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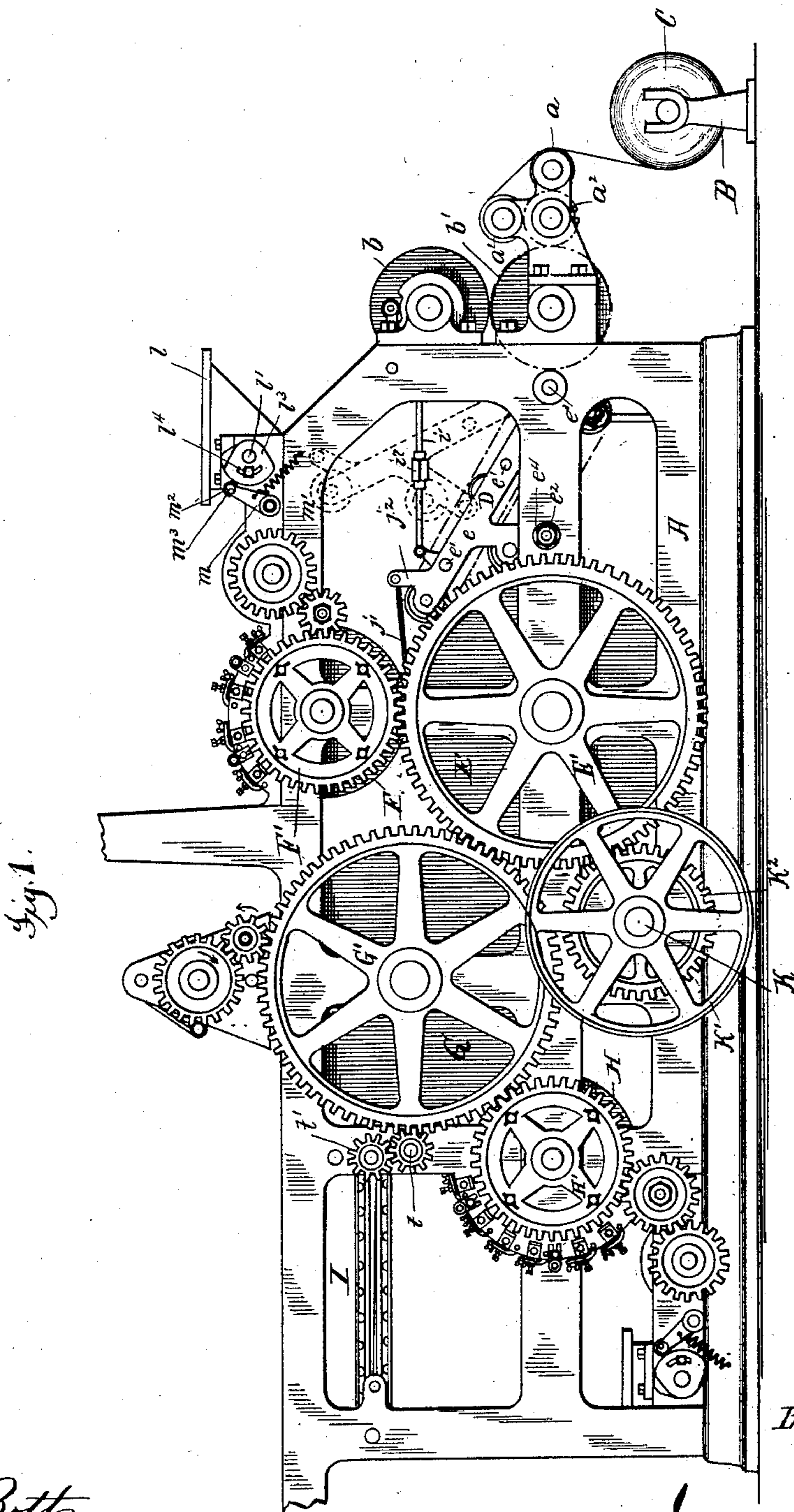
6 Sheets—Sheet 1.

J. L. FIRM.

ROTARY PRINTING MACHINE.

No. 374,355.

Patented Dec. 6, 1887.



Attest:

Geo. H. Bott.

Geo. D Morris

Inventor:

Asper Co. Firm.

Wm. H. Finckel Atty.

(No Model.)

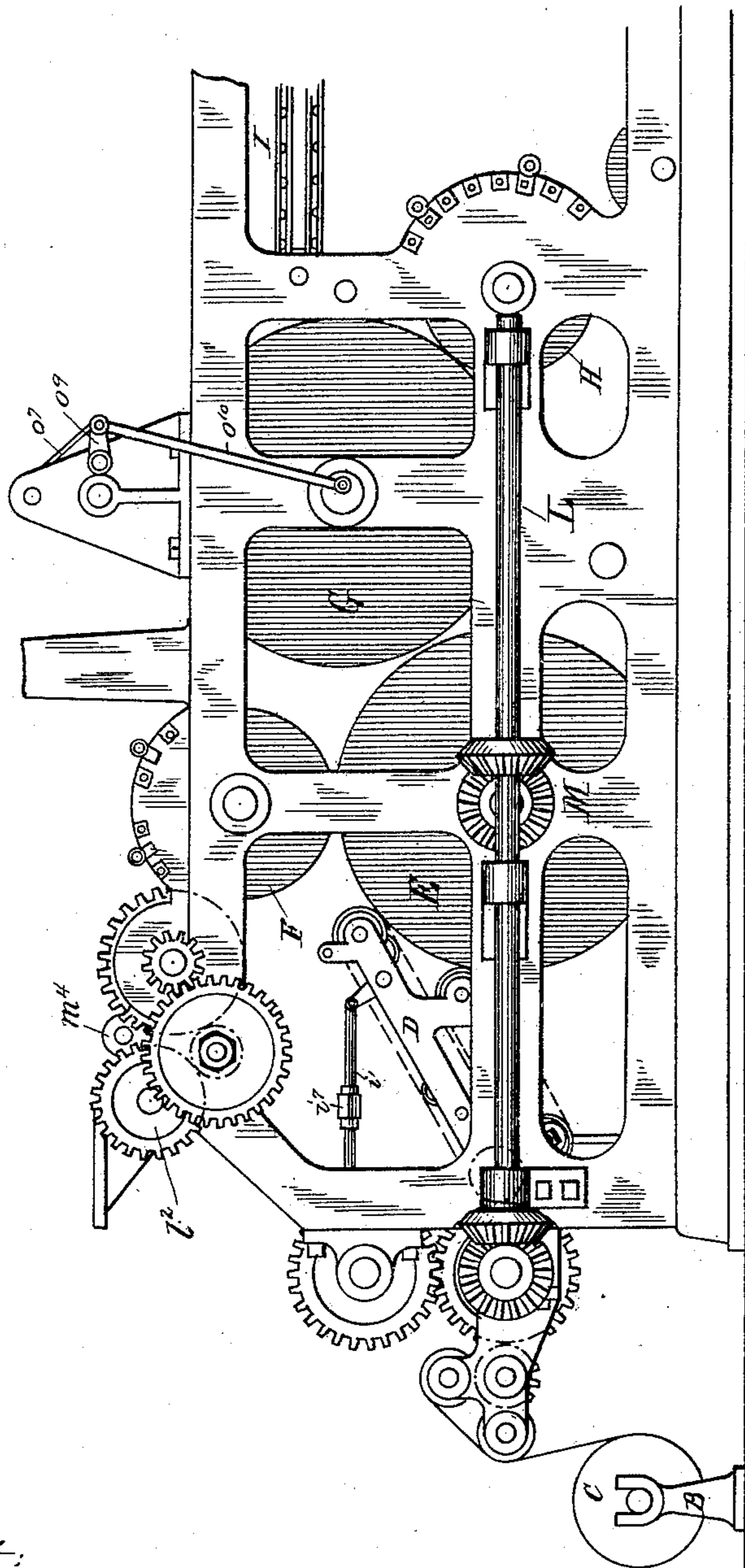
6 Sheets—Sheet 2.

J. L. FIRM.
ROTARY PRINTING MACHINE.

No. 374,355.

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Fig. 2.



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Fig. 17.

