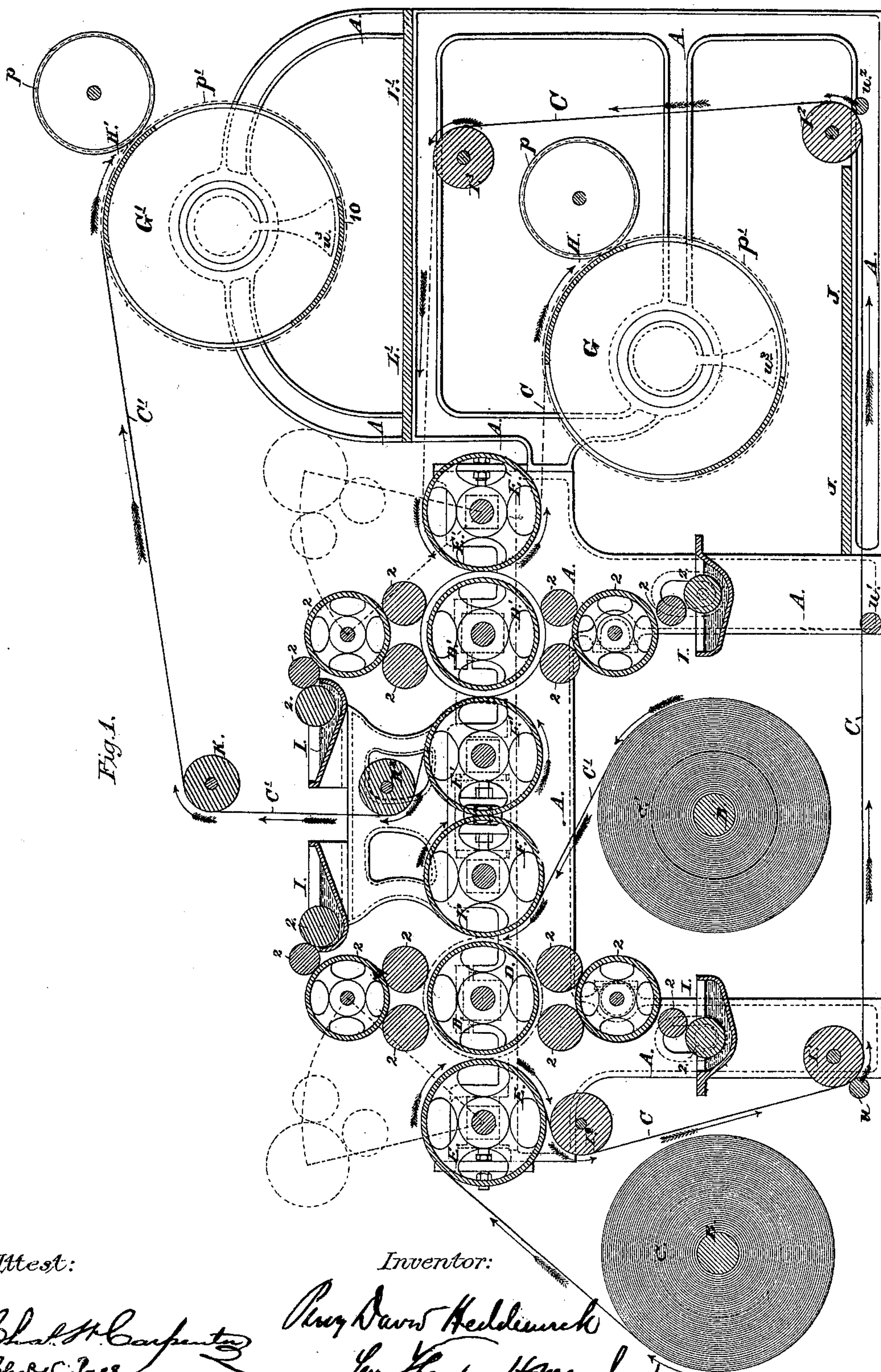


Fig. 1.

Attest:

*Chas. H. Carpenter*  
*Chas. V. Jace*

Inventor:

