

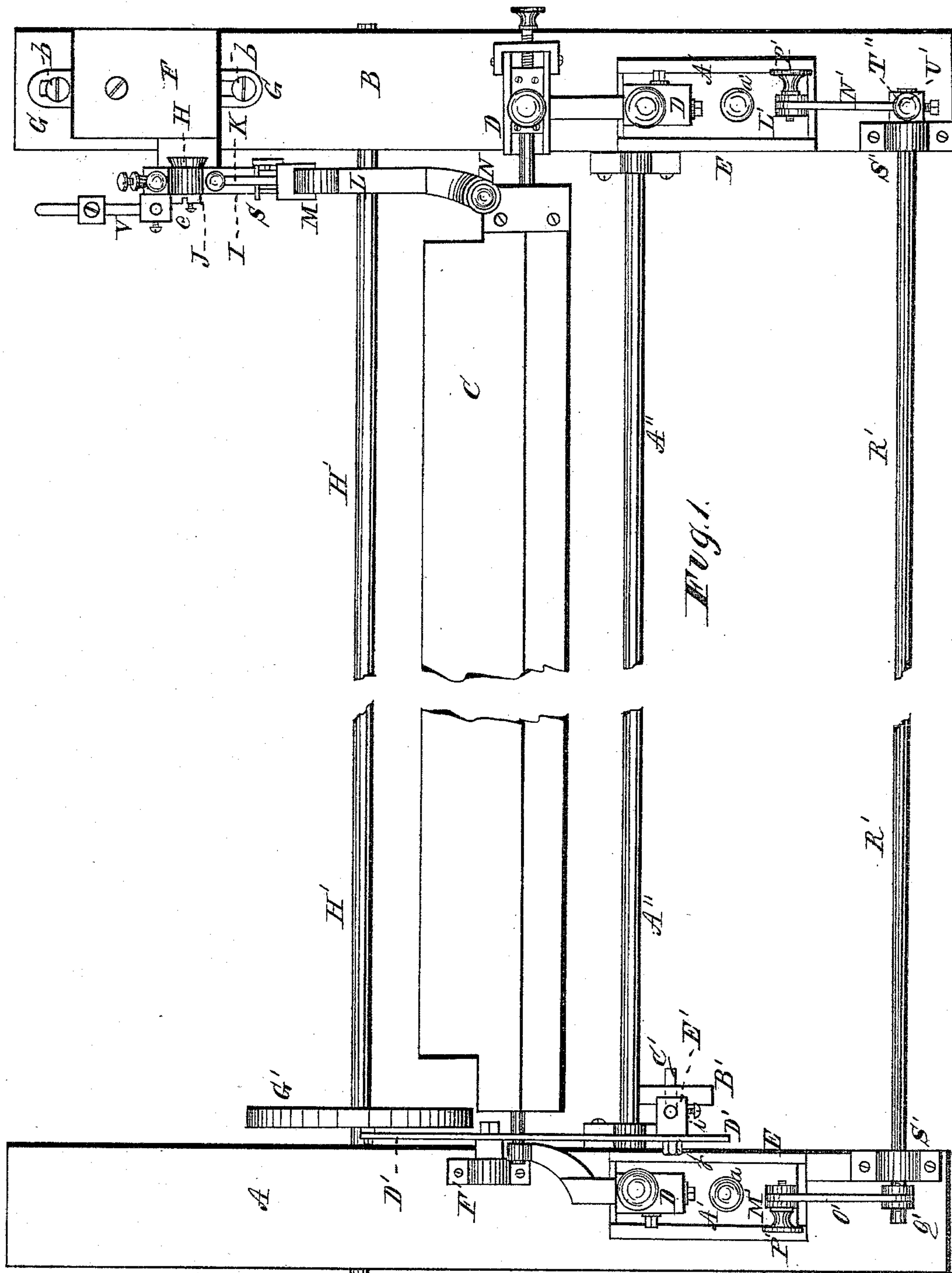
(Model.)

2 Sheets—Sheet 1.

J. C. FORMAN.  
PAPER RULING MACHINE.

No. 401,151.

Patented Apr. 9, 1889.



Witnesses.  
J. H. Burridge.  
A. M. Culver

Inventor.  
J. C. Forman  
W. H. Burridge, Atty.

