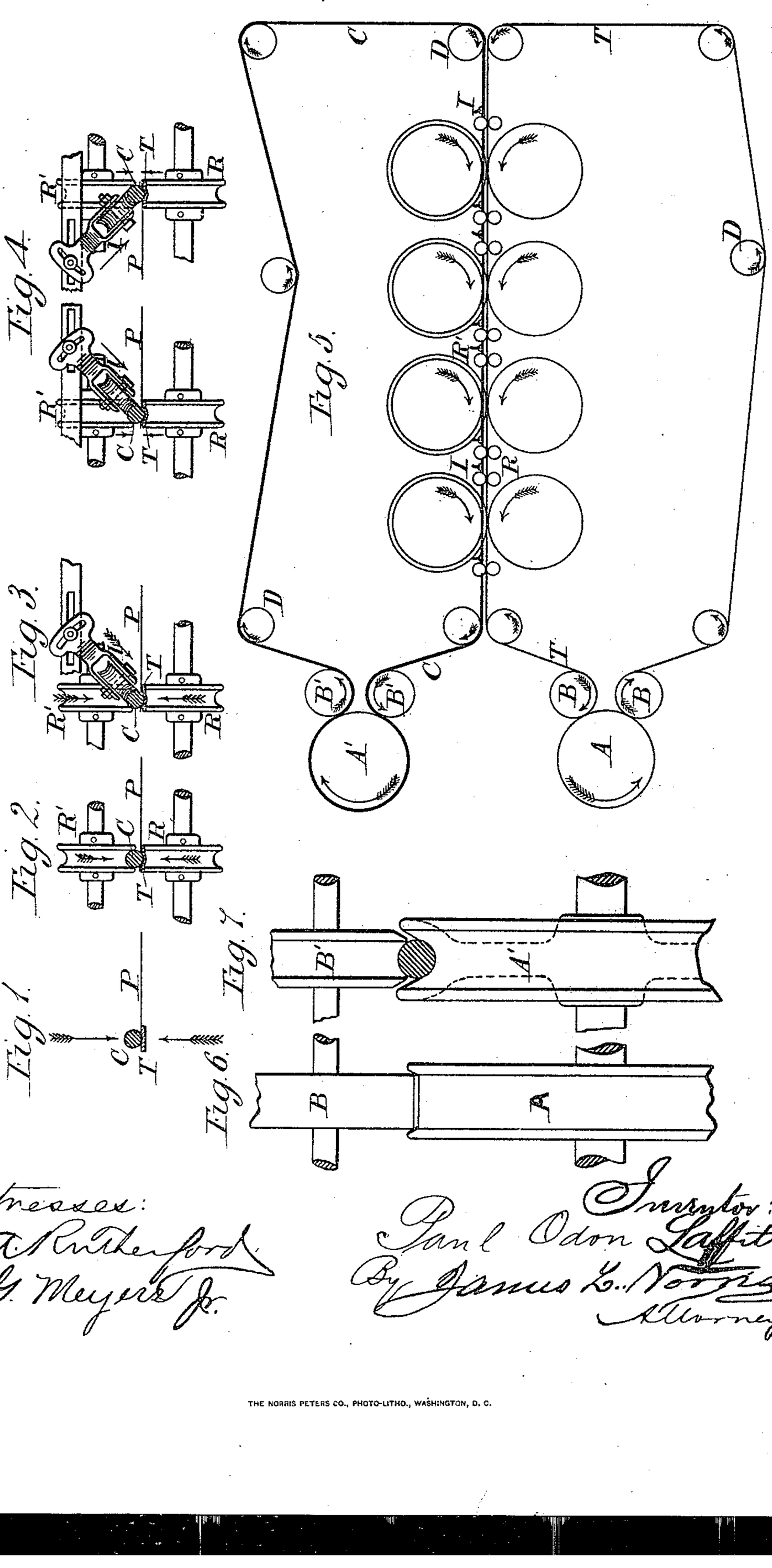
(No Model.) 6 Sheets—Sheet 1.

P. O. LAFFITTE.

ROTARY PRINTING MACHINE.

No. 438,239. Patented Oct. 14, 1890.



Witnesses:
J. A. Rutherford.
J. G. Meyers Jr.

Inventor:
Paul Odon Laffitte.
By James L. Norris.
Attorney.