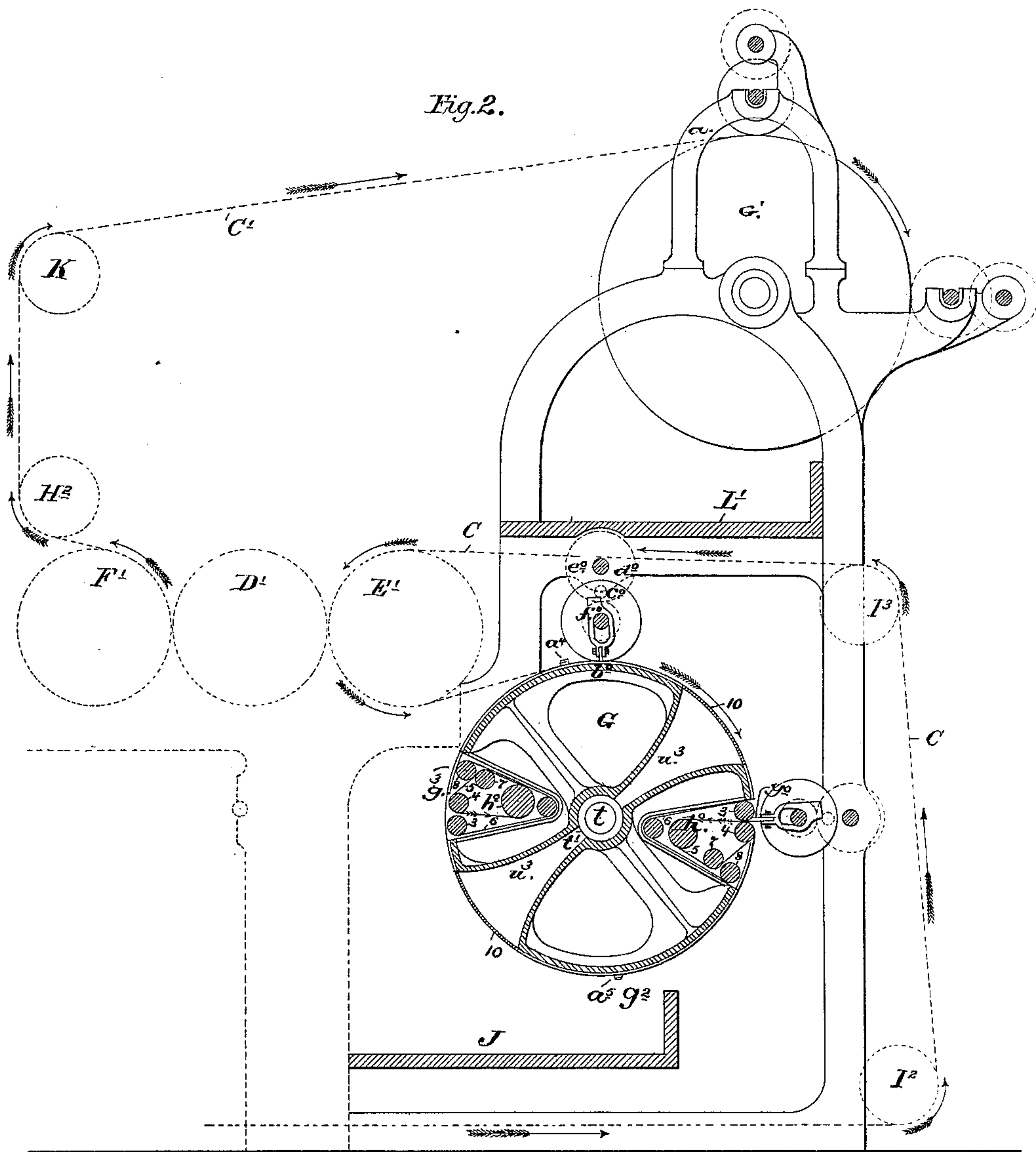
*Percy Davis Hedderwick*  
*J. W. Gordon & Mead*  
*Attorney*



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Inventor:  
Percy Davis Hedderwick  
per Theodore H. Mend  
Attorney

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Fig. 3.