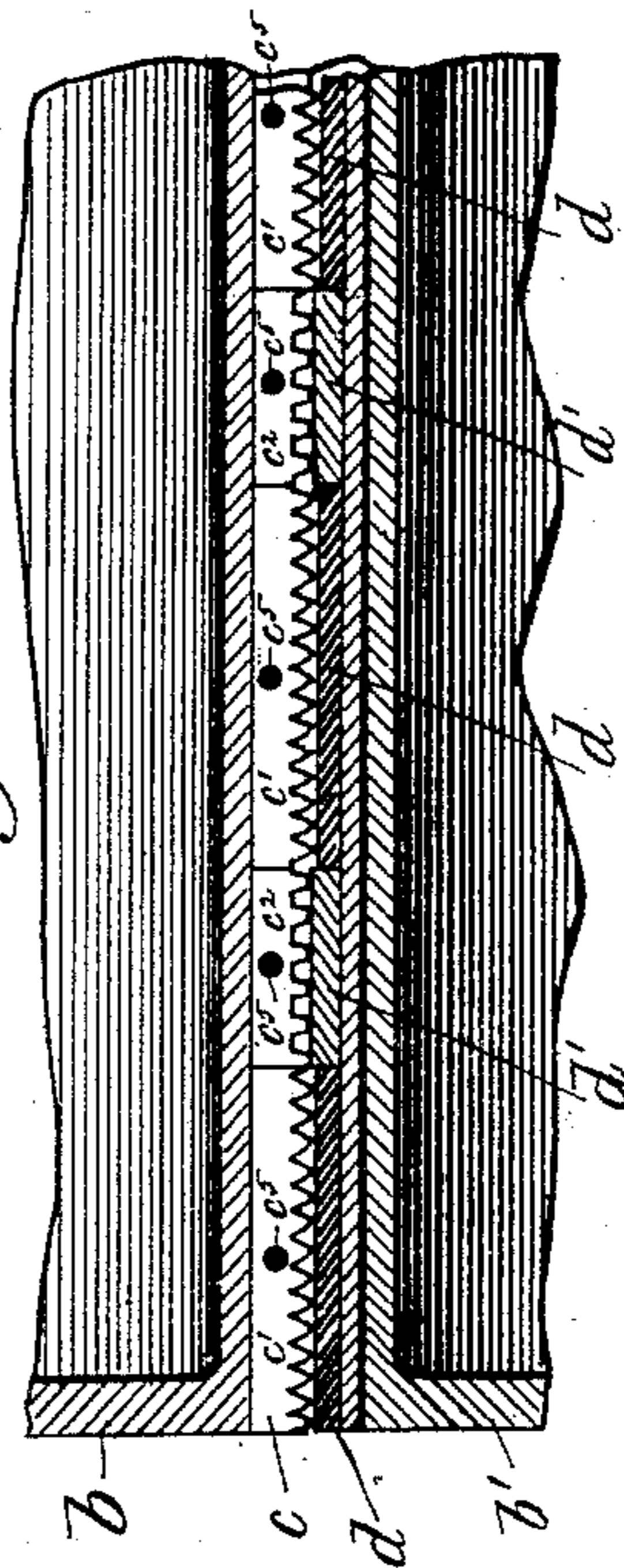
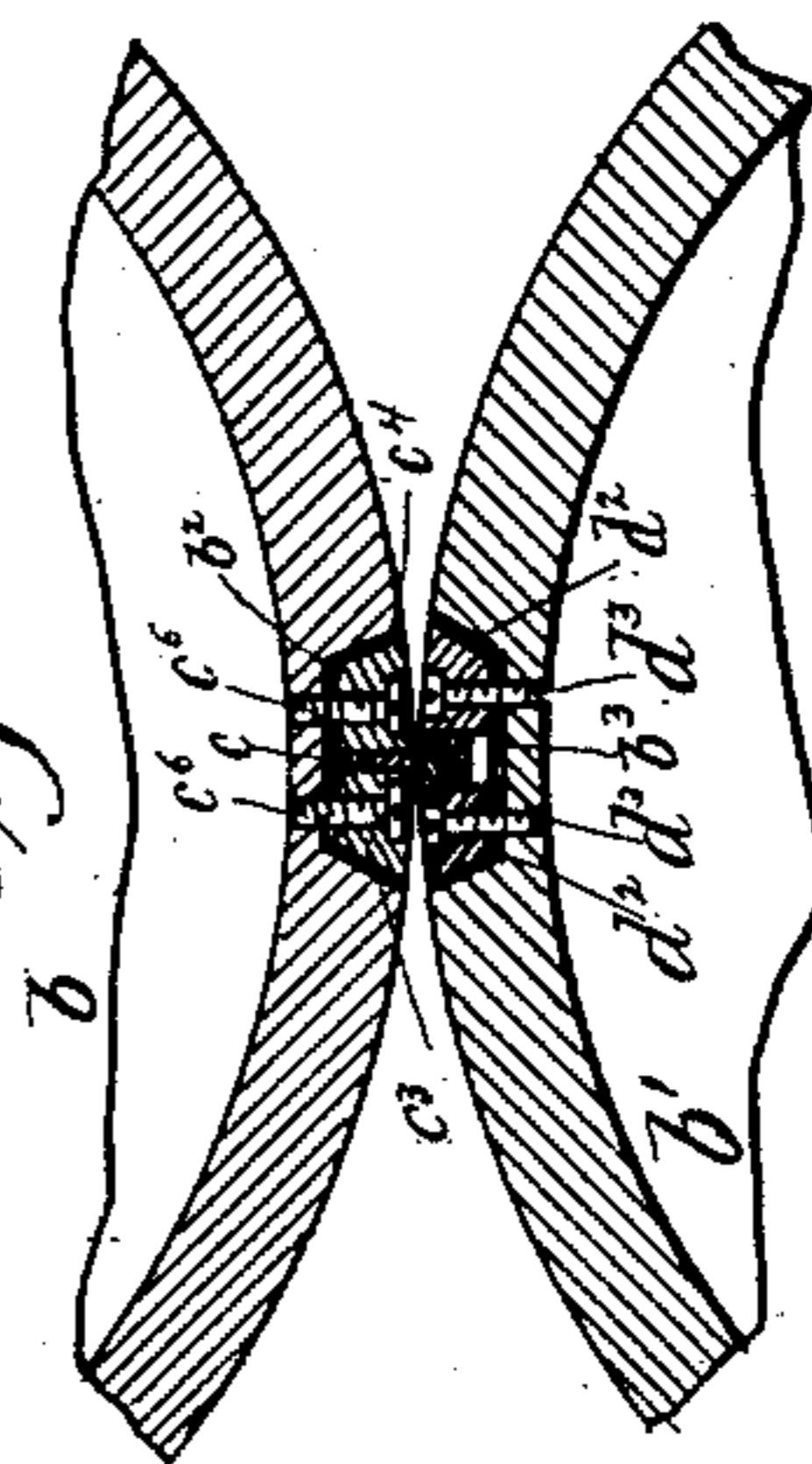


Fig. 16.



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(No Model.)

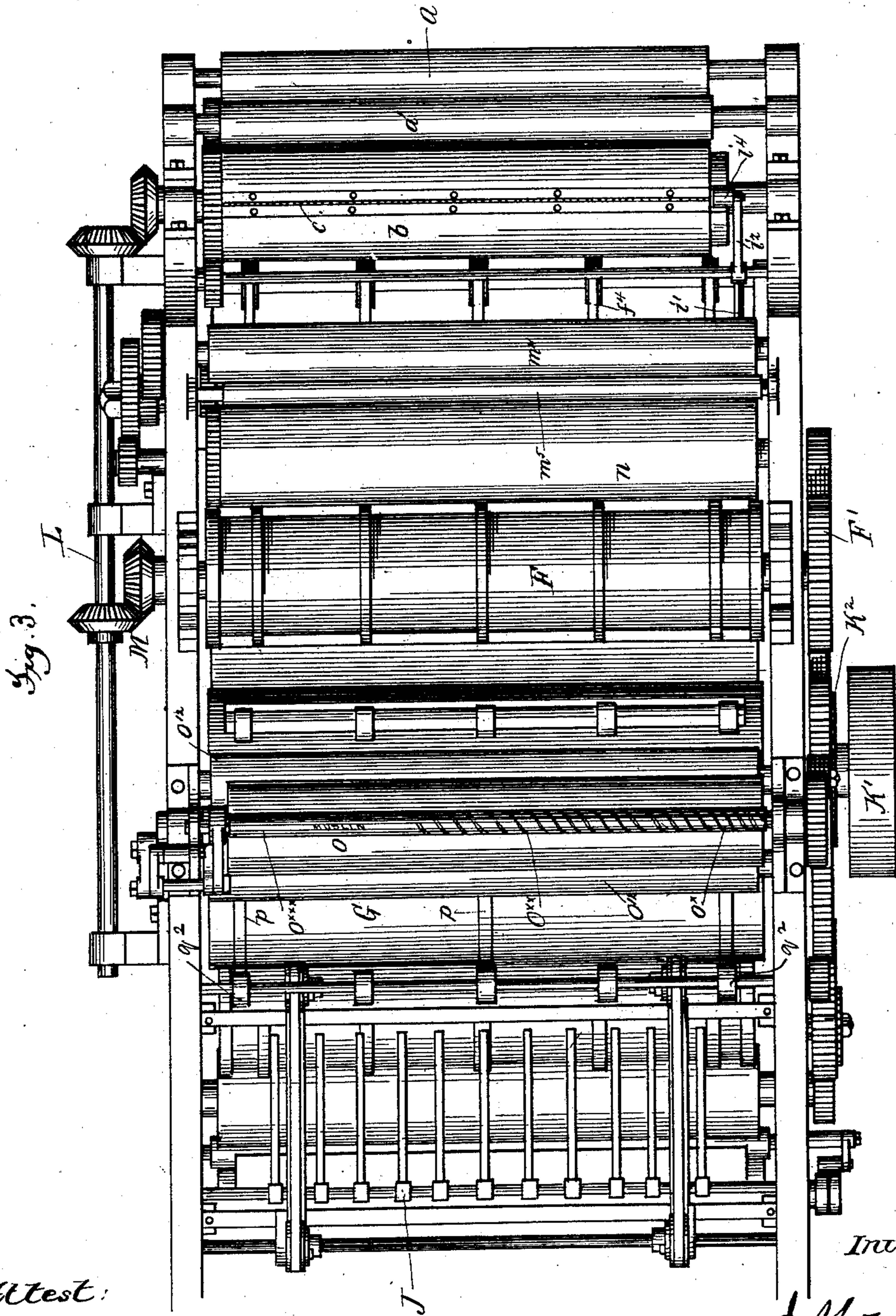
6 Sheets—Sheet 3.

J. L. FIRM.

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No. 374,355.