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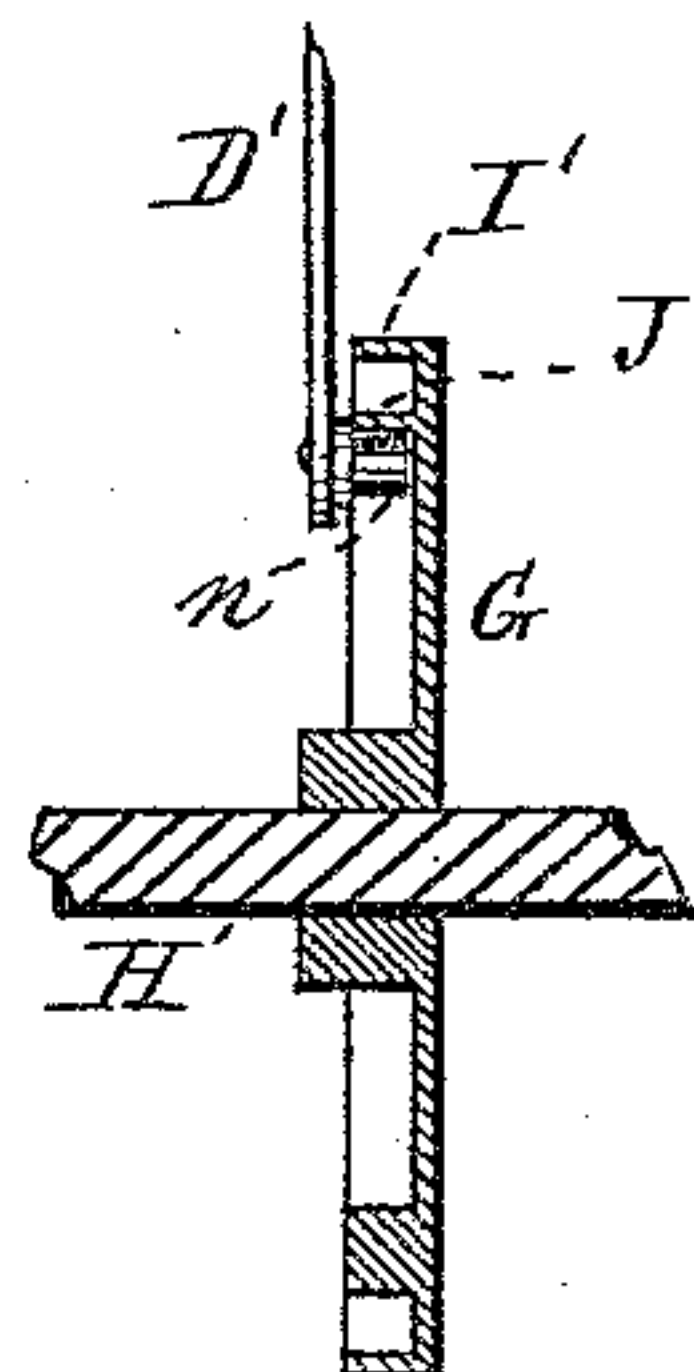