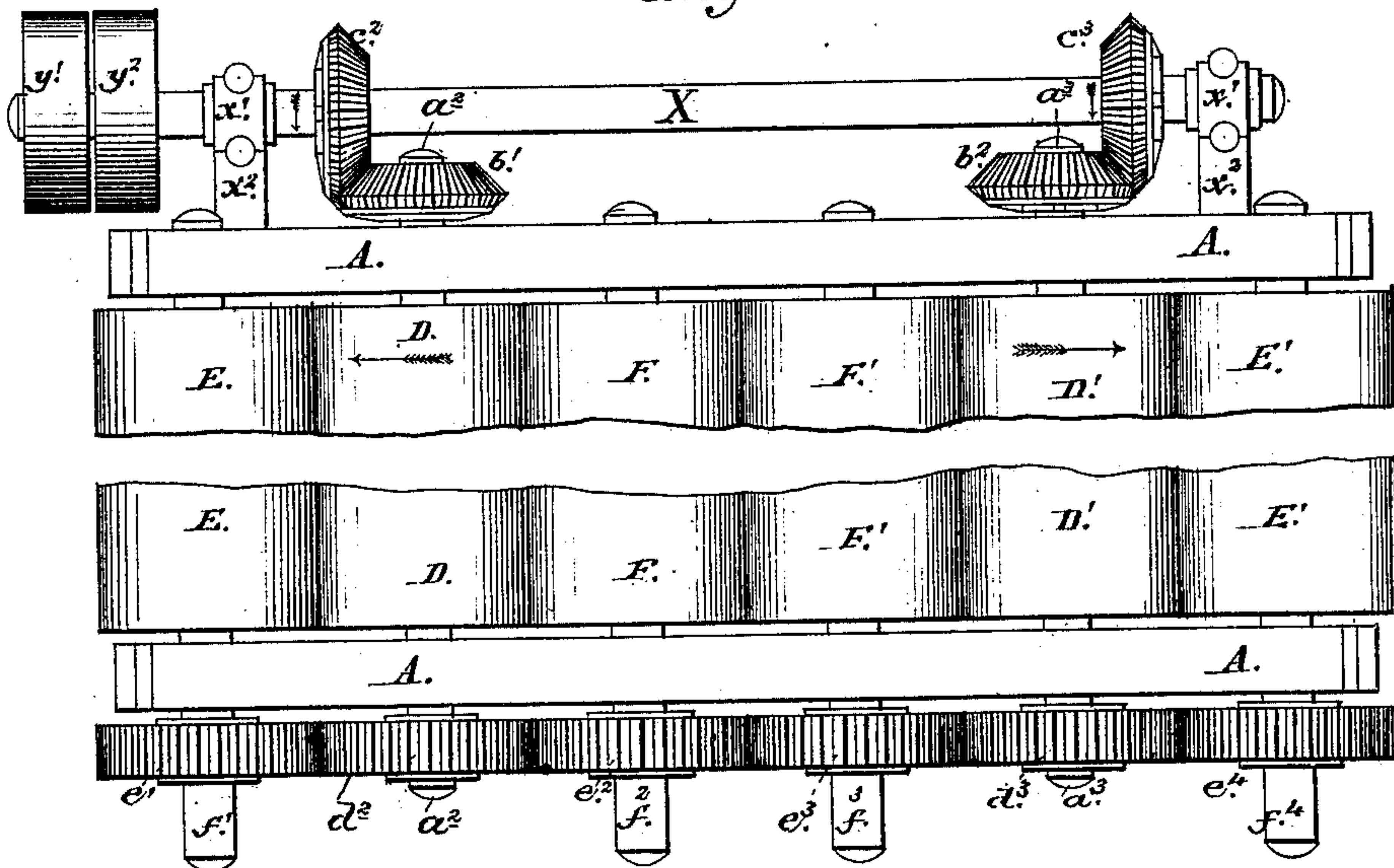


Fig. 4.