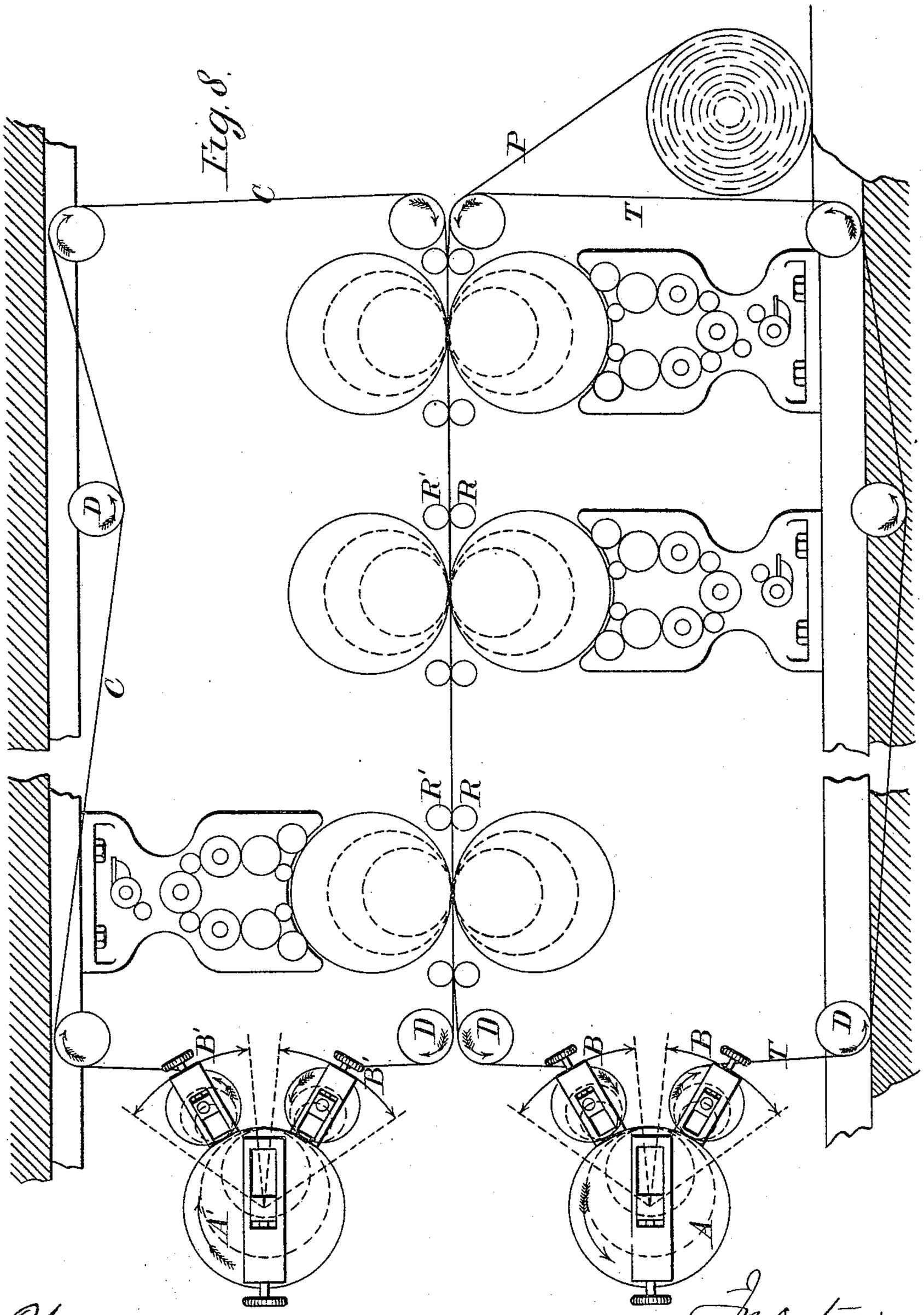
(No Model.) 6 Sheets—Sheet 2.

P. O. LAFFITTE.

ROTARY PRINTING MACHINE.

No. 438,239. Patented Oct. 14, 1890.

Fig. 6.



Witnesses:
J. A. Rutherford.
J. G. Meyer Jr.

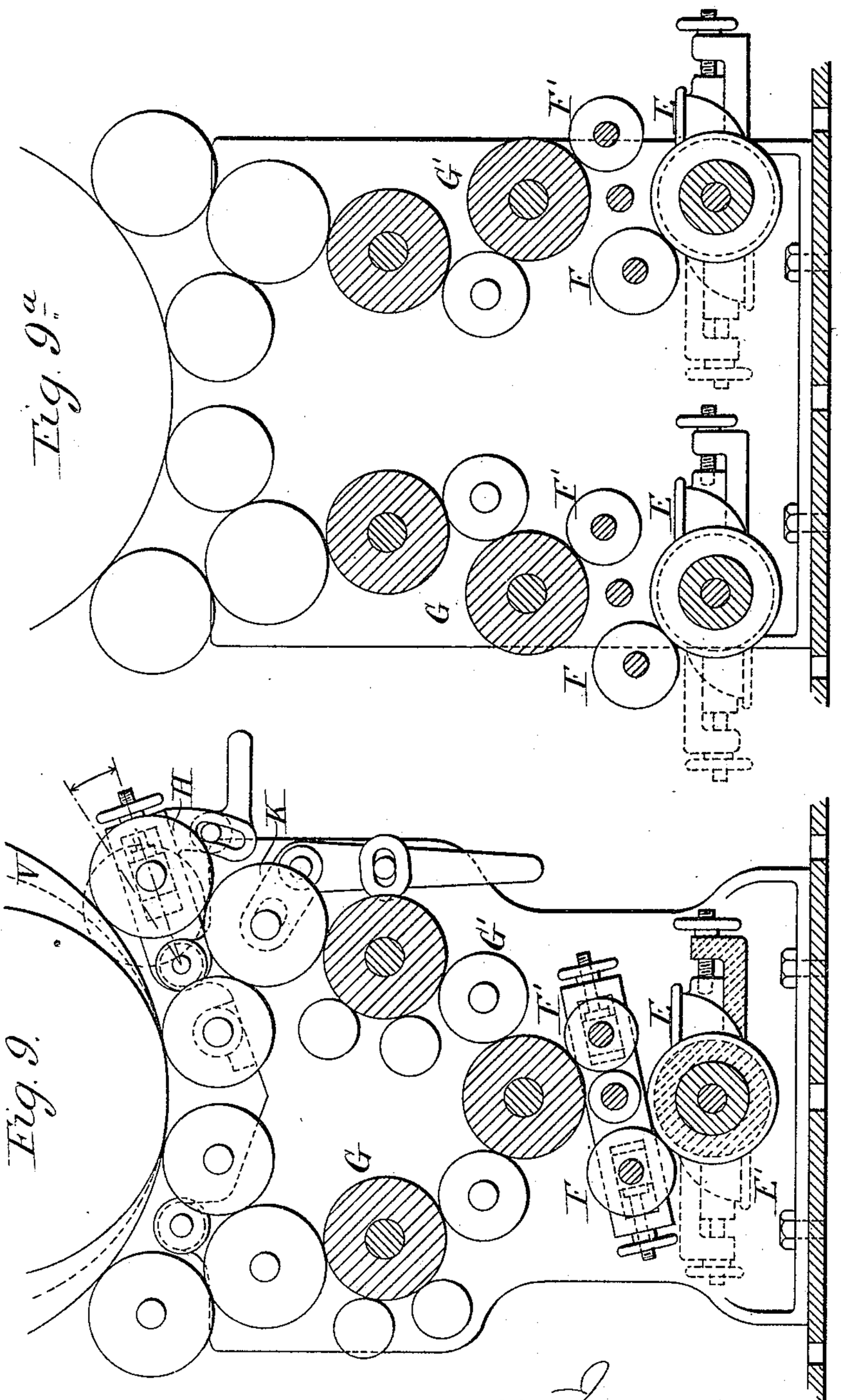
Inventor:
Paul Odon Laffitte.
By James L. Norris.
Attorney.