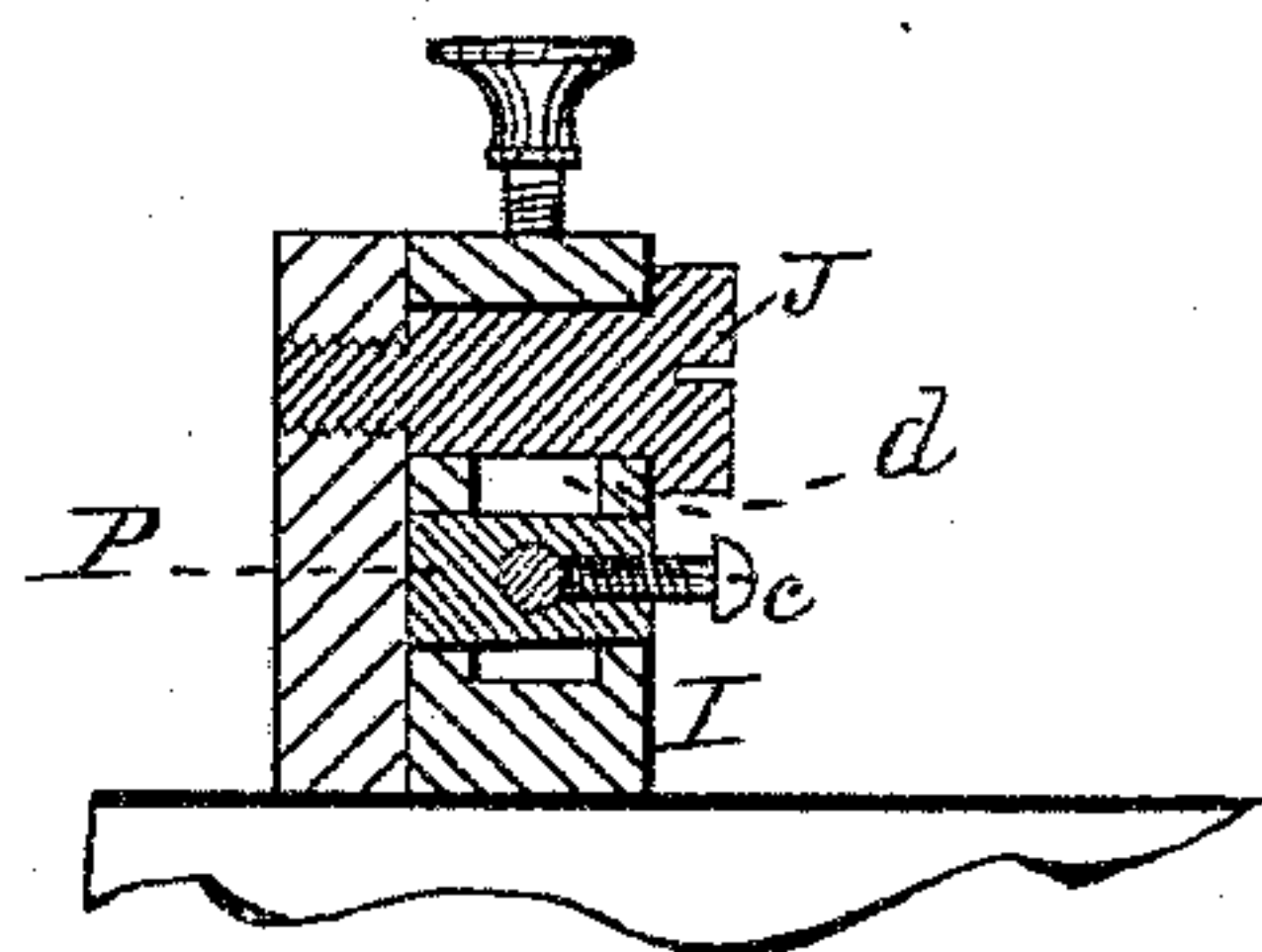
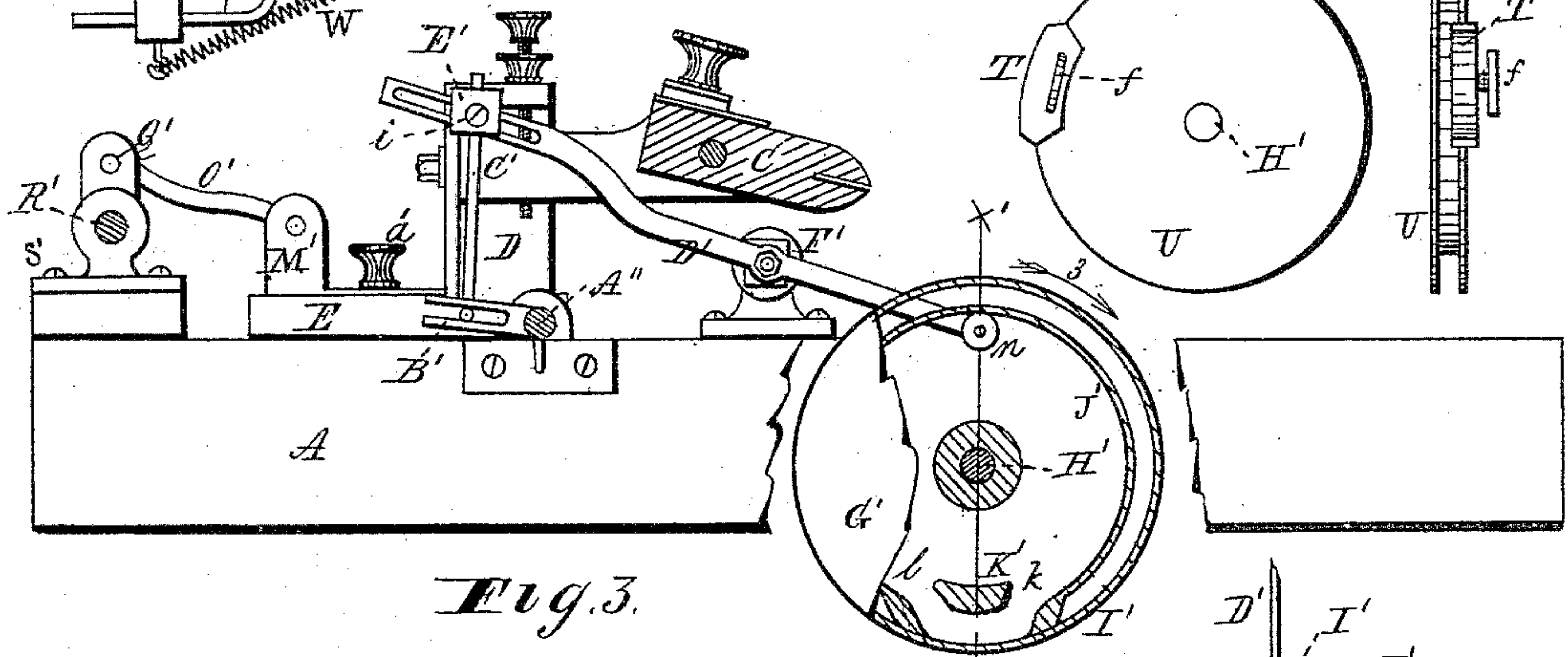