Patented Dec. 6, 1887.



Attest:
Geo. H. Bott
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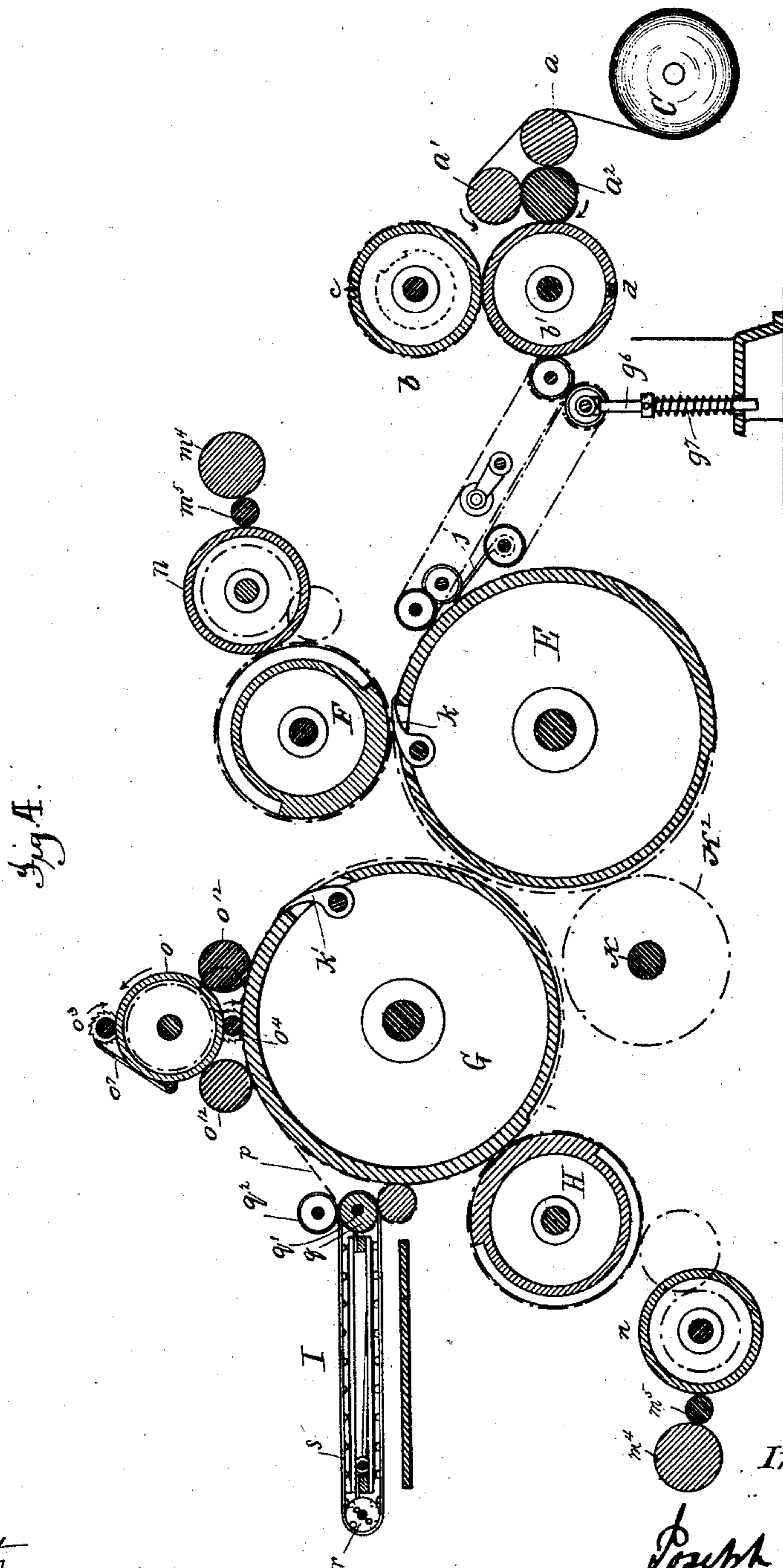
(No Model.)

6 Sheets—Sheet 4.

J. L. FIRM.
ROTARY PRINTING MACHINE.

No. 374,355.

Patented Dec. 6, 1887.