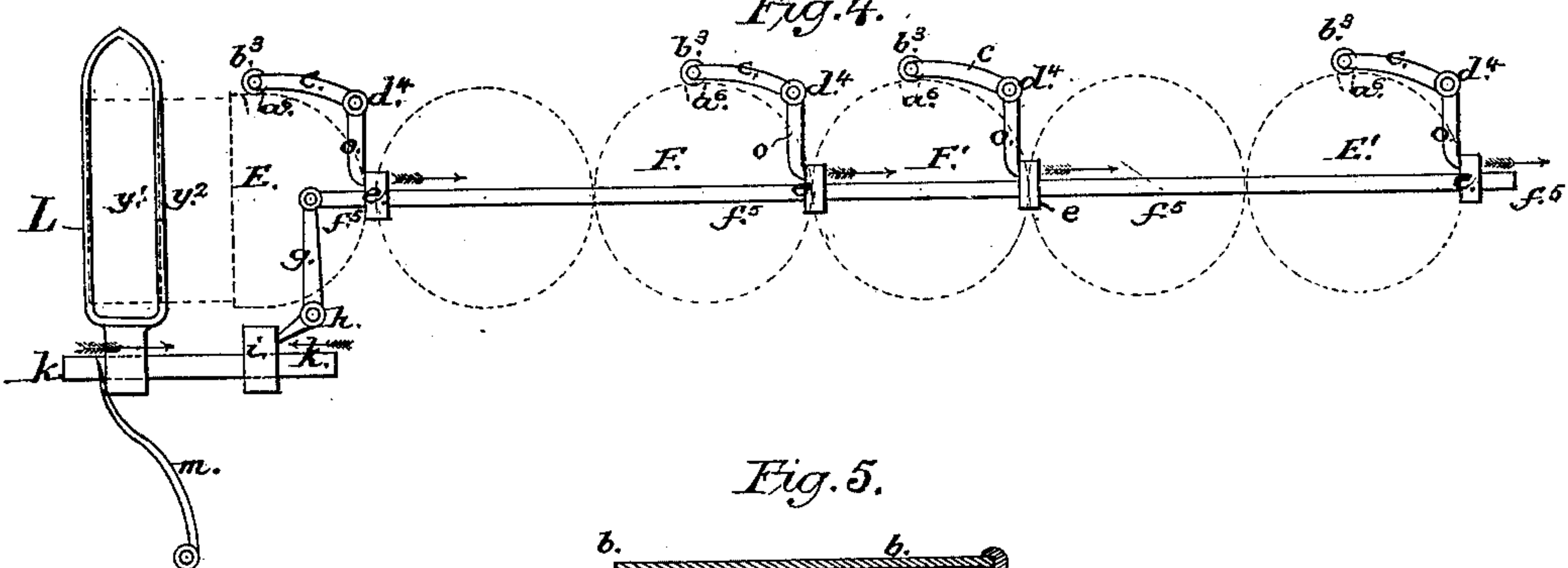
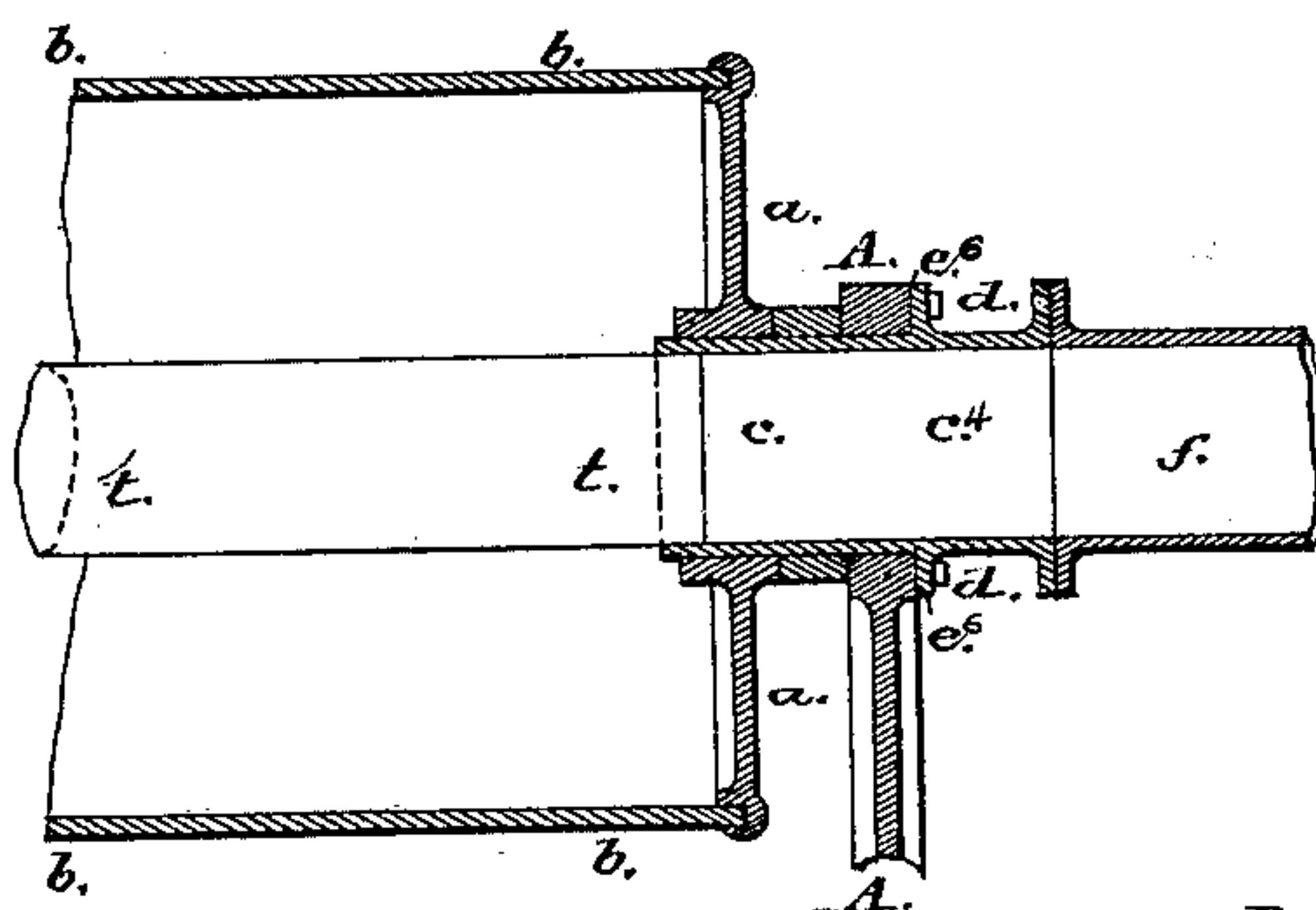


Fig. 5.



Attest:

Chas. H. Carpenter  
Chas. V. Paer

Inventor:

Percy David Hedderwick  
per Theodore A. Mead Attorney



# UNITED STATES PATENT OFFICE.

PERCY DAVID HEDDERWICK, OF GLASGOW, NORTH BRITAIN, ASSIGNOR  
BY MESNE ASSIGNMENT, TO R. HOE & CO., OF NEW YORK, N. Y.

## PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 231,316, dated August 17, 1880.

Application filed August 16, 1875. Patented in England May 31, 1870.

*To all whom it may concern:*

Be it known that I, PERCY DAVID HEDDERWICK, of Glasgow, county of Lanark, Scotland, have invented certain Improvements in Web-Printing Machines, of which the following is a specification.