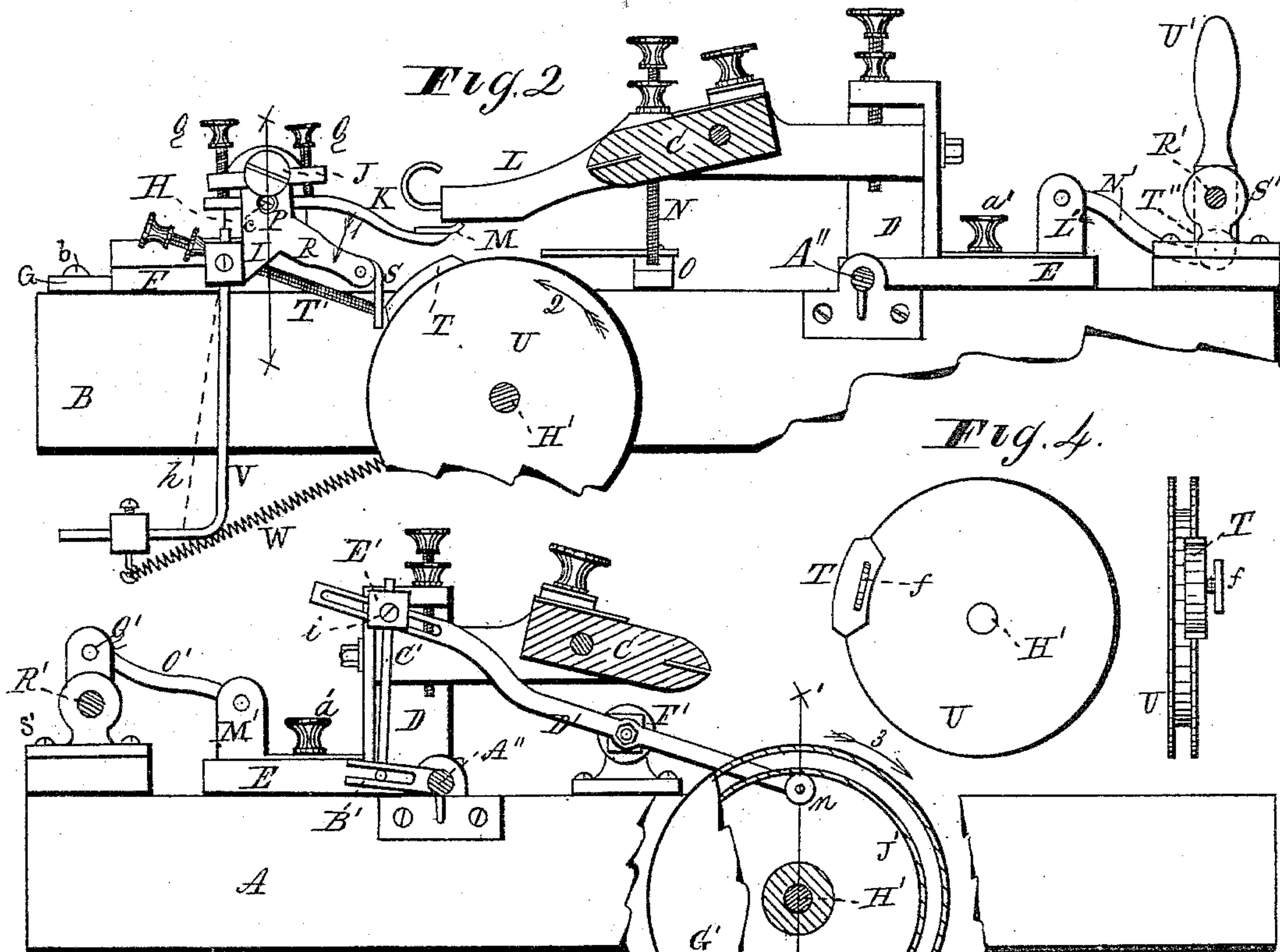
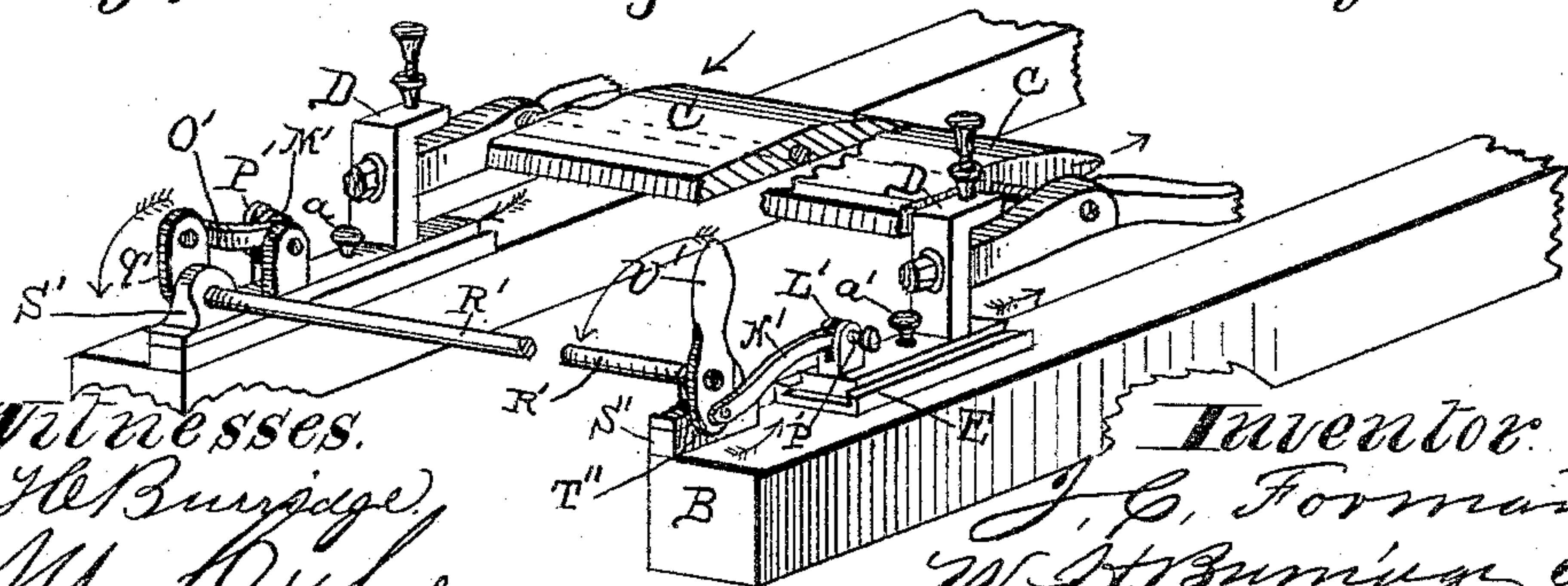