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Geo. H. Roth
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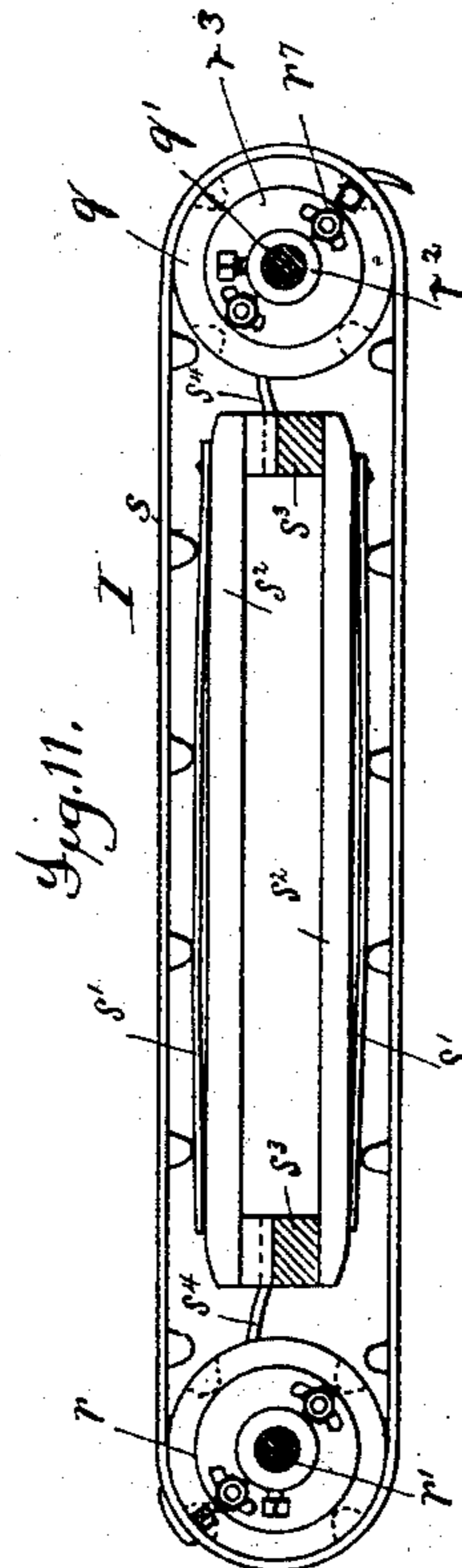
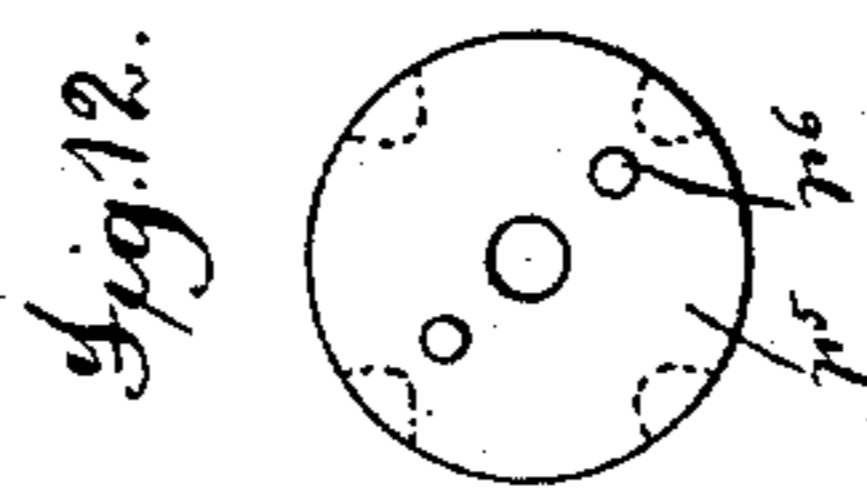
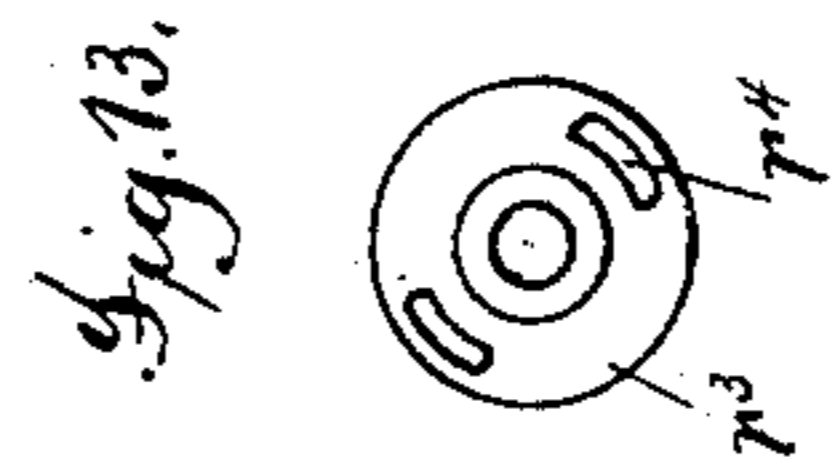
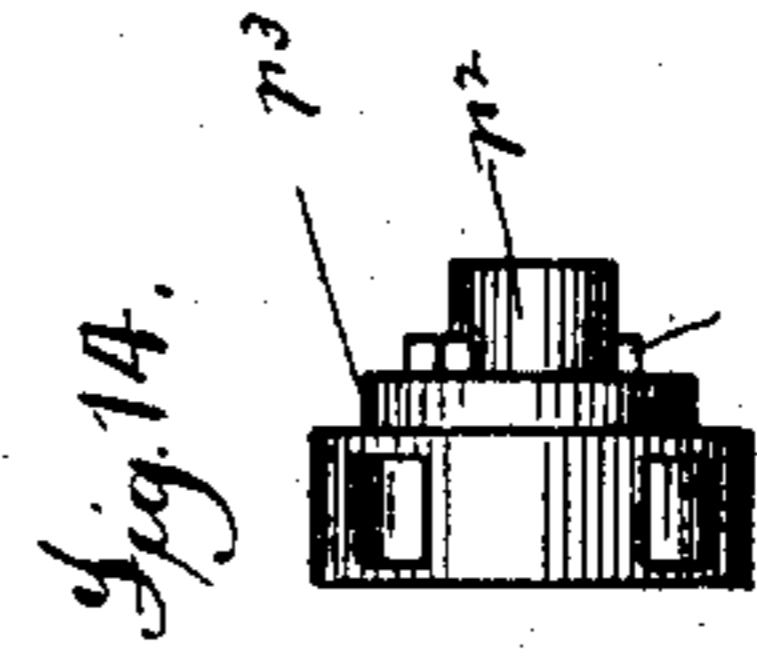
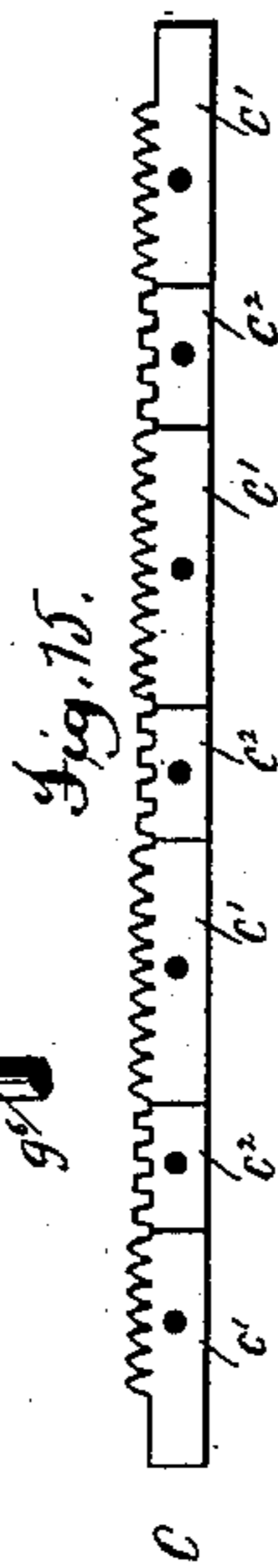
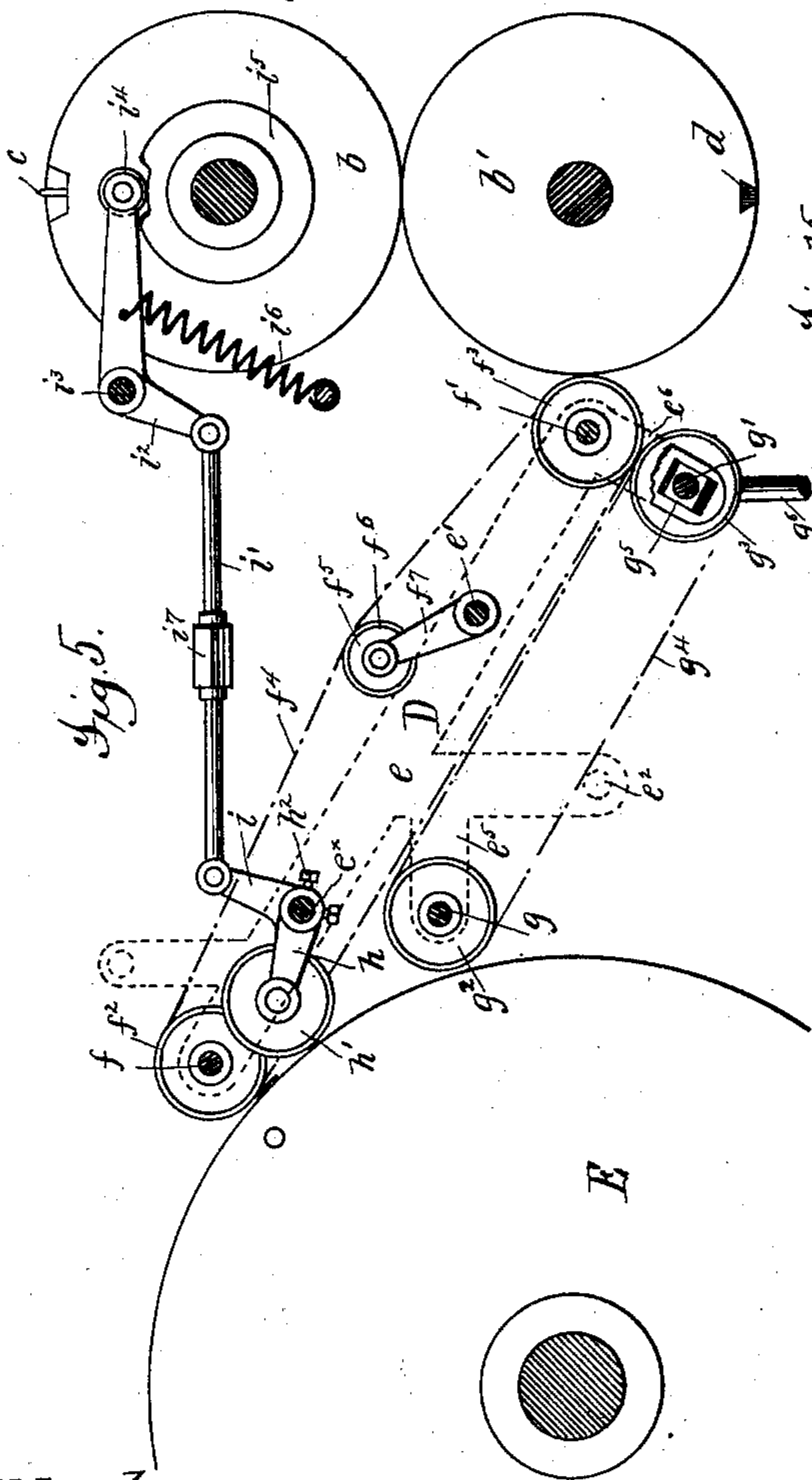
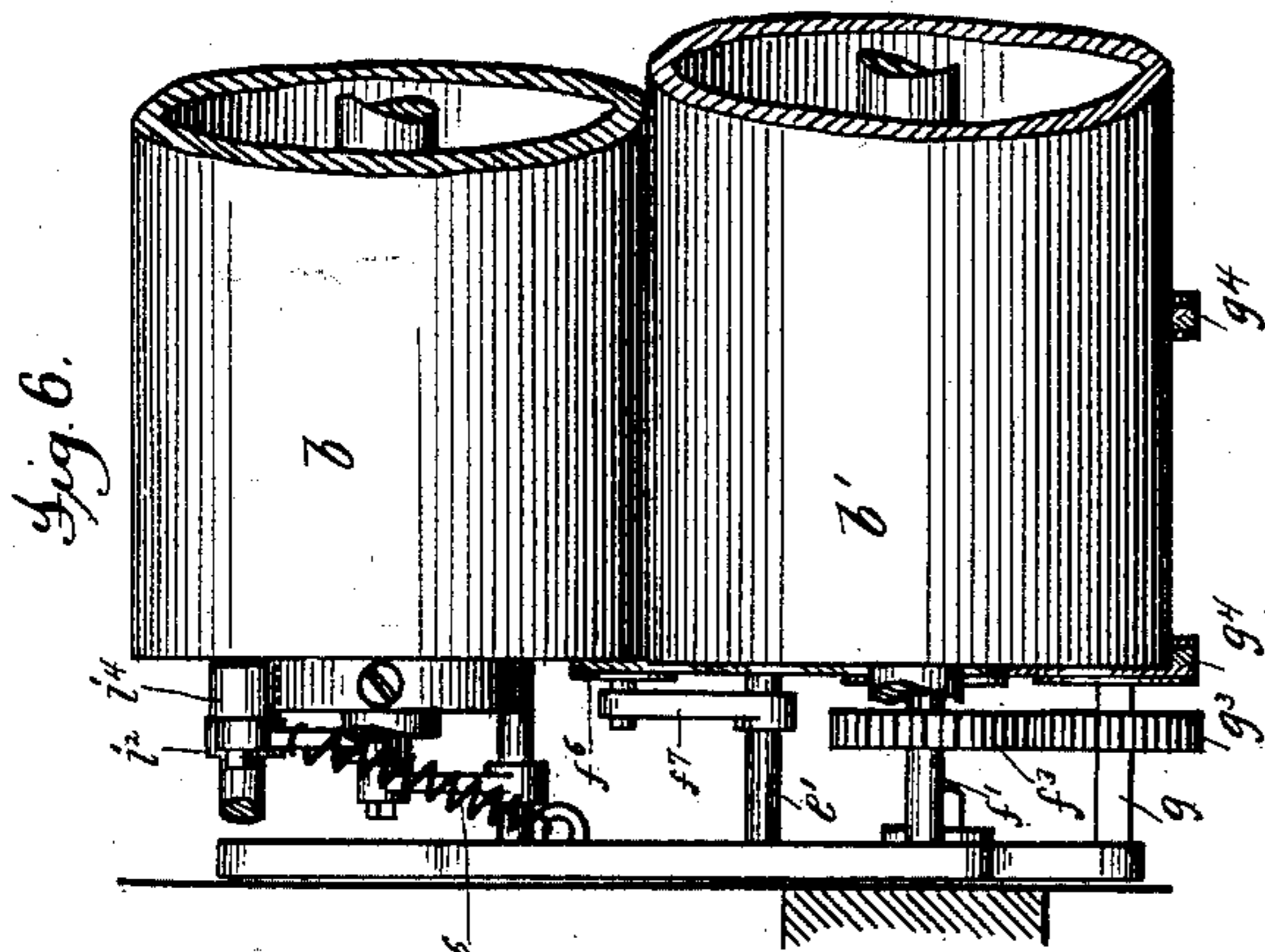
(No Model.)