In the accompanying drawings, in which like letters indicate like parts, Figure 1 represents a longitudinal sectional elevation of a printing-machine provided with mechanisms for perfecting and delivering one or two webs. Fig. 2 represents a longitudinal sectional elevation of a detached portion of said machine, showing a delivery mechanism consisting of two folding-drums, one of which is in section. Fig. 3 is a part plan view of Fig. 1. Fig. 4 is a diagram illustrating a mechanism for stopping the machine when the web is broken, and Fig. 5 is a detached longitudinal sectional elevation of one of the delivery-drums.

The invention consists of a printing-machine provided with mechanism for perfecting one or two webs of paper, severing the same into sheets, and delivering and piling the sheets; also, in a rotary folding mechanism co-operating with a perfecting printing-press, and in certain details, all of which will be more specifically hereinafter pointed out.

The mechanisms are supported in an open frame-work, A. The two webs of paper C C' to be printed are respectively wound upon two rollers, B and B', supported in brackets or bearings. (Not shown.) Upon the upper part of the frame-work A two type or stereotype cylinders, D and D', and four impression-cylinders, E E' and F F', are mounted and arranged in such a manner that two of the impression-cylinders—namely, those marked E F'—are adjacent to each other and situated between the type-cylinders D and D', while the two remaining impression-cylinders, E E', are, in consequence, situated respectively at the outer side of the said type-cylinders D and D'. Each of the cylinders D and D' is provided with two inking apparatuses of the usual roller type. The ink, being placed in the reservoirs I I I I, is conducted to the type-cylinders by means of the ordinary train of ink-distributing rollers 2, acting with their peripheries in contact, the lowest roller of the train on the under side and

the extreme roller of the train on the upper side being partially immersed in the ink, while the latter two rollers of the trains farthest from the ink-reservoir are in contact with the type-cylinders and distribute the ink thereon.

The object of supplying inking apparatuses at both the upper and lower sides is to give a separate inking for each printing operation upon the two webs.

To facilitate the operation of taking out or putting in types, stereotype-plates, or the type or stereotype cylinders themselves, the inking apparatus on the upper side is movable, (by preference in a circular arc,) so that it may be drawn away from interfering with any of the above-mentioned operations, as indicated by dotted lines in Fig. 1.

The delivering mechanism is as follows: Two revolving drums, G and G', are mounted at suitable points in the frame, and each consists, as shown in Fig. 5, of end plates or frames, a, between which is fixed the drum proper, which consists of a thin plate, b, bent cylindrically, and at intervals either perforated or slotted with openings, as shown in Fig. 1. The end frames or plates, a, of the drums G G' are each centered and free to revolve upon hollow tubular bearings c<sup>4</sup>, which are secured to the frame-work A by means of screwed studs or bolts d being passed through flanges e<sup>6</sup>, formed upon the hollow bearings c<sup>4</sup>. To the outer ends of the said cylindrical bearings c<sup>4</sup> a pipe, f, is attached, which is in communication with an adjacent fan, pump, or other apparatus, whereby a blast or strong current of air is passed through the pipe f and the hollow bearing c<sup>4</sup>, thence into a pipe, t, which is situated concentrically with and extends from the bearing c<sup>4</sup> across the entire length of the drum G or G'. The said pipe t is provided at suitable intervals with blow-pipes w<sup>3</sup>, as shown in Fig. 1. The revolving drums G and G' are each provided with two distinct sets of grippers, as shown at a<sup>4</sup> a<sup>5</sup>, (see Fig. 2,) which gripe the web at its edges, and which operate as hereinafter set forth.

Situated adjacent to the drums G and G', respectively, with their peripheries in contact therewith, are two cutting-rollers, H and H', each of which has at a certain part of its periphery a knife or sharp cutting-instrument,



which is brought into contact with the peripheries of the drums G or G' at regular intervals, as the rollers H and H' are revolved by means of a spur-pinion,  $p$ , fixed upon the axis of each and geared into corresponding spur-wheels  $p'$ , fixed upon the axis of the drums G and G', respectively. The functions and operation of these blades are hereinafter more specifically set forth.

The arrangement of gearing by preference employed for the transmission of motion to the working parts of the whole apparatus is particularly shown in Fig. 3.