Fig. 7.

Fig. 8.

Fig. 6.



Witnesses.

J. H. Burridge,  
A. M. Oliver

Inventor.

J. C. Forman  
W. H. Burridge atty



# UNITED STATES PATENT OFFICE.

JONATHAN C. FORMAN, OF CLEVELAND, OHIO.

## PAPER-RULING MACHINE.

SPECIFICATION forming part of Letters Patent No. 401,151, dated April 9, 1889.

Application filed March 7, 1885. Serial No. 158,005. (Model.)

*To all whom it may concern:*

Be it known that I, JONATHAN C. FORMAN, of Cleveland, Cuyahoga county, and State of Ohio, have invented certain Improvements in Paper-Ruling Machines, which relate to a new device for operating the pen-beam, whereby a greater degree of accuracy is obtained to the work of ruling, and the same accomplished more expeditiously and with greater facility than when the beam is worked in the ordinary way, all of which will be hereinafter more particularly described, and pointed out in the claims, reference being had to the accompanying drawings, making a part of this specification.

Figure 1 represents a plan view of so much of a paper-ruling machine as is sufficient to show the application thereto of the above-mentioned improvements. Fig. 2 is a view of the inner side of one side of the machine, showing a sectional end view of the pen-beam and a side view of the mechanism for operating it. Fig. 3 is a view of the corresponding opposite inner side of the machine, showing a sectional end view of the pen-beam and side views of the devices for a parallel adjustment of the same, and also a side view of the mechanism for operating the gate. Figs. 4, 5, 6, and 7 are detached sections. Fig. 8 is a perspective view of that part of the machine by which the adjustment of the ends of the pen-beam is effected, as seen in elevation in Figs. 2 and 3 and in plan in Fig. 1.

Like letters denote like parts in the several drawings.

As above stated, only so much of a paper-ruling machine is shown in the drawings as will be sufficient to show the relation thereto of the new parts. The general construction of the machine, however, is or may be like ruling-machines in common use.

As shown in the drawings, A and B represent the two sides of the frame upon which the pen-beam C is hung in the arms of the adjustable standards D D, Figs. 1, 2, and 3. The foot of each standard is fitted to slide in a groove formed in a base-plate, E, fixed to the frame of the machine. The standards are made fast in the grooves of the base-plates by set-screws  $a'$ , which may be moved or adjusted in the plates, as and for a purpose hereinafter explained.

F, Figs. 1 and 2, is a base-plate adjustably secured to the top of the side B of the frame by set-screws  $b$  inserted in the slots of the ears G of the base-plate.

To the side of the stud H, Figs. 1 and 2, projecting upward from the base-plate F, is pivoted a rocker-head, I, of which J is the pivotal screw.

K is an arm, adjustably secured in the rocker I by the set-screw  $c$ , and said rod extends to and terminates under the end of the lifting-arm L of the pen-beam. To the front end of the said rod is secured a face-plate, M, having an upturned edge, on which the arm of the pen-beam rests while being lifted, but which is not in contact with the plates when the arm is down and the pens are ruling, in which position the beam is supported by the adjusting-screw N, Fig. 2, resting upon the support O. Said screw N is for retaining the pens in their adjustable contact with the paper while being ruled, and is operated for that purpose in the ordinary way.

The arm K, above referred to, is so secured in the rocker that it may have a vertical vibratory movement, and to this end an elongated opening is made through the rocker, as seen at  $d$  in Fig. 7, said figure being an enlarged sectional view taken through the line  $x x$  in Fig. 2. The arm K in passing through the opening  $d$  also passes through a cylindrical and slightly-tapering core, P, having its bearing in the sides of said opening  $d$  and free to turn therein for the vibratory movement of the arm, which is secured in the core by the set-screw,  $c$ , substantially as seen in Fig. 7. An end view of the core and the set-screw are shown in Fig. 2. The vibratory movement of the arm K is for raising or lowering the end thereof that it may lift the arm L of the pen-beam to obtain the proper touch and pressure of the pens on the paper, which is done by the adjusting-screws Q, operated for that purpose as in the ordinary ruling-machines.