6 Sheets—Sheet 5.

J. L. FIRM.
ROTARY PRINTING MACHINE.

No. 374,355.

Patented Dec. 6, 1887.



Attest:
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Wm. H. Finckel
Attor.

(No Model.)

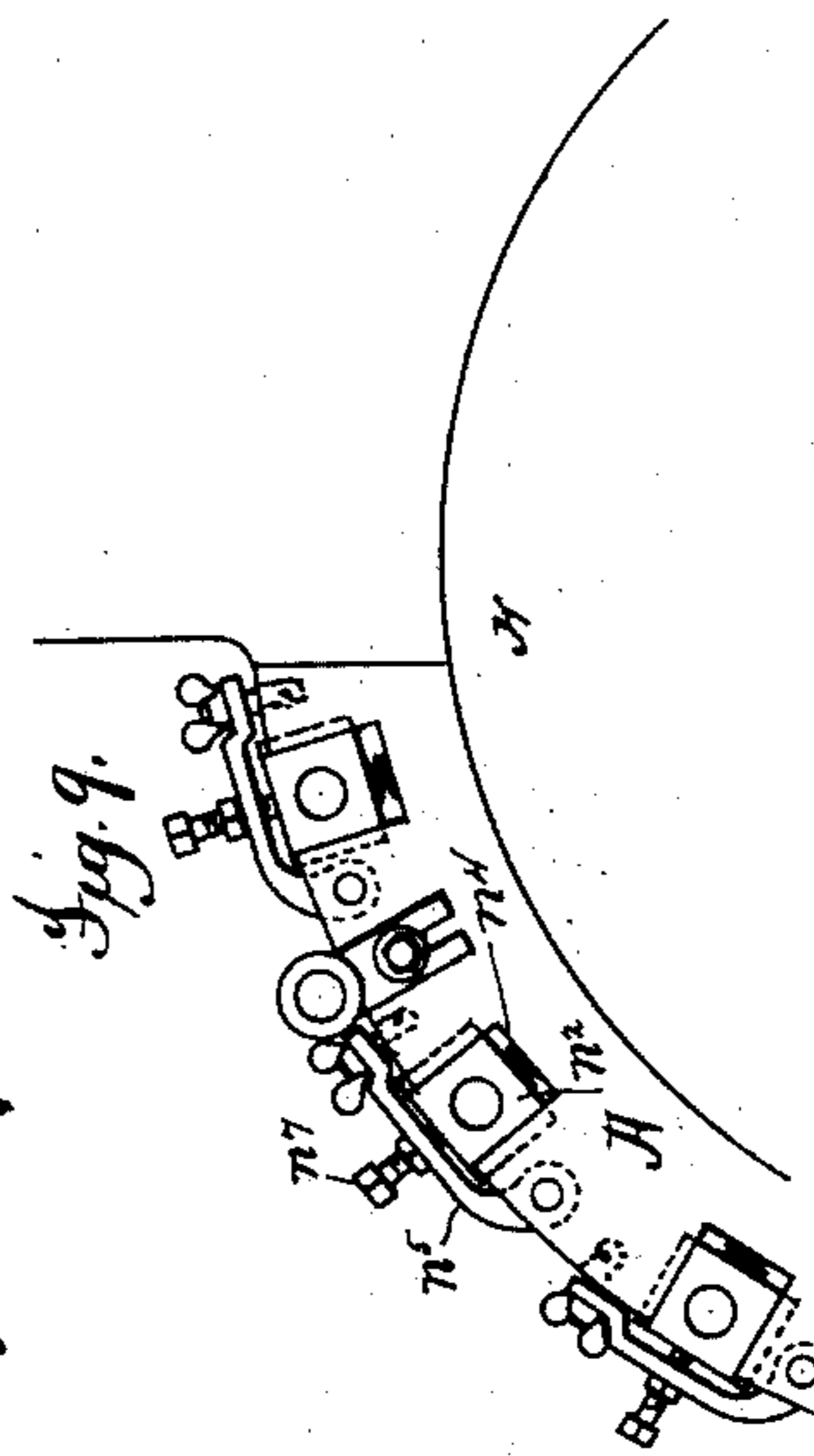
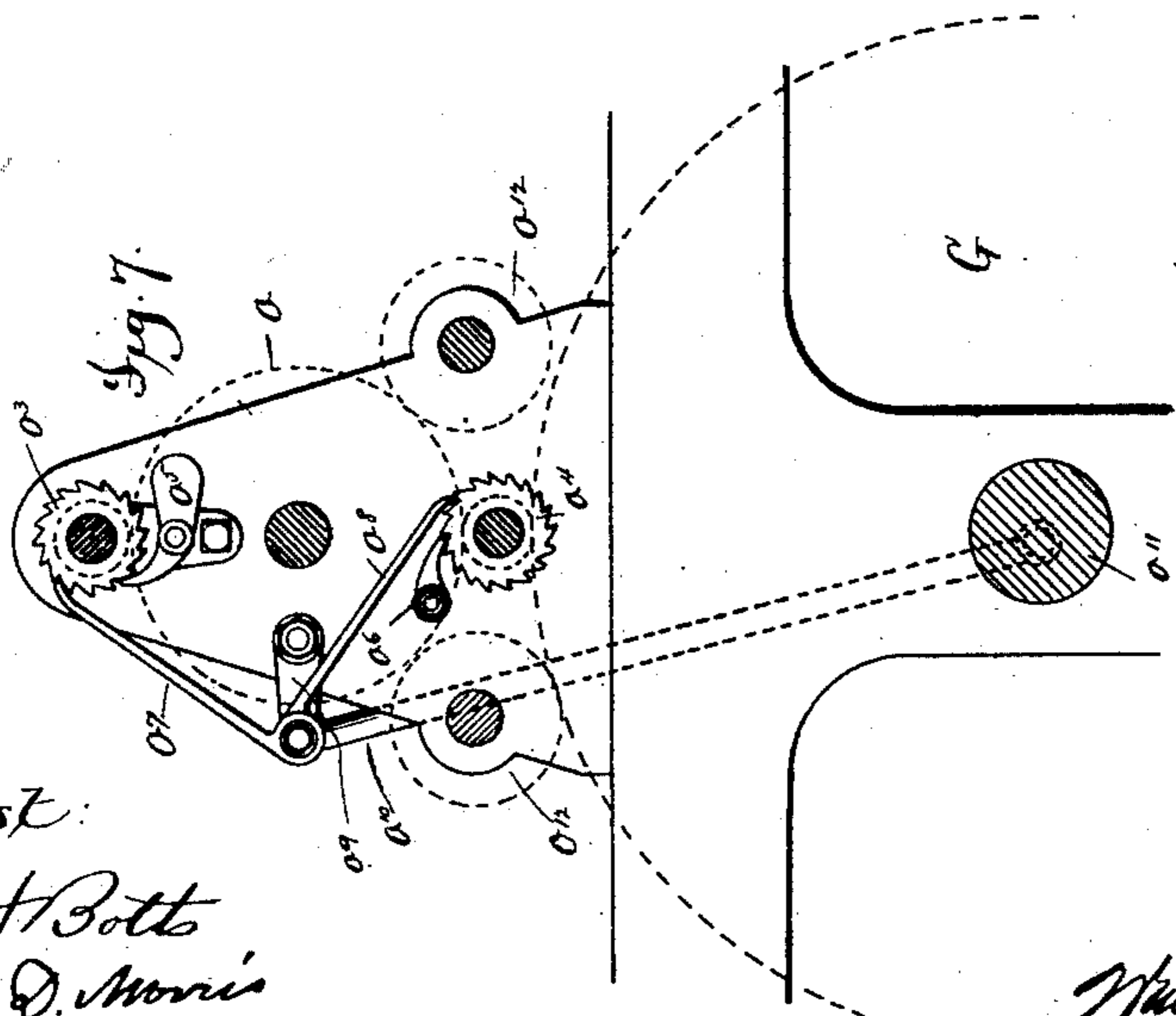
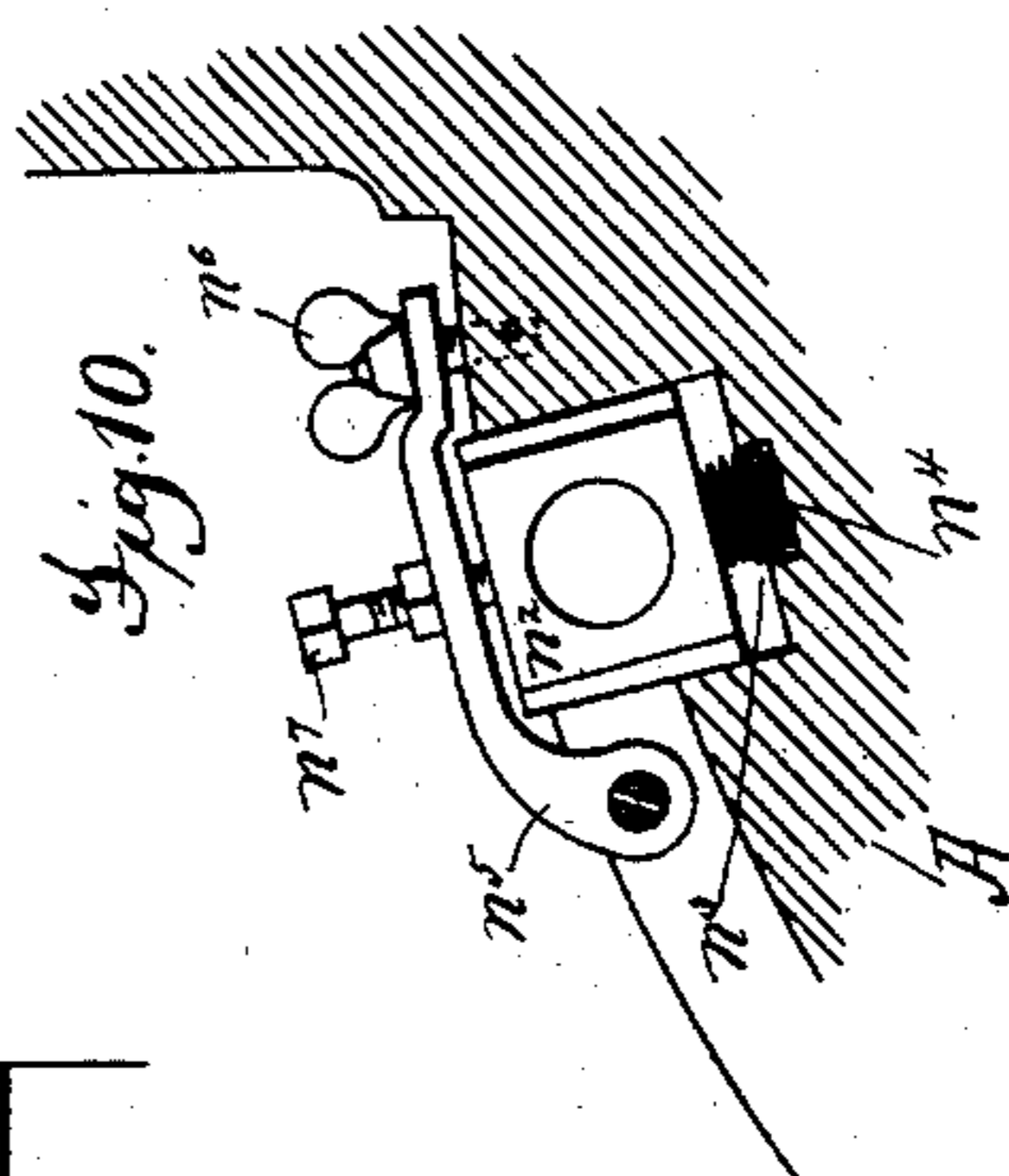
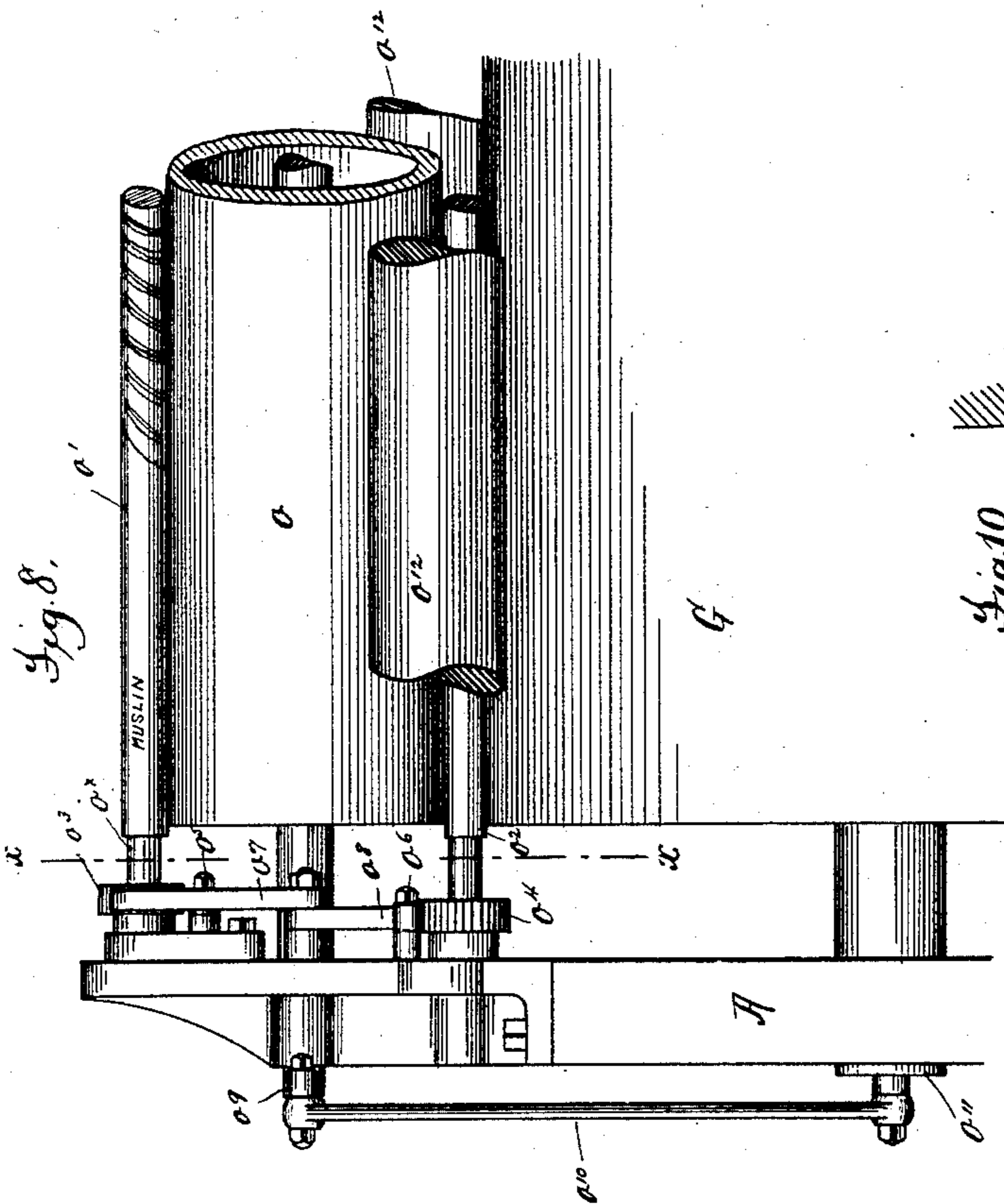
6 Sheets—Sheet 6.