The shafts  $a^2 a^3$ , upon which the type-cylinders D and D' are fixed, have each bevel-wheels  $b' b^2$  fixed upon one end. The said wheels  $b' b^2$  are geared into corresponding wheels  $c^2 c^3$ , respectively, which are fixed upon a shaft, X, carried in bearings  $x'$ , supported on brackets  $x^2$  formed upon one of the side frames, A. Upon one end of the shaft X fast and loose pulleys  $y'$  and  $y^2$  are situated, provided for the purpose of transmitting a rotary motion to the said shaft X and the type or stereotype cylinder D and D' through the intervention of a driving band or belt which is in communication with some adjacent motor. In order that the impression-cylinders may in like manner be made to revolve or kept stationary, as may be desired, the shafts  $a^2 a^3$  of the type-cylinders D and D' have upon their ends opposite to those upon which the bevel-wheels  $b' b^2$  are situated spur-wheels  $d^2 d^3$  fixed. Each of these is in turn geared respectively into two corresponding wheels,  $e' e^2$  or  $e^3 e^4$ , situated upon their adjacent shafts  $f' f^2 f^3 f^4$ —that is to say, the wheel  $d^2$  is geared into the wheels  $e' e^2$ , causing the impression-cylinders E and F to revolve, while the wheel  $d^3$  is geared into the wheels  $e^3 e^4$  in like manner, causing the impression-cylinders E' and F' to revolve; and in order that any of the impression-cylinders E E' or F F' may be kept stationary while the type-cylinders D D' are in motion, it is provided that any of the wheels  $e' e^2 e^3 e^4$  may be drawn out of contact with their respective driving-wheels  $d^2 d^3$ , the shafts  $f' f^2 f^3 f^4$  being elongated for this purpose.

In order that the motion of all the moving parts of the machine may be stopped when a web breaks mechanism is provided, as shown and as particularly illustrated by Fig. 4.

Above and freely rolling on each of the impression-cylinders E E' F F' are rollers  $b^3$ , which are attached to the extremities of bell-crank levers  $c$ , centered upon studs  $d^4$ . The rollers  $b^3$  lie upon the top of the web as it extends over the upper side of the impression-cylinders, and if the web breaks one, any, or all of the rollers  $b^3$  drop into the slots  $a^6$ , (which are those made for fastening the impression-cylinder blankets in the usual well-known manner, but which may be independent slots provided for this express purpose,) and which has the effect of drawing down the ends of the bell-crank levers  $c$ , to which the rollers

$b^3$  are attached, while their opposite ends  $o$  are in consequence forced outward in the direction indicated by the arrows, and as these opposite ends are in contact with the tappets  $e$ , which are fixed upon a rod,  $f^5$ , the rod is thereby moved in the direction indicated by the arrow. To the end of the rod  $f^5$  a bell-crank lever,  $g$ , is jointed, the fulcrum of which is centered upon a stud,  $h$ .

When the rod  $f^5$  is moved in the manner already described it drags with it the end of the bell-crank lever  $g$ , to which it is jointed, while the opposite end of the said bell-crank lever  $g$  is moved upward and thrown out of contact with the tappet  $i$ , which is fixed upon the shaft  $k$ . Upon this shaft  $k$  the belt-guide L is also situated, against which the end of a strong spring,  $m$ , (or its equivalent as a weighted lever) is brought to bear. Immediately that the tappet  $i$  is relieved from contact with the lower end of the bell-crank lever  $g$  the pressure from the spring  $m$  instantly draws along the belt-guide L and the shaft  $k$  a sufficient distance to shift the belt from the fast pulley  $y'$  to the loose pulley  $y^2$ , and thereby stops the motion of the working parts of the machine.

Having now described the construction and general arrangement of the chief parts of my improved printing apparatus as in one arrangement, I will now proceed to set forth its operation.

The end of one of the webs of paper C which is wound upon the roller B is drawn upward and passed over the outer impression-cylinder, E; thence it is passed downward, and, being subjected to contact with the type or stereotype cylinder D, is thereby printed upon one side. In being passed onward it is next led over a carrying-roll,  $l^0$ , thence downward to another and corresponding carrying-roller,  $l^1$ , whence it is led along the under side of the apparatus, being supported and conducted in its course by traveling bands or tapes extending between the stretching-rollers  $u u' u^2$ , when, having arrived at the latter, it is brought into contact with and conducted round another carrying-roller,  $l^2$ , thence upward, when it is passed over another carrying-roller,  $l^3$ , from which it is conducted and passed over the impression-cylinder E', in passing around which it has that side which has not been printed upon brought into contact with the type or stereotype cylinder D', and is in like manner printed. From the impression-cylinder it is then passed over the revolving drum G, and is caught upon its edges by one set of the grippers  $a^4$  or  $a^5$  with which the said drum is provided, as by the grippers  $a^4$ , as seen in Fig. 2, which seize hold of the edges at one end of the printed web, and carrying the web around with them, the said drum also revolving the cutting-cylinder H until the knife or cutting-instrument, situated at its periphery, is, in passing through a revolution, brought into contact with the web upon the periphery of the drum G, when it severs or cuts the said paper into



sheets of the requisite length. The detached  
 portions of paper when cut off are in the lengths  
 corresponding to the circumferences of type on  
 the cylinders D and D'. Immediately before  
 5 the cutting of the web has been accomplished  
 the second set of grippers, as  $a^5$ , situated upon  
 the drum at a point opposite to the set of grippers  
 $a^4$ , just referred to, has caught hold of the  
 web close to and behind that part where the  
 10 cut has to be made, the web thereby being se-  
 cured from being thrown or falling off from  
 the drum G while passing through the lower  
 half of its revolution, and until arriving at the  
 point where the grippers are released and the  
 15 sheet freed to be removed from the drum G.  
 It is blown off from the drum G by means of  
 a current of air passing from the blow-pipe  $w^3$ ,  
 and impinging on the inner side of the paper  
 by issuing through the perforations, so that it  
 20 is finally deposited upon the receiving-board  
 J, provided for the purpose. The said current  
 of air is intermittent, and it is adjusted by the  
 opening and closing of a valve so as to come  
 into action at the desired instant.