(No Model.) 6 Sheets—Sheet 3.

P. O. LAFFITTE.

ROTARY PRINTING MACHINE.

No. 438,239. Patented Oct. 14, 1890.



Witnesses:
J. A. Rutherford.
J. G. Meyers Jr.

Inventor:
Paul Odon Laffitte
By James L. Norris.
Attorney.

(No Model.)

6 Sheets—Sheet 4.

P. O. LAFFITTE.

ROTARY PRINTING MACHINE.

No. 438,239. Patented Oct. 14, 1890.

Fig. 10.

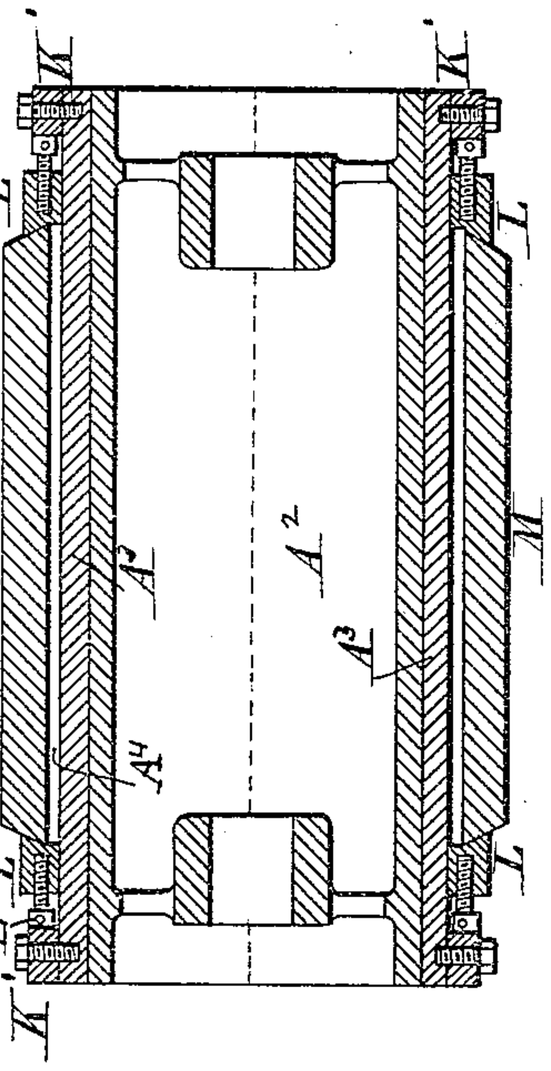


Fig. 14.

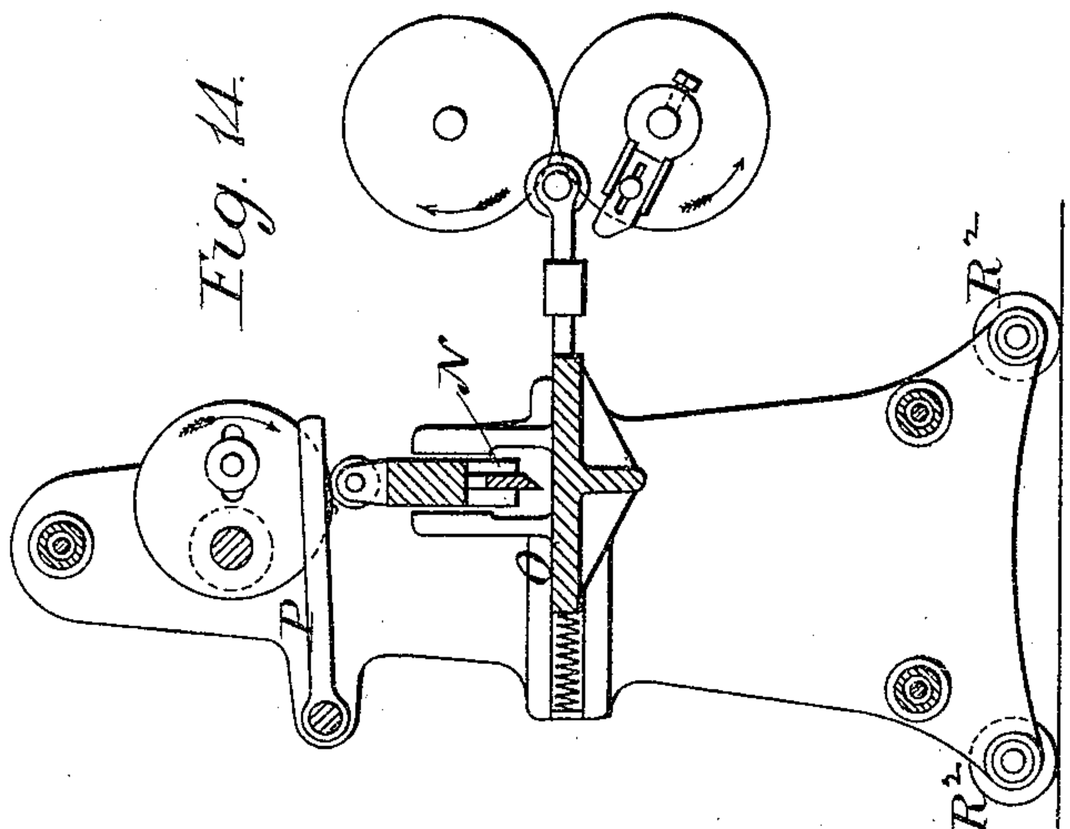


Fig. 11.