J. L. FIRM.

ROTARY PRINTING MACHINE.

No. 374,355.

Patented Dec. 6, 1887.



Attest:
Geo. H. Bott
Geo. D. Morris

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Atty:

UNITED STATES PATENT OFFICE.

JOSEPH L. FIRM, OF JERSEY CITY, NEW JERSEY.

ROTARY PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 374,355, dated December 6, 1887.

Application filed January 19, 1887. Serial No. 224,795. (No model.) Patented in England April 9, 1880, No. 1,454.

To all whom it may concern:

Be it known that I, JOSEPH L. FIRM, a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Rotary Printing-Machines, (the same having been patented in part in England under date of April 9, 1880, No. 1,454,) of which the following is a full, clear, and exact description.

This invention relates to that class of printing-presses known as "perfecting-presses," and in which the paper used is in a roll, or, as usually stated, is a "web," and is printed on both sides, the machine being a rotary press specially designed for printing illustrated matter.

The objects of the invention are to secure accurate feed of the web of paper, print both sides of the sheet in one passage through the machine, proper inking, neat offset, and accurate delivery.

The invention consists in the several constructions and combinations of parts necessary to attain these objects, as I will now proceed to particularly set forth and claim.

In the accompanying drawings, in the several figures of which like parts are similarly designated, Figure 1 is a side elevation of sufficient of a printing-press to show my invention in operative form. Fig. 2 is a similar view, of part of the other side of the machine, some details being omitted. Fig. 3 is a plan view some of the gear-wheels of Fig. 1 being omitted and the inking-roller sockets and other parts of the inking mechanism being also omitted. Fig. 4 is a vertical sectional diagram. Fig. 5 is a sectional side or end elevation of the feeding mechanism, on a larger scale; and Fig. 6 is a front elevation of the same. Fig. 7 is a sectional elevation of the offset mechanism, taken in the plane of line x , Fig. 8, and looking toward the left; and Fig. 8 is a front elevation of the same. Fig. 9 is a side or end elevation of the inking-roller sockets; and Fig. 10 is a similar view, partly in section, and on a larger scale, of one of such sockets. Fig. 11 is a side elevation of part of the delivery apparatus, and Figs. 12, 13, and 14 details of the adjusting devices thereof. Fig. 15 is a plan view of the web-dividing knife. Fig. 16 is a cross-section of

parts of the web-dividing cylinders, and Fig. 17 a longitudinal section of the same.