25 The direction in which the web is drawn and  
 conducted from one part of the series of oper-  
 ations to the others is indicated by the arrows  
 upon Fig. 1.

With reference to the end of the second web  
 30 or roll of paper—that one marked C', which is  
 wound upon the roller B'—it is drawn upward  
 and passed round the impression-cylinder F,  
 by which it is printed on one side through be-  
 ing in contact with the adjacent type or stereo-  
 35 type cylinder D. It is then conducted round  
 and passed downward between the impression-  
 cylinders F and F', and it is then conducted  
 round the latter and drawn upward between  
 it and the second type or stereotype cylinder,  
 40 D', whereby it is printed upon the opposite  
 side through being in contact with the said  
 type or stereotype cylinder D'. The web is  
 then drawn onward and passed round a car-  
 rying-roller, H<sup>2</sup>; thence it is drawn upward  
 45 and passed over another carrying-roller, K,  
 from which it is conducted to the revolving  
 drum G', whence it is cut and treated in a  
 manner in every respect similar to that here-  
 inbefore described with reference to the first  
 50 web, and the detached sheets are finally de-  
 posited upon the receiving-board L'. The di-  
 rection in which the second web is drawn and  
 conducted is clearly shown by arrows upon  
 Fig. 1.

55 When it is desired to fold the sheets instead  
 of piling them flat, the apparatus illustrated  
 by Fig. 2 is substituted at the delivery end of  
 the machine, the drums G and G' being pro-  
 vided with different mechanisms than those  
 60 forming the blast-delivery simply.

The webs of paper, after having been sub-  
 jected to the double printing operations, are  
 led to the revolving delivery-drums G and  
 G', and when they are brought onto the sur-  
 65 face thereof the opposite edges of each web  
 are seized by grippers  $a^4$  or  $a^5$ , which open lat-

erally, and are of any suitable kind, the posi-  
 tion of which two sets of grippers upon the  
 drums G G' is shown in Fig. 2 by one member  
 of each set, it being explained that while the  
 70 position of the drum G' is indicated by a line,  
 it is fitted with grippers and other moving parts  
 similar to those shown in connection with the  
 drum G. Each web is then drawn onward and  
 partially wound round each of the drums G  
 75 and G' until, having been carried thereby  
 through a portion of the revolution of the  
 drums G and G', each web is severed or cut  
 by the action of serrated knives  $b^0$ , which are, at  
 suitable intervals of their revolutions, pressed  
 80 toward the periphery of the drums G and G', in  
 which openings or grooves are formed, and into  
 which the cutting-edge of the knife  $b^0$  advances.

Each knife  $b^0$ , when being pushed forward,  
 is actuated by means of a tappet,  $c^0$ , which is  
 85 fixed upon a disk,  $d^0$ , the said disk  $d^0$  being  
 upon a shaft,  $e^0$ , and made to revolve there-  
 with at such a velocity as to bring the tappet  
 $c^0$  into contact with and push a light frame,  
 $f^0$ , to which the knife  $b^0$  is attached, toward  
 90 the drum G or G' at intervals corresponding  
 to the length of the sheet required and in pro-  
 portion to the circumference of the type-cyl-  
 inder. Immediately that the web has been  
 cut in the manner now described the frame  
 95  $f^0$  is pushed backward or away from the drum  
 by a spring (not shown in the drawings) to its  
 former position, and while in the act of being  
 so pushed back the cutting-edge of the knife  
 is brought into contact with a brush or its  
 100 equivalent situated in such a position as to in-  
 sure the said contact. By this means any  
 small portions of paper or detached fiber or  
 dirt that may have adhered to the said cut-  
 ting-edge of the knife  $b^0$  during the cutting  
 105 operation are removed, and the knife is thus  
 kept clean for the succeeding cut. Simulta-  
 neously with the cutting of the web in the man-  
 ner hereinbefore described the web is again  
 caught (close behind where it was severed) by  
 110 another set of grippers,  $a^5$ , similar to those  $a^4$  al-  
 ready referred to, but placed apart therefrom at  
 a distance equal to the length of sheet required,  
 while during the next succeeding instant of  
 time the first set of grippers—namely, those  
 115 marked  $a^4$ , but which by the continuous re-  
 volving of the drum G are now situated at the  
 point where the grippers  $a^5$  are shown in Fig.  
 2—are released, and the center of the detached  
 sheet is pushed inward between folding-rollers  
 120 3 4 by means of a folding-blade,  $g^0$ , (whose  
 frame and gearing are in every respect similar  
 to the frame and gearing of the knife  $b^0$ ,) and  
 brought into contact with traveling tapes 5 6,  
 by which the sheet is driven inward in the di-  
 125 rection indicated by the arrows, and carried  
 round roller  $h^0$ , whence it is conducted outward  
 in the direction of the periphery of the drum,  
 when its leading end—that is to say, the mid-  
 dle or fold of the sheet—having arrived at the  
 130 rollers 7 8, (which, through the continuous re-  
 volving of the drum G, are then situated at the