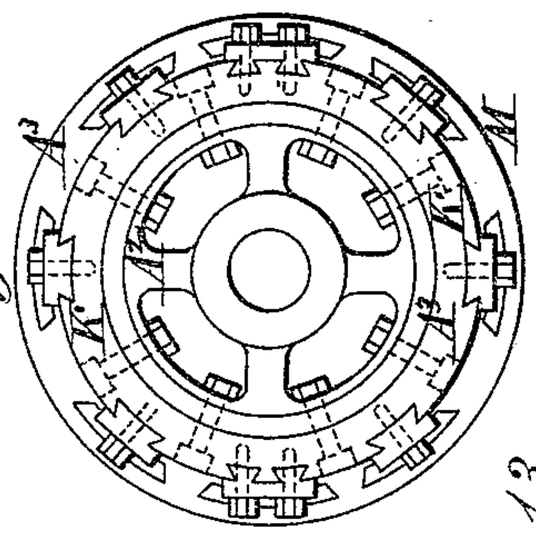


Fig. 12

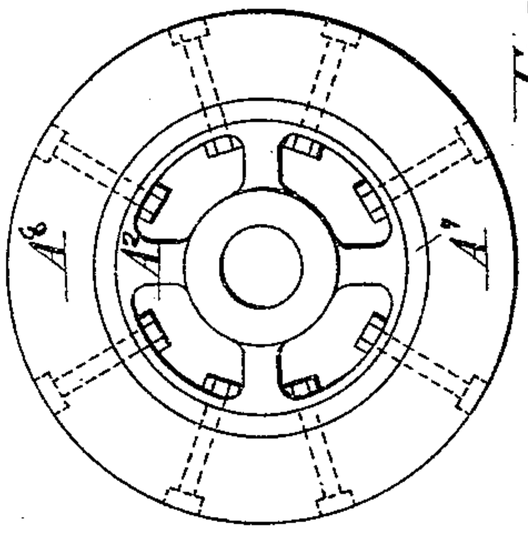
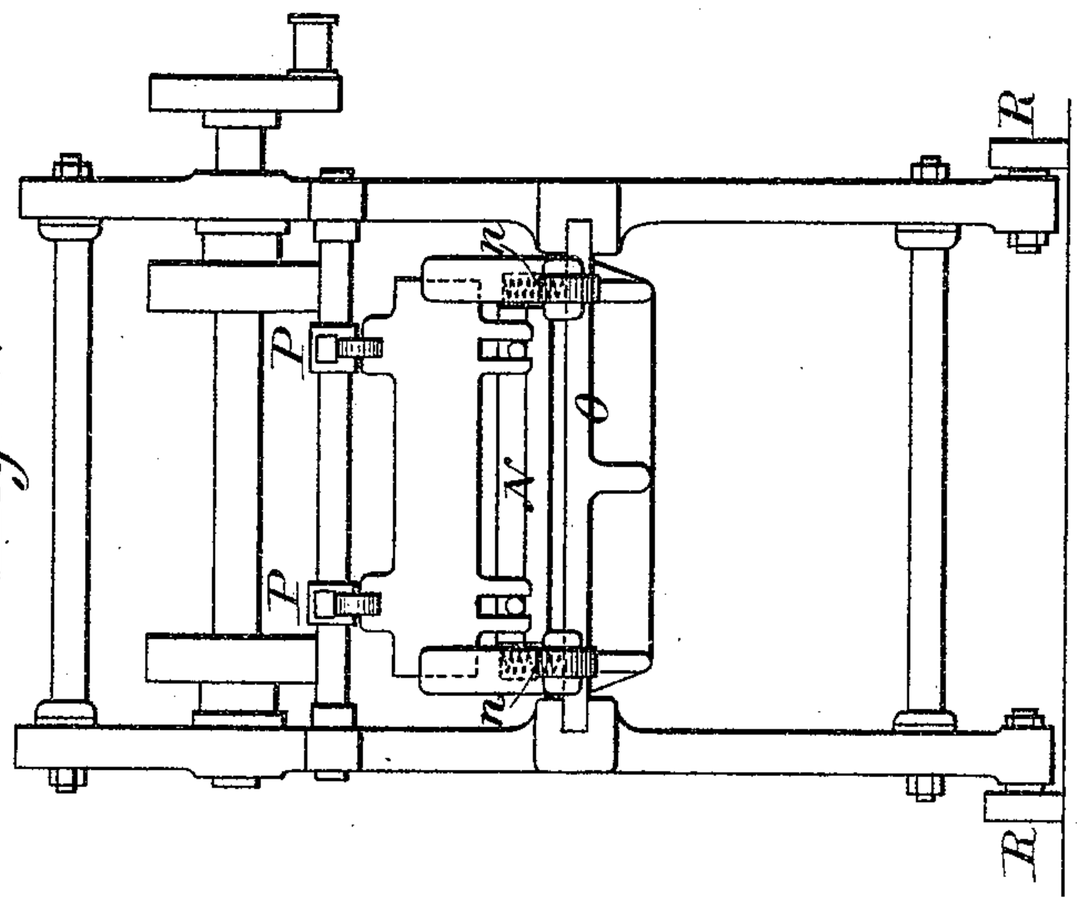


Fig. 13.



Witnesses:
J. A. Rutherford
J. G. Meyers Jr.

Inventor:
Paul Odon Laffitte.
By James L. Norris.
Attorney.

(No Model.) 6 Sheets—Sheet 5.

P. O. LAFFITTE.

ROTARY PRINTING MACHINE.

No. 438,239. Patented Oct. 14, 1890.

Fig. 17.