The object of the arm K in its adjustment is for operating the pen-beam when short or long pens are used. If the former, then the beam has to be lowered to give the proper bearing of the pen on the paper, the same as when long ruling-pens are used, only the beam has to be raised. These adjustments of the pen-beam require the arm K to be raised and



lowered, according as it carries or operates the beam when ruling. Then it has to be adjusted out and in or longitudinally to reach the proper place on the beam-arm that rests upon it to adjust the same for pens of different lengths. This is done by loosening the set-screw *c* in the tapering core *P*, which is held in its place when secured by the set-screw. The tapering core *P* is necessarily made so to prevent its being drawn out. The core must have a free movement to allow the arm *K* to be adjusted up and down and admit of a longitudinal movement of the arm *K* in adjusting the pen-beam. The vibrating movement of the arm *K* is accomplished by means of the adjusting-screws *q q*. These devices for adjustment are very essential and contribute very important elements in the operation of the pen-beam in ruling paper in the many changes of patterns required.

In the arm *R*, Figs. 2 and 5, of the rocker is pivoted a face-plate, *S*. Above the axial line of the pivoted connection of the plate with the arm is interposed a spring, *e*, between the connecting-eye of the plate and the back of the slot, in which it is pivoted. The use of said spring is to give steadiness to the plate *S* when impinged upon by the cam *T*, and bring it back against the adjusting-screw *T'*. The cam *T* alluded to is made fast to the drum *U* by a set-screw, *f*, Fig. 4, in which it will be seen that the cam is fixed to one edge of the drum, and is adjustable thereon to any position required, and any number of cams may be used as the nature of the work may demand.

The drum *U* is so arranged in its relation to the face-plate *S* of the rocker that as it revolves in the direction of the arrow 2, Fig. 2, the cam will impinge upon said face-plate *S* and vibrate the rocker for operating the pen-beam practically as follows: As shown in the drawings, the arm *L* is resting on the edge of the plate *M* of the arm *K*, tilting the pen-beam so far as to lift the pens from the sheet, (supposed to be in place for being ruled.) In this position of the beam no ruling of course is done by the pens while the sheet is passing under them; but the moment the head-line previously drawn on the sheet comes to and passes under the pens, the pens are instantly dropped to the sheet in time to strike the head-line without crossing it and the column-lines drawn therefrom to the length required. The pens are then lifted from the sheet by the reaction of the spring *W*, Fig. 2, as the work being done may require in case there be several head-lines.

The dropping of the pens above mentioned is done by the cam *T* in its engagement with the face-plate *S*. The impingement of the cam on the plate forces the arm *R* in the direction of the arrow 1, Fig. 2, and vibrates the rocker *I*. This movement of the rocker carries with it the arm *K* and plate *M* from under the lifting-arm *L*, thereby causing the pen-beam to drop the pens to the sheet for

the purpose above stated. The descent of the pen-beam or pens is arrested at the proper time for their required contact and pressure on the sheet by the adjusting-screw *N*, the end of which drops onto the rest *O* and holds the beam in position while the pens are ruling, during which time the face-plate *M* is not in contact with the arm *L*, thereby avoiding the transmission of any movement of the rocker to the pen-beam that would otherwise interfere with the work of the pens and cause broken or irregular lines.

Column-ruling is done during the time that the plane of the cam is in contact with the face-plate *S*. The instant the cam leaves the face-plate the rocker reacts, thereby causing the arm *K* to start upward and elevate the arm *L*, and consequently lifts the pens from the sheet in time to allow the head-lines of a following sheet to pass under them, which, when passed, the pens are again dropped, as and for the purpose above described.

The lifting of the pens as alluded to, and for the purpose specified, is surely done as follows: While the arm *R* and the arm *K* of the rocker *I* were being forced down by the cam, the arm *V*, Figs. 1 and 2, attached to the rocker was at the same time carried to or about to the dotted line *h*, thereby giving tension to the spring *W*, connecting the end of the said arm *V* to the side *B* of the frame of the machine. It will be noted that when the said cam *T* has passed from its contact with the face-plate of the arm *R* the resilience of the spring will cause a reverse movement of the rocker and bring it to the position seen in Fig. 2. This action of the rocker carries the arm *R* and arm *K* upward, causing the end of said arm to elevate the lifting arm *L* of the pen-beam, and thereby lift the pens from the sheet for the purpose above mentioned. From the aforesaid statements it will be seen that the vibratory action of the rocker caused by the cam, and the cam and spring alternately, lifts the pens from the sheet and drops them thereon in timely successive order and regularity as the cam or cams may be adjusted for the various kinds of work.

The preceding described operation of the machine as shown is simple and more efficient in producing accurate work than can be done by the mechanism now used for that purpose in this class of machines.

The improvements referred to further relate to devices for operating the gate of the machine, said gate being constructed substantially like those in common use in ruling-machines and being arranged in about the same relation to the pen-beam.