point  $g^2$ ,) it is fed out from the tapes 3 4 and emerges from the rollers 7 8 in the drum G at the same speed as, but in an opposite direction to, that in which the periphery of the drum G is traveling. When the rollers 7 8 have arrived at the point  $g^3$  the sheet is entirely released from the tapes and cleared from the rollers 7 8, and will be in the act of falling onto the board J, in which act it will be assisted by a blast of air from within the drum. The blast of air is caused (as hereinbefore described) by a fan-pump in connection with the fixed pipe  $t$ , on which the drums G and G' revolve.

In the under side of the pipe  $t$  is a slit,  $t'$ . As the blow-pipes  $u^3$ , which revolve with the drums, come alternately opposite this slit  $t'$ , a current of air rushes through the slit  $t'$  into the blow-pipes  $u^3$  and out through the perforations or slots in that part 10 of the outer casing of the drums G and G' which covers the mouths of the blow-pipes  $u^3$  at the moment when the sheets are freed from the tapes inside the drums G and G'. If, however, the weight of the paper used be sufficient to cause the sheets to fall without any assistance the blast of air may be dispensed with.

The roller  $h^0$  is made to revolve by means of any suitable arrangement of gearing communicating with any of the revolving shafts in the mechanism, the proportions of the said gearing being such as to cause the periphery of the roller  $h^0$  to travel at the same velocity as the periphery of the drum G. By this mechanism and connecting-gearing or surface contact all the tapes are caused to travel at the same velocity, and the distance over which they conduct the sheet is in correspondence with the time which the rollers 3 4 have occupied in traveling from their position of cooperation with the folding-blade  $g^0$  around to the position indicated at  $g^2$ , or from that indicated by  $g^2$  to that of  $g^3$ . By this means each sheet is in succession accurately folded and delivered in the same position.

It is to be observed that the arrangement of the series of type and impression cylinders with their axes placed in a horizontal plane may be varied. Thus, they may be arranged vertically or at any angle of inclination; or, in place of arranging the impression-cylinders in a horizontal line with the type-cylinders, the impression-cylinders may be placed above or below the type-cylinders. Moreover, the delivery attachment, as well as the folding-drum, may be attached to a press arranged to perfect one web only.

Having now described the nature and operation of my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of a rotating folding-blade automatically projected in the act of

doubling a sheet carried upon a supporting-drum into a recess therein with said drum and suitable mechanism with which it is provided for receiving and holding said doubled sheet, substantially as shown and described.

2. In combination with a rotating folding-blade, a rotating drum carrying folding-rollers, having a series of tapes leading therefrom, whereby a sheet is folded into and delivered from the drum while it is revolving, substantially as shown and described.

3. A rotating drum provided with a pair of rollers, through which the sheet is folded, and conducting-tapes which carry and deliver the folded sheet during the continuous rotation of the drum, substantially as shown and described.

4. The combination, with a rotating folding-blade, of a pair of folding-rollers supported in a carrier which moves on a center to bring said folding-rollers into a position to co-operate with said folding-blade, substantially as herein shown and described.

5. The combination of a folding-blade with a pair of folding-rollers, both of which folding devices are mounted in carriers which have curvilinear movements to cause the said folding devices to coact in doubling the material, substantially as herein shown and described.

6. The combination of a folding-blade with a revolving carrier, through the periphery of which the sheet is doubled, said carrier being provided interiorly with devices for seizing, propelling, and ejecting said doubled sheet, substantially as herein shown and described.

7. The combination of a rotating folding-blade automatically projected to double a sheet carried upon a supporting-drum into a recess therein, which is supplied with means for receiving and holding said doubled sheet, with suitable mechanism for leading, carrying, or directing the forward end of the sheet into a proper position for its central portion to be acted upon by the folding devices, substantially as shown and described.

8. In combination with a revolving folding-blade automatically projected to double a sheet into a recess in a supporting-drum, the grippers for holding the free end of the sheet until the folding devices secure it, substantially as shown and described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

PERCY D. HEDDERWICK.

In presence of—

WM. MOORE,  
Solicitor, 46 Chancery Lane, London, England.  
FRANCIS F. ROBINSON,  
46 Chancery Lane, W.C., London, Clerk to Messrs.  
Bower & Cotton.