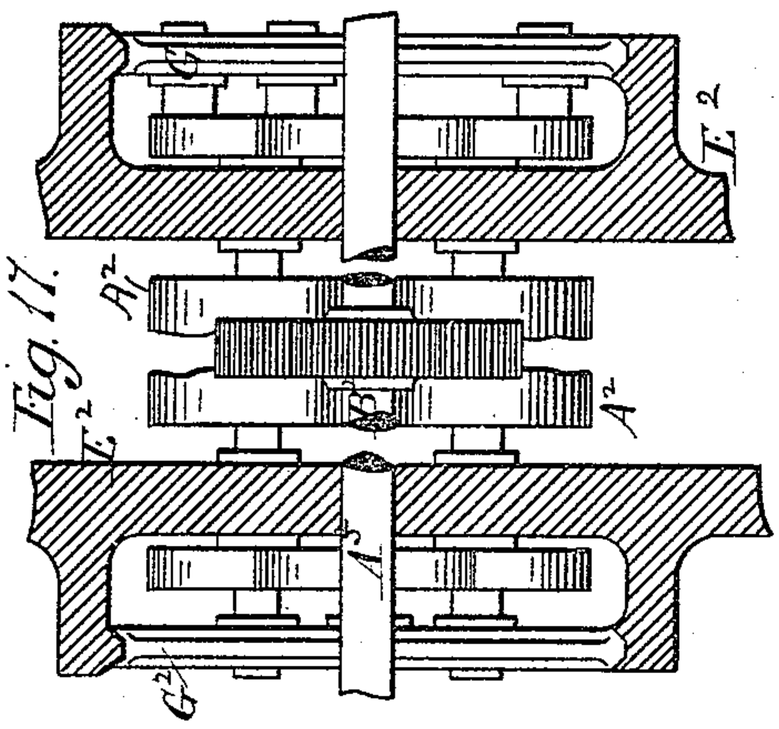


Fig. 15.

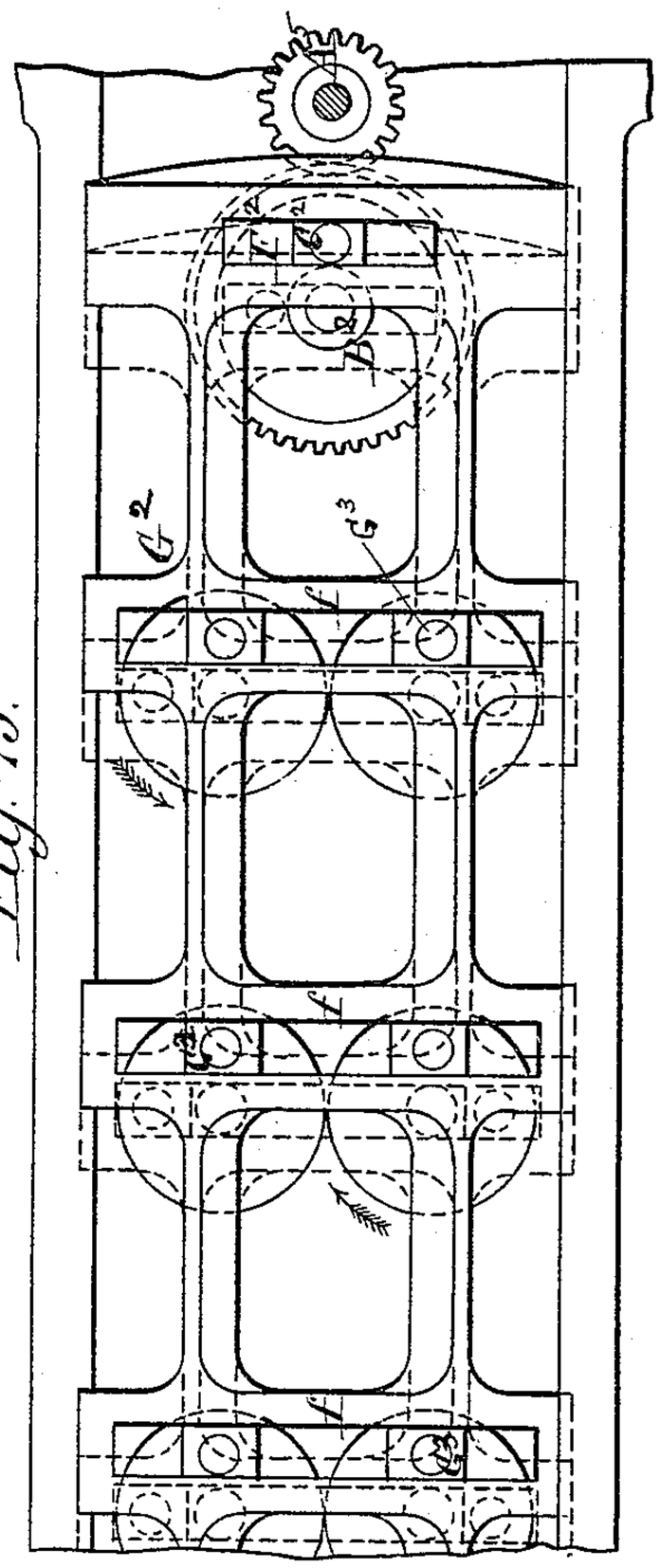
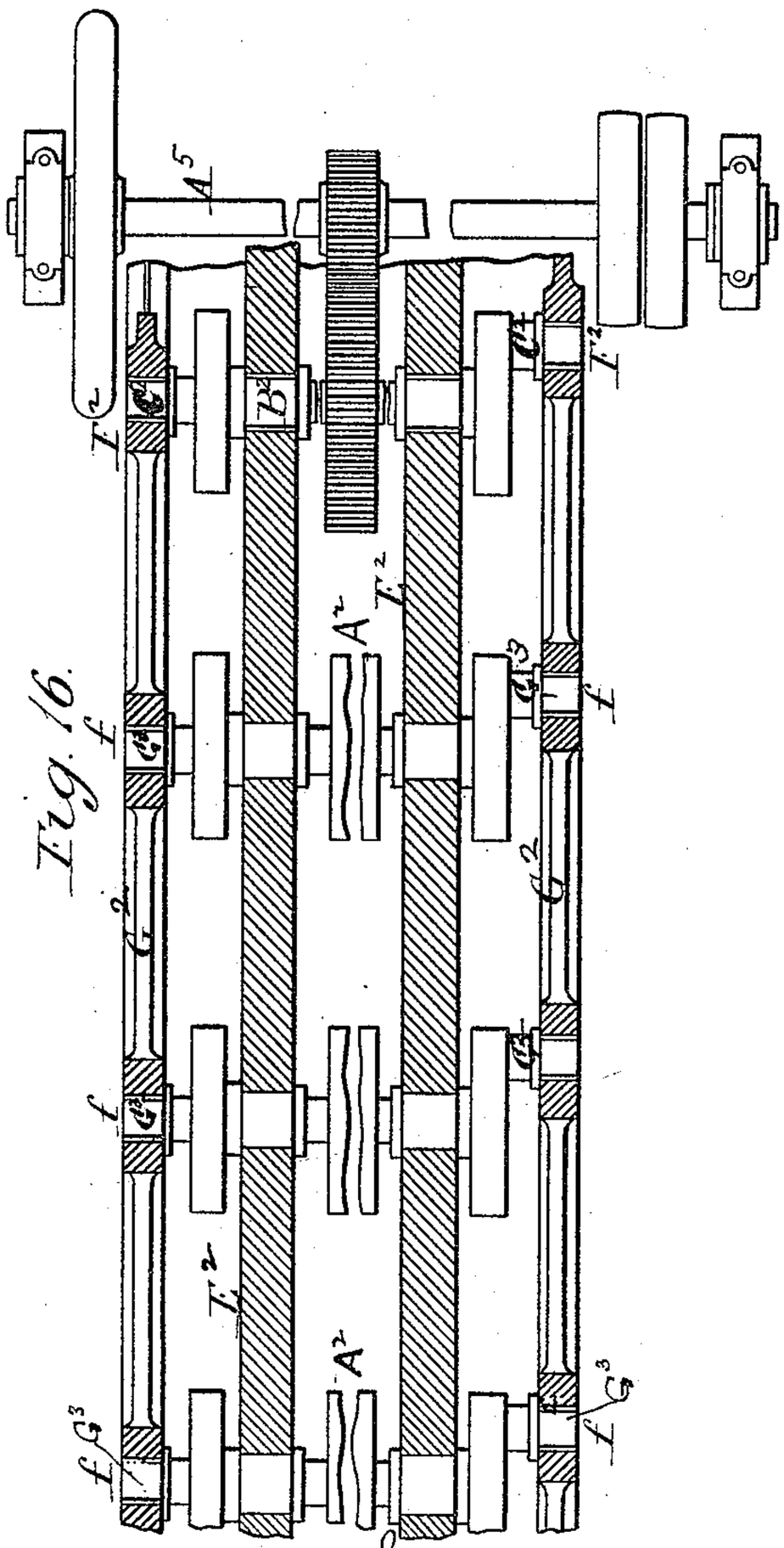