In Figs. 1 and 3 *A''* represents the gate referred to, having its axial bearing in suitable seats attached to the sides of the frame of the machine. *B'* is a bifurcated arm projecting from the bar of the gate. In said arm is inserted one end of a connecting-rod, *C'*. The upper end of the rod *C'* is secured to the end



of the lever  $D'$  by means of an adjustable block,  $E'$ , through which the rod passes, and which is made fast therein by a set-screw,  $i$ . The block  $E'$  is secured to the lever by inserting the threaded neck of the block in a slot in the arm of the lever, and made fast therein at any desired point by the nut  $j$ . (Seen in Fig. 1.) The lever  $D'$  alluded to is pivoted to the side of the frame at  $F'$ , forming the fulcrum of the lever. The opposite end of the lever extends to and terminates in a closed or inside cam-wheel,  $G'$ , Fig. 3, mounted on the shaft  $H'$ , carrying the drum  $U$  and cam  $T$ , above described. An inside view of said cam is shown in Fig. 3, in which it will be seen that it consists of a disk provided with a peripheral flange,  $I'$ , Fig. 6, within which flange is an annular rib,  $J'$ , corresponding in width to that of the flange.  $K'$  is a cam inserted in the line of the rib, which is cut away for its admission, having at each end of the rib a space some distance from the ends of the cam, thereby forming passage-ways  $k$  and  $l$ , respectively, at each end of the rib.

It will be noticed that the outer side,  $m$ , of the cam is in alignment with the outer side of the rib, and that the inner side of the cam extends inward beyond the rib, thereby forming a shoulder near the end of the rib, as seen in Fig. 3. The lower end of the lever  $D'$  is provided with an anti-friction roller,  $n$ , adapted to run along the inner side of the rib, as shown in Figs. 3 and 6, Fig. 6 being a sectional view through the line  $x'x'$  in Fig. 3. An anti-friction roller is not essential, as a pin or wrist may be used instead of a roller; but a roller is preferred.

Practically the application of the above-described cam-wheel and lever for operating the gate is as follows: The use of the "gate," so termed, in paper-ruling machines is too well known in the art to require its being set forth in this place. As the cam-wheel revolves in the direction of the arrow 3, and the block or cam  $k'$  comes to the roller  $n$  or a pin, the roller impinges upon the shoulder of the passage-way  $l$ , and is forced thereby up said way  $l$ , and runs over the side  $m$  of the cam to the way  $k$ , through which it passes to the side of the rib on which it rolls as the cam-wheel continues to revolve, and brings the way  $l$  of the cam again to the roller, up which it passes, and over the plane of the cam, as before, and so on, as the cam-wheel continues to rotate. The action of the cam on the roller end of the lever elevates said end and depresses the opposite end accordingly, which, by its connection to the arm of the gate by the connecting-rod  $C'$ , lifts the gate to allow the sheet to pass forward to the pens for being ruled. The gate is held open while the sheet is passing through by the contact of the roller on the plane or side of the rib, as seen in the drawings, and the gate again instantly closed by the cam when the sheet has passed through, thereby arresting the next following sheet until the proper time for it to pass, when the

gate is opened for that purpose, as above described. Further notice will be called to this part of the machine hereinafter.

A further improvement is for adjusting the pen-beam to a parallel relation to the head-line on the sheet, which often varies more or less from being at right angles to the side of the sheet and therefore is more or less not parallel with the pens, which should be so placed that all the column-lines may start directly from the head-line, and not some from the head-lines and others some distance therefrom, while others may possibly cross the head-line, which irregularity would be the case if the pens were not in an exact parallel relation to the head-lines on the sheet. To adjust the pens in conformity to the direction of the head-lines, the pen-beam is moved more or less diagonally across the machine as the oblique direction of the head-line may require to bring the pens parallel therewith. That this adjustment of the pen-beam may be done with facility and precision is the object of this further improvement, which consists in moving both ends of the pen-beam at once and in opposite directions, instead of moving only one end for that purpose, as in ordinary ruling-machines. Both the ends of the pen-beam are moved for the said purpose by the following-described means.

As hereinbefore mentioned, the foot of each standard supporting the pen-beam is fitted to slide in a base-plate,  $E$ , that they may be moved for adjusting the pen-beam. In the foot of said standards are inserted short posts  $L'$  and  $M'$ , Figs. 1, 2, and 3, and to said posts is pivoted one end of each of the connecting-links  $N'$  and  $O'$ , respectively, by means of the set-screws  $P'$ , Fig. 1. The opposite end of the link  $O'$  is connected to an arm,  $Q'$ , Figs. 1 and 3, on the end of the shaft  $R'$ , journaled in the boxes  $S'$ . On the opposite end of the said shaft is a corresponding arm,  $T''$ , Fig. 2, to which the connecting-rod  $N'$  is attached.  $U'$  is a handle, an integral part of said arm  $T''$ , and by which the shaft is rocked for operating the two arms  $Q'$  and  $T''$  conjointly and co-ordinately for moving the pen-beam.

It will be noticed that the two arms  $Q'$  and  $T''$  are in a reverse direction respecting each other. The arm  $Q'$  projects upward above the shaft, as seen in Fig. 3, whereas the corresponding arm,  $T''$ , projects downward below the shaft in alignment with the handle  $U'$ . In this arrangement of the two arms it will be obvious that as the shaft is rocked by the handle the two arms will move simultaneously, but in a reverse direction to each other. Practically the operation of this arrangement of the said shaft and arms in connection with the pen-beam is thus: As above-said, the head-lines on sheets of paper on coming to the pens are not always parallel therewith, as they should be for doing good work. In order to produce a parallel relation of the pens and head-lines, the ruler, by means of the handle  $U'$ , rocks the shaft  $R'$ ,



through which, by its connection with the pen-beam standards, as above described, both ends of the beam are moved at once in opposite directions, thereby adjusting the pens to the oblique direction of the head-lines in the most exact manner, and that without materially changing the proper place of the column-lines.