I will first describe the parts of the machine and their relations, and then set forth the mode of and means for driving them.

The frame A of the machine may be of any approved construction, and is here shown as composed of two side pieces suitably cross-stayed, and this frame receives and supports all of the several parts of the press hereinafter described, excepting the usual support for the web or roll of paper, which latter support, herein designated B, may be secured in position in any desired and usual manner, and is adapted to receive and permit the unwinding of the roll C as it passes to the press. The paper passes from the roll C over the guide-rolls a and a' , and down around and beneath the guide-roll a^2 , which latter is positively driven, and imparts motion to the guide-rolls a and a' , which latter are in frictional contact with the roll a^2 , and are thereby rotated. The paper is thence led up between the male and female cutting-cylinders b and b' , respectively. The several rolls, a , a' , and a^2 , and the cutting-cylinders have bearings in suitable portions of or brackets attached to the main frame A and at the front thereof.

The cutting-cylinders b b' (shown in detail in Figs. 3, 4, 5, 6, and 16 and 17) may be hollow castings mounted upon suitable rotary shafts. In these cylinders longitudinal recesses b^2 b^3 , respectively, are made parallel with the axis of the said cylinders, which recesses receive the mechanism for so partly severing or dividing the web of paper into sheets as to admit of the separation of such sheets from the paper at the proper time. This severing or dividing mechanism consists of a knife or blade, c , (shown detached in Fig. 15,) made up, by preference, of a number of sections, and having alternating series of fleam or cutting teeth, c' , and square perforating-teeth c^2 ; or the knife may be made of a single piece with such teeth. One mode of securing the knife to the cylinder b is to arrange it between blocks c^3 c^3 , of wood or metal, by cross pins or bolts c^5 , and then secure these blocks with their attached knife within the recess b^2 by means of bolts or screws c^6 c^6 . In the recess of the female cutting-cylinder b' , opposite the fleam-teeth, I place strips or blocks d , of rubber or like yielding

material, so as to insure the passage of the fleam-teeth through the paper and the complete severance of the paper at these points; but in order to connect the thus partly-severed sheet with the roll or web, the teeth c^2 only perforate the portions of paper upon which they act and do not completely sever it, and to insure this perforation and guard against severance at these points, I arrange in the recess in the female cylinder b' , opposite the perforating-teeth, blocks of wood d' , or other equivalent substance. The blocks of rubber d and wood d' may be secured in the recess by clamping strips or blocks d^2 d^3 and screws or bolts d^3 , arranged substantially as indicated in Fig. 16. The paper partly severed by these cutting-cylinders, and before being completely separated or detached from the web, is engaged by the feed mechanism proper to be presented to the printing mechanism. This feed mechanism is constructed as follows:

Referring to Figs. 1, 4, and 5 for details, it will be seen that I employ a frame, D, composed of two side pieces, e , connected as by cross bars or rods e^x e' e^2 . This frame is pivoted at e^3 between the sides of the main frame A, and locked in such position by nuts e^4 engaging the rods e^2 , and is adapted to be vibrated upon the pivot e^3 by removing the bar e^2 and nuts e^4 when it is desired to make ready the impression-surface of the impression-cylinder conformably with the forms on the form-cylinder. The position of the frame D when swung up is shown by the broken lines, Fig. 1, and said frame may be propped up in this position by any suitable means. The main portion of the frame D carries at opposite ends shafts f f' , which are respectively provided with series of wheels or drums f^2 f^3 , upon which tapes f^4 are arranged. These tapes are kept taut by a sort of belt-tightener, f^5 , of usual construction, made, for example, as a drum, f^6 , arranged to revolve upon arms f^7 , which are mounted upon the rod e' , the drum acting upon the uppermost portions of the tapes. (See Fig. 5.) The frame D is provided with the downward extensions e^5 and e^6 , which respectively receive the shafts g and g' , which are respectively provided with the wheels or drums g^2 and g^3 , supporting the tapes g^4 parallel with the tapes f^4 , the wheels g^2 and g^3 being in alignment with the wheels f^2 and f^3 . The shaft g' is supported in boxes g^5 , adjustable toward and from the shaft f' in slots in the extensions e^6 , and said shaft g' is ultimately supported by posts g^6 , arranged to play freely up and down in the frame A, and supported by springs g^7 , (see Fig. 4,) so that the wheels or drums on the shaft g' will be held against the wheels or drums of shaft f' under pressure, and so give a nipping action to the wheels and tapes at this point, in order to grasp the paper as it comes from the cutting-cylinders with sufficient force to draw it in between the tapes and so feed it forward toward the printing mechanism. As shown in the diagram, the paper passes between the cutting-cylinders,

over the cylinder b' , and thence under the wheels f^3 and between their tapes and the tapes of the wheels g^2 g^3 , and is so forwarded. Upon the rod e^x is secured a series of arms, h , having journaled to them rollers h' , the said arms being adjustable upon the said rod by means of set-screws h^2 . These rollers h' in the position shown in Fig. 5 are in frictional contact with the impression-cylinder E. The rod e^x has a rocking motion in the frame D, imparted to it by a crank, i , connected by an extensible rod, i' , with a rock-lever, i^2 , pivoted to the frame A, and having a roller, i^4 , which engages a cam, i^5 , on the shaft of the cutting-cylinder b , the said roller being drawn against the cam by a spring, i^6 , attached at opposite ends to the lever i^2 and main frame. In the position of parts in Fig. 5 the knife-cylinder is supposed to have engaged the web, made a complete revolution, partly severed the web, and then made a half-revolution. The paper is now between the tapes f^4 and g^4 , with its leading end (when necessary) held up by the bands j . (Shown only in Fig. 4.) The depression in the cam being now opposite the roller i^4 , the rock-lever is actuated to force the rollers h' into contact with the impression-cylinder, and which rollers are rotated at the speed of the impression-cylinder, and the web being engaged between the rollers and impression-cylinder, it (the web) is strained between the said wheels and cylinder and the wheels f^3 and g^3 , and the partly-divided sheet thus completely severed from the web and then taken by the grippers on the impression-cylinder E.

The rod i' is made in two pieces, adjacent ends being screw-threaded and connected by a right and left hand nut or turn-buckle, i^7 , to lengthen or shorten said rod to vary the pressure on and lift of the rollers h' , it being understood that the rollers h' are only momentarily in engagement with the impression-cylinder.

Each roller h' , as already stated, is adjustable on the rod e^x , and the purpose of this is to compensate for inequalities in the web, variations in thickness of the web being thus no detriment to the proper feeding of the sheet.

Bands j' , secured to vertical projections j^2 from frame D, (shown only in Fig. 1,) may be employed to insure the paper going to the grippers k .

A feeding mechanism of the construction just described will insure the proper severance of the sheet and its introduction to the printing mechanism in a smooth flat condition.

The next feature of my invention consists in the employment of two sets of impression and form cylinders, arranged substantially as indicated in the drawings. (See, specially, Fig. 4.) The impression-cylinder E has half of its surface depressed or of less radius than the remainder, so as to receive the forms on the form-cylinder when not printing, and is provided with any approved construction of grippers, k , and gripper-operating mechanism.

The form-cylinder F has about two-thirds of its surface depressed to receive the forms, and this cylinder receives two revolutions to one of the impression-cylinder, and its forms are inked twice or oftener during each revolution of the impression-cylinder, according to the number of revolutions it is geared up to make relative to the impression-cylinder, and without the necessity of raising or separating either cylinder. The form-cylinder F is arranged above the impression-cylinder E, and the other impression-cylinder, G, is arranged in the rear of and slightly higher than but in surface contact with the form-cylinder H, arranged below and in the rear of it; and these cylinders G and H are of the same construction as the cylinders E and F, respectively, the grippers k' of cylinder G taking the sheet from cylinder E, printed on one side, reversing it, and presenting its unprinted side to the form-cylinder H, to be printed. By this arrangement of the impression-cylinders close together no independent transfer-cylinder is needed, but the sheet is taken directly by one cylinder from the other without loss of time and at a gain in length of the press and number of parts.

It is to be noted that the two impression-cylinders, and also their complementary form-cylinders, rotate in opposite directions, and while form-cylinder F is printing then form-cylinder H is making its non-printing revolution; but just as soon as cylinder F completes its printing then cylinder H is ready and in position to begin printing the other side of the same sheet.

The next feature of my invention is the inking mechanism.

Referring to Fig. 1, l represents the usual ink well or fountain, having a roller (not shown) on a shaft, l' , which is provided at one end with a toothed wheel, l'' . (See Fig. 2.) At its other end this shaft l' is provided with a split cam, l^3 , the two parts of which are adjustably connected by a slot-and-bolt device, l^4 , one of the parts of said split cam being fast on the shaft and the other loose and movable over the fast part and clamped to it in desired position to increase or diminish the active surface of the cam.

The transfer-roller (not shown) is held in position by a lever, m , which is pivoted to the main frame and drawn toward the fountain by a spring, m' . This lever is provided with an eccentric-stud, m^2 , adjustable axially upon the lever by a set-screw, m^3 , and this stud is acted upon by the split cam to regulate the contact of this roller with the roller in the well to gather more or less ink. But this feature of my machine I do not now claim, the same being reserved for a future application. However, the ink is distributed from the fountain in desired quantity by this transfer-roller through the rollers m^4 and m^5 , Figs. 2, 3, and 4, to the form-inking cylinder n , arranged in contact with the form-cylinder F. The inking mechanism for each form cylinder may be of like construction.

anism for each form cylinder may be of like construction.