Fig. 16.



Witnesses:-
J. A. Rutherford.
J. G. Myers Jr.

Inventor:
Paul Odon Laffitte.
By James L. Norris.
Attorney.

(No Model.) 6 Sheets—Sheet 6.

P. O. LAFFITTE.

ROTARY PRINTING MACHINE.

No. 438,239. Patented Oct. 14, 1890.

Fig. 19.

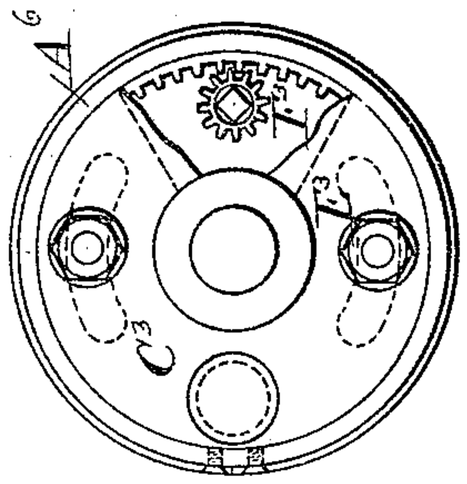


Fig. 20.

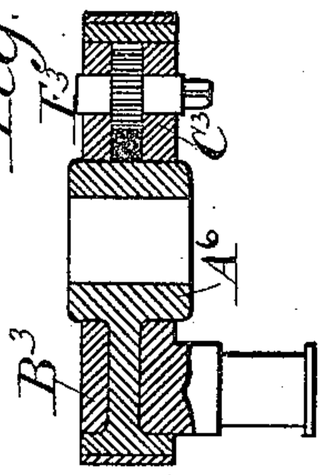
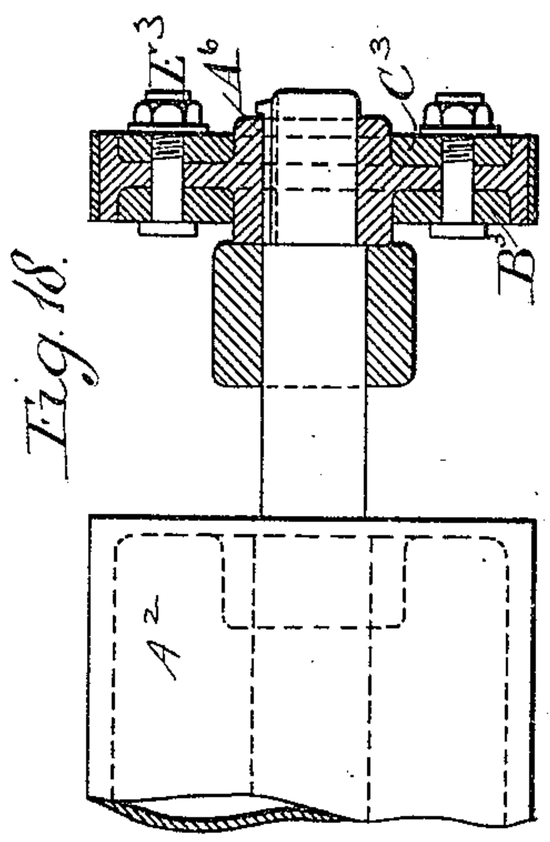


Fig. 18.



Witnesses:
J. A. Rutherford.
J. G. Meyer Jr.

Inventor:
Paul Adon Laffitte.
By James L. Norris.
Attorney

UNITED STATES PATENT OFFICE.

PAUL ODON LAFFITTE, OF LONDON, ENGLAND.