In ruling-machines now in use the pens are adjusted to the head-lines by moving one end of the beam only, the opposite end being the pivotal point of the beam movement. In this way of adjusting the pens the free end of the beam must sometimes be moved so far for the pens to meet the head-line as to cause a displacement of the pens from the desired place for the column-lines, thereby causing the column-lines to be ruled more or less out of place and all the lines not ending at the head-line and some crossing it, for those near the pivotal end of the beam will be nearer to the head-line than those farther therefrom; hence some of the column-lines touch the head-line, while others do not, and some may run over, the result of which is defective or bad work. This defect in adjusting the pens by moving only one end of the beam is avoided by moving both ends of it, as above described, so that the distance the pens are to be adjusted to the head-lines is divided one-half of the distance at each end of the beam; hence there can be no material displacement of the column-lines, and all of them will be equally started from the head-line; also, the adjusting of the beam is more conveniently done by the ruler, as he is not obliged to leave the side of the machine as in the old way of moving only one end of the beam, but simply uses the handle U' within his reach for adjusting the pens for the purpose specified. This practical adjustment of the beam is for hand-work and will produce a fine quality. For striker-work the connecting-link N' may be disconnected from the standard L' and the sliding foot of the standard made fast to the base-plate by the set-screw a', whereas the opposite link, O', remains connected to the standard M', Fig. 3, which is loosened that it may slide in the base-plate E for moving that end of the beam for adjusting it to the head-line without changing the relation of the lifting-arm L and the cam or cams when operating by the striker.

Referring to the device for lifting the pen-beam, hereinbefore described, it will be known to those using paper-ruling machines that to produce good work a steady and uniform speed is necessary. An irregular speed causes defective and ununiform work. Such irregular speed is the result of an irregular movement of the motor driving the machine, a slight variation of which tells directly on the speed of the ruling-machine.

As the strikers are now constructed in ruling-machines, the pen-beam support has attached to it an adjustable foot or toe piece adapted to run over cams secured to a "revolv-

ing drum," so termed, said cams being set on the drum as various work may require, and when so set they are made to travel with the cloth on which the sheets to be ruled are carried.

The adjustment of the cams is such that as they revolve they impinge upon the foot-piece of the beam and lift it and the pens from the cloth. The lifted beam is supported on the continuous plane of the cam until the head-line to be struck is reached, at which point the last cam is set to let the beam drop, bringing the pens to the sheet for ruling, which is then done while the beam is not held by the cams. In this way of lifting the pen-beam a spring is used to cause a descent of the beam that the pens may strike the head-line passing under them.

Referring to the "gate," so termed, of the machine many devices have been devised for operating it, but which fail to act with such precision as to produce the closeness and quality of work desired, for the reason that it is seriously affected by the varying speed of the machine in a similar manner to that mentioned respecting the pen-beam, and also the head-lines of the paper being ruled. The use of the gate is well known to retain each sheet fed to the machine until the proper time to allow it to pass on to the pen in successive order following the sheets passing from under the pens.

In the improved way of actuating the gate the spring used for that purpose in ordinary devices is dispensed with, leaving the gate free from any such resisting attachment, so that it is easily and quickly actuated by the lever in its combination with the close cam, it being simply rocked thereby with but little resistance for the purpose intended, and that with a degree of accuracy unattained heretofore.

What I claim as my invention, and for which I solicit Letters Patent, is—

1. In a paper-ruling machine, the rocker I, provided with an arm in which is secured a face-plate, S, arranged in relation and in combination with the drum U and cams thereon, and spring for operating said rocker, pen-beam C, and arms L and K, substantially as described, and for the purpose set forth.

2. In a paper-ruling machine, the combination of a rock-shaft arranged in the rear of the pen-beam and having at each end thereof an arm whereby the ends of the shaft are attached by suitable connecting rods or links to the sliding standards of the pen-beam, respectively, for moving simultaneously and oppositely both ends of the pen-beam, for the purpose specified, and the pen-beam c, substantially as hereinbefore set forth.

3. The combination of the rocker I, the arms K and L, and pen-beam C, the conical core P, and its set-screw c, for the adjustment of the arm K in relation to the lifting-arm L of the pen-beam.

4. In a paper-ruling machine, the combina-



tion, with the pen-beam and its movable standards, of the transverse shaft provided with devices, substantially as described, at its ends connected with and simultaneously imparting opposite movements to said standards, substantially as set forth.

5. In a paper-ruling machine, the closed cam G' and lever D', having one end thereof adapted to run on the course of the said cam,

in combination with the connecting-rod and to the gate A'', substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JONATHAN C. FORMAN.

Witnesses:

J. H. BURRIDGE,  
W. H. BURRIDGE.