The form-rollers (not shown, but of usual construction) are arranged above the form-cylinder F, and their journals have bearings in blocks or boxes n^2 . (Shown in detail in Figs. 9 and 10 as applied to the form-cylinder H.) These boxes are secured in recesses or sockets n^3 in the main frame, and are normally elevated by springs n^4 , interposed between the bottoms of the boxes and the bottoms of the sockets; but in order to regulate the pressure of the rollers upon the form I provide the boxes with adjusting devices consisting of arms n^5 , pivoted at one end to the main frame and extending across the top of the boxes, and at the other end detachably secured to such frame by thumb-screws n^6 . Set-screws n^7 are provided in the said arms to act upon the blocks and adjust them to the proper pressure. By turning out the thumb-screw n^6 the arms n^5 may be swung back and the individual rollers removed at pleasure. Both form-cylinders are provided with distributing-rollers in proper number and arrangement, applied thereto substantially in this manner.

The next feature of my invention is the mechanism for removing the offset from the impression-cylinders. This mechanism I arrange above the impression-cylinder G, and it consists (see details, Figs. 7 and 8) of a receiving-cylinder, o , hung in bearings in the main frame and deriving motion from the said impression-cylinder. Above and below this receiving-cylinder are wipers o' and o'' , provided with ratchets o^3 and o^4 , respectively, having dogs o^5 and o^6 to prevent reversal. These ratchets are moved intermittently in the same direction by pawls o^7 o^8 , secured to one end of a cranked rock-shaft, o^9 , secured in the main frame, and this shaft is rocked by a pitman, o^{10} , secured eccentrically to a disk, o^{11} , on the shaft of the impression-cylinder G, to actuate the pawls so as to move the ratchets tooth by tooth, and thus rotate the wipers in a direction opposite to that in which the receiving-cylinder is moving. The wipers o^3 and o^4 each consists of a suitable wooden or metallic roller, o^x , provided with such fabric as Brussels carpet, o^{xx} , which is wound about the same diagonally and its ends tied around the roller. (See Figs. 3, 7, and 8.) Around the carpet-covered roller is secured a covering, o^{xxx} , of unbleached muslin, which, when fouled, may be readily replaced. The offset is taken by the composition-rollers o^{12} o^{12} from the impression-cylinder and transferred to the receiving-cylinder. These set-off rollers may be such as set forth in my United States Patent No. 227,157, dated May 4, 1880.

The last feature of my invention is the delivery mechanism. This consists of bands p , arranged in connection with the impression-cylinder G, (see Figs. 3 and 4,) and which pass over wheels q on a shaft, q' , having bearings in the main frame and driven from the im-

pression-cylinder G, said bands being supported on the freely-rotating wheel q^2 on a shaft arranged in the main frame. These bands deliver the printed sheet to the device I, which consists of the series of wheels q and the complementary series of wheels r , mounted on the shaft r' , having bearings in the main frame. These wheels q and r support the gripper-bands s of substantially the construction shown in Reissued Patent No. 5,887, dated May 26, 1874, and these gripper-bands take the printed sheet from the bands p and deposit it upon the ordinary fly, J, Fig. 3.

The bands s , as heretofore constructed, would flap and wind the sheet as it was being delivered to the knocker or fly, and thus prevent a straight delivery. I find in practice, by using curved spring-bands $s^1 s^1$, placed above and below wooden bars $s^2 s^2$, mounted on cross-bars $s^3 s^3$, suspended by hangers $s^4 s^4$ from the shafts q' and r' , and arranging these spring-bands so as to bear against the teeth of the belts or bands s , that this difficulty is overcome, these springs serving to keep the gripper-bands taut.

The wheels q and r are independently adjustable on their shafts in order to compensate for any fouling of the stripper-bands occasioned, for example, by the straining of these bands; and this adjustment is secured by constructing each wheel with a hub, r^2 , having an attached disk, r^3 , provided with concentric slots r^4 . To this slotted disk is fitted the pocketed disk r^5 , having screw-threaded bolts r^6 , which project through the slots r^4 in the disk r^3 , and are then provided with nuts r^7 . The wheels r and q are constructed similarly and arranged in pairs. By loosening the nuts r^7 and rotating the disk r^5 axially its pockets may be changed in position to meet the requirements of the gripper-band which it supports. Both wheels r and q of each pair will of course receive the same adjustment. In common parlance this adjustability of these wheels enables the pressman to accurately time his gripper-bands independently of each other.

The driving mechanism may be as follows: K is the main shaft, provided with a driving-pulley, K' , and a toothed wheel, K^2 . This toothed wheel K^2 meshes with a toothed wheel, E' , on the shaft of the impression-cylinder E, and this toothed wheel E' meshes with a toothed wheel, F' , on the shaft of the form-cylinder F. The wheel E' also meshes with the toothed wheel G' on the shaft of the impression-cylinder G, and the toothed wheel G' meshes with a toothed wheel, H' , on the shaft of the form-cylinder H, so that said form-cylinders and impression-cylinders move in the same relative time.

The inking mechanism of each form-cylinder may be geared to its form-cylinder in substantially the manner indicated in the drawings or in any suitable manner.

The delivery mechanism may receive motion

from the impression-cylinder G by an idler, t , and a gear-wheel, t' , on the shaft q' .

The cutting-cylinders may be driven by a counter-shaft, L, having a miter-gear, M, with the shaft of the impression-cylinder E, and also miter-geared with the cylinder b' , and the two cylinders b and b' are geared together.

The shaft f' of the feed mechanism may be geared with the cylinder b' , as indicated in Fig. 4, and this shaft f' may also be geared with the shaft g' , as indicated by the dotted lines in Fig. 4. Any other mode of and means for gearing the parts so as to insure their running harmoniously may be employed.

It is within the scope of my invention to gear the wheels g^2 with the impression-cylinder E, and then reverse the wheels h' , so as to come in contact with the wheels g^2 and pass the paper between the wheels g^2 and h' , and cause said wheels to separate the sheet from the web without the intervention of the impression-cylinder.

What I claim is—

1. The male and female cutting and perforating cylinders and the impression-cylinder, combined with the swinging frame provided with a series of tapes and a series of wheels over which the tapes pass and pivoted between the cutting-cylinders and impression-cylinder, and automatically-operated paper-nipping wheels in said frame, substantially as described.

2. A frame provided with a series of tapes, combined with the main frame, to which it is pivoted, a series of automatically-operated paper-nipping wheels, and the cutting and impression cylinders, substantially as described.

3. The combination, with the male and female cutting-cylinders, of a knife having a number of fleam or cutting teeth, and also a number of square perforating-teeth, substantially as described.

4. A knife for the cutting-cylinder of a printing-press, composed of a number of sections having fleam or cutting teeth, and a number of sections having square perforating-teeth arranged alternately with the fleam-teeth sections, combined with the said cylinder and its mate, substantially as set forth.

5. A rotary perfecting printing-press comprising two impression-cylinders having about half of their peripheries of reduced radius and two form-cylinders of substantially half the diameter of the impression-cylinders, and driving and connecting gearing, combined and arranged, substantially as set forth, to permit the inking of the forms a number of times for each revolution of the impression-cylinders and without raising either the form or impression cylinders, as set forth.

6. In a printing-press, two large impression-cylinders provided with intermeshing toothed wheels, whereby the two cylinders rotate in the same time, but in opposite directions, and having substantially half of their peripheries of reduced radius, combined with

complementary form-cylinders, each of substantially half the diameter of the impression-cylinders and each driven from its own impression-cylinder, and inking mechanism, substantially as described, arranged in connection with the form-cylinders to ink the forms two or more times for each revolution of the impression-cylinders, substantially as set forth.

7. In a printing-press, the ink-distributing rollers, combined with boxes arranged in sockets or recesses in the frame, interposed springs, arms hinged to the frame at one end and detachably connected therewith at the other, and provided with adjusting-screws for acting upon the boxes, substantially as described.

8. The combination, with the inking-rollers, of spring-operated boxes arranged in sockets in the frame and detachable box-adjusting arms adapted to permit the ready removal of the rollers, substantially as described.

9. The combination, with the impression-cylinder, of a receiving-cylinder, and wipers arranged above and below the same and provided with ratchets, and a cranked rock-shaft, pawls thereon engaging said ratchets, and a pitman driven from the impression-cylinder to give said wipers the intermittent rotary motion, substantially as set forth.

10. In a delivery mechanism for printing-presses, the combination, with the wheels q and shaft q' , wheels r and shaft r' , the bands s , bars $s^2 s^3$, and hangers s^4 , with the springs s' interposed between the bars s^2 and bands s , substantially as and for the purpose set forth.

11. In a printing-press, the combination, with male and female cutting-cylinders, of a knife composed of alternate sections of fleam or cutting teeth and square perforating-teeth arranged in the male cylinder, and alternate strips of yielding material and hard or unyielding material arranged in the female cylinder, respectively, opposite the fleam and square teeth in the male cylinder, substantially as described.

12. The combination, with the impression-cylinder, of a receiving-cylinder, wipers for said receiving-cylinder, and a pawl-and-ratchet mechanism, substantially such as set forth, to give to said wipers an intermittent rotary motion, substantially as specified.

In testimony whereof I have hereunto set my hand this 14th day of January, A. D. 1887.

JOSEPH L. FIRM.

Witnesses:

A. SUTHERLAND,
GEO. D. MORRIS.