ROTARY PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 438,239, dated October 14, 1890.

Application filed December 16, 1889. Serial No. 333,999. (No model.) Patented in England January 11, 1889, No. 564, and December 4, 1889, No. 19,496; in France December 17, 1889, No. 202,674; in Belgium December 17, 1889, No. 88,884; in Canada January 2, 1890, No. 33,278; in Austria-Hungary April 7, 1890, No. 55,110 and No. 11,524; in Italy January 9, 1890, LII, 241; in Victoria January 13, 1890, No. 7,396, and in New South Wales January 15, 1890, No. 1,964.

To all whom it may concern:

Be it known that I, PAUL ODON LAFFITTE, a citizen of France, residing at 33 Ryland Road, London, in the county of Middlesex, England, have invented new and useful Improvements in Rotary Printing-Machines, (for which I have obtained patents in Great Britain dated January 11, 1889, No. 564, and December 4, 1889, No. 19,496; in Canada, dated January 2, 1890, No. 33,278; in France, dated December 17, 1889, No. 202,674; in Belgium, dated December 17, 1889, No. 88,884; in Austria-Hungary, dated April 7, 1890, No. 55,110 and No. 11,524; in Italy, dated January 9, 1890, Vol. LII, 241; in Victoria, dated January 13, 1890, No. 7,396, and in New South Wales, dated January 15, 1890, No. 1,964,) of which the following is a specification.

My invention relates to printing-machines in which the paper to be printed, either in a continuous web or in a separate sheet, is made to travel in a straight line between a revolving form-cylinder and a corresponding impression-cylinder or between successive pairs of these, becoming printed in its passage.

One object of my improvement is to insure the continuous travel of the paper at the same speed as that of the peripheries of the printing-cylinders by novel means arranged to hold the paper, keeping it properly stretched and carrying it onward with them.

Another object which I have in view is to arrange inking apparatus for the form-cylinders in such a manner that it can readily be moved from one cylinder to another of the machine and adjusted to suit the dimensions of the cylinder to which it is applied, and that it can be inverted, so as to be capable of inking either a form-cylinder above it or a form-cylinder below it. Thus when the machine is used for perfecting—that is to say, printing on both sides of the paper—some of the form-cylinders must be below the impression-cylinders and some of them must be above, the inking apparatus being applied below the former and above the latter.

Another object of the invention is to provide a novel construction for varying the diameter of the form-cylinder and securing the type-form thereon.

The mode of driving which I adopt also admits of an accurate adjustment of the form on the cylinder to proper register. Finally, as the machine can be readily adapted by variation of its cylinders to produce impressions of less or greater length, I provide movable cutting apparatus for dividing the paper into suitable lengths, either before or after it is printed.

Such being the objects of my invention, I shall describe the means by which I carry it out practically.

Referring to the accompanying drawings, Figure 1 is a transverse section of the paper carriers or feeders. Fig. 2 is the same, with elevation of a pair of the guide-rollers. Fig. 3 is the same, with elevation of the inclined guide-rollers. Fig. 4 is the same, showing the paper carriers or feeders on both sides of the printing-machine. Fig. 5 is a diagrammatic longitudinal section of a machine with four pairs of cylinders, showing the course of the paper carriers or feeders with their driving-wheels and guide-rollers. Fig. 6 is an elevation of the wheel and pressing-roller for moving the tape. Fig. 7 is an elevation of the wheel and pressing-roller for moving the cord. Fig. 8 is a diagrammatic longitudinal section of a machine showing the application of the paper carriers or feeders and inking apparatus to cylinders of various diameters. Fig. 9 is a transverse section of the movable inking apparatus. Fig. 9[A] shows the same somewhat modified in arrangement. Fig. 10 is a longitudinal section of one of the form-cylinders altered in diameter. Fig. 11 is an end view thereof. Fig. 12 is an end view of an impression-cylinder enlarged. Fig. 13 is a front view, and Fig. 14 is a side view, partly in section, of the movable cutting apparatus. Fig. 15 is a side elevation, Fig. 16 a plan, and Fig. 17 a transverse section, showing the crank

apparatus for driving the printing-cylinders. Fig. 18 is a vertical section, Fig. 19 a front view, and Fig. 20 a sectional plan, of one of the crank-disks with means of adjustment for register.

As shown in Fig. 1, the paper carriers or feeders consist of a continuous tape T and a continuous cord C, between which the paper P is gripped by the pressure of guide-rollers R R′, as indicated in Fig. 2. The one guide-roller is hollowed in the periphery, so that the tape T and paper P are pressed by the cord C into a curved condition, giving the paper a frictional hold, such that it is made to travel with the tape and cord and cannot be dragged laterally out from between them.

In order to resist lateral drag, inclined guide-rollers I (shown in Fig. 3) are mounted near the rollers R R′, so as to impose on the cord C an oblique strain, as indicated by the arrows.

Fig. 4 shows the tape and cord with their guide-rollers on each side of the machine, the paper P being stretched between them.

Referring to Fig. 5, the tape T is shown as being driven by a wheel A, and the cord C by a wheel A′ being pressed by pairs of pressing-rollers B and B′, which can be geared to the driving-wheels A and A′, and can be set sufficiently near to one another and strained sufficiently against said wheels A and A′ to insure that the tape and cord shall travel with the driving-wheels A and A′, these having the same surface speed as the printing-cylinders. The tape and cord are guided between each pair of printing-cylinders by pairs of the guide-rollers R R′, having mounted near them the inclined guide-rollers I, and they are guided, respectively, below and above the machine by guide-rollers D.

Fig. 8 shows, diagrammatically, a machine with three pairs of printing-cylinders, which may be varied in diameter, as indicated by the dotted circles, the wheels and rollers for driving the tape and cord being varied in diameter to a corresponding extent and the pressing-rollers B and B′ being adjusted suitably in their angular position and in their pressure against the driving-wheels A A′, respectively.

Although I have shown in Fig. 4 only two sets of paper carriers or feeders—one for each edge of the paper—there may obviously be several intermediate sets, especially when the paper is of considerable width.

Figs. 9 and 9^{A} represent movable inking apparatus according to my present invention, these being capable of inking forms on cylinders of various diameters, as indicated by the circles V, Fig. 9, and also capable of being moved from one cylinder to another or of being worked upside down, as in the case of a perfecting-machine, where one of the forms is on an under cylinder and another of the forms is on an upper cylinder.

The inking apparatus shown in Fig. 9 has a single ink-duct E, which can be inverted, as indicated by the dotted lines E′, when the apparatus is used upside down. It has two vibrating rollers F F′ and a duplicate set of rotating tables and distributing-rollers G G′.

One or more of the upper inking-rollers H can be adjusted in its attitude and pressure to suit cylinders of different diameters, and another roller K of the set can be varied in position, according as more or less inking is required. These adjustable rollers may be applied in the set G, as well as in the set G′.

In the inking apparatus shown in Fig. 9^{A} there are two ink-ducts E, each capable of inversion and each feeding a set of distributing-rollers G and G′, which may be provided with adjustable rollers, such as H and K of Fig. 9.

In Fig. 8 are represented inking apparatus of the kind shown in Fig. 9, one of them inverted. In Fig. 8 the inking apparatus are shown as being applied to the cylinders when they are of large diameter. When they are of smaller diameter, as indicated by the dotted circles, the inking apparatus which is under each cylinder has to be raised and that which is above has to be lowered. This may be done by placing suitable blocking-pieces between the bases of the inking apparatus and those parts of the framing of the machine to which they are fixed.

In Figs. 10 and 11 I show the means for varying the diameter of the form-cylinders. To the form-cylinders A^{2} are bolted two half-shells A^{3}, of the desired thickness. At the ends are bolted ring-pieces K′, and in dovetailed grooves A^{4} in the half-shells are arranged sliding dogs L, which engage or overlap the ends of the form M. The sliding dogs are engaged with screws L′, the heads of which abut the ring-pieces K′ in such manner that by properly turning the screws the form is firmly secured in position. The impression-cylinder A^{7}, Fig. 12, may be enlarged by half-shells A^{8}, detachably bolted thereto.

In the paper-cutting apparatus, Figs. 13 and 14, the knife N is fitted to slide vertically in a frame projecting up from a table O, which is guided to move horizontally and caused to reciprocate by an adjustable cam and rod. The knife is urged upward by springs *n* and is pushed down by levers P, acted on by cranks or eccentrics above them. The moving parts are so timed that while the knife is descending making its cut the table O moves horizontally at the speed at which the paper is traveling. The cutting apparatus is preferably mounted on rollers R^{2}, so that it can be conveniently moved to either end of the printing-machine, nearer to or farther from the printing-cylinders, to suit the cut to the places of the paper where the sheets are to be severed.

Instead of driving the printing-cylinders

A^2 in the usual way by toothed gearing, which is often somewhat inaccurate and noisy, particularly when it is much worn, and which could not be applied to cylinders that are varied in diameter except with great trouble and at considerable expense, I employ the method of driving by cranks as shown in Figs. 15, 16, and 17.

From the prime moving shaft A^5 I drive a counter-shaft B^2, which has at each end of it a crank C^2, these two cranks being set at about right angles to one another.

On each side of the machine I fit to slide horizontally in guides a frame G^2, which has one vertical slot E^2 to receive the bush of the crank-pin C^2, and a number of slots *f*, one for each pair of cylinders A^2 of the machine. On the shaft of each cylinder A^2, at each end of it, is fixed a crank G^3, these two cranks being at the same angle to each other as the cranks C^2, and in such relative positions that when the frames G^2 slide to and fro they cause the upper cylinders A^2 to revolve in the one direction and the lower cylinders to revolve in the opposite direction, as indicated by the arrows. By making the slots *f* sufficiently long for receiving the crank-pins G^3 when the cylinders A^2 are of their maximum dimensions, and by making the upper and lower cranks of such throw that their bushes clear each other in the slots when the cylinders A^2 are of their minimum diameter, the apparatus can drive sets of cylinders of intermediate diameters all at equal speeds. The bearings for the shafts of the cylinders A^2 are fitted to slide vertically in the side frames E^2 of the machine, so that the cylinders can be adjusted to proper contact, the upper of each pair with the lower. When the cylinders are thus driven by cranks it may be necessary to adjust the position of the crank in each case relatively to the cylinder, so as to bring some particular part of the form to register with a particular part of the paper. For this purpose I arrange each of the cranks as shown by Figs. 18, 19, and 20.

It consists of a central disk A^6, keyed on the shaft and having on each side of its middle hollows which receive two other annular disks B^3 and C^3. From one of these C^3 projects the crank-pin G^3. The two disks B^3 and C^3 are secured by bolts E^3, which pass through slotted holes of the central disk A^6. On slackening the nuts of these bolts the disks B^3 and C^3 can be turned a little round to adjust the position of the crank-pin G^3, where it is secured by tightening the nuts again. In order to facilitate the adjustment, a pinion F^3 is mounted in bearings in the outer disks. B^3 and C^3 are gears with internal teeth of the disk A^6. On turning this pinion by a key or wrench applied to its axis the disks B^3 and C^3 and crank-pin G^3 can be moved a little round in either direction. I cover the periphery of the disk A^6 with leather, caoutchouc, felt, or such like somewhat yielding material, so that as it revolves in contact with another like disk shocks are deadened. A similar covering may be applied to the ends of the type-cylinders for the same purpose, and the covering thus applied to the disk or to the cylinder may be locally thickened by pasting on paper or the like in places where it is desired to relieve the impression.

Having thus described the nature of my invention and the best means I know for carrying the same into practical effect, I claim—

1. In a printing-machine, the combination, with the printing-cylinders, of feeders for carrying the paper between the cylinders, consisting of traveling co-operating tapes and cords, supporting guide-rollers under the tapes, pressing guide-rollers above the cords for pressing the same upon the tapes, and inclined guide-rollers which impose lateral strain in opposite directions on the cords, substantially as described.

2. In a printing-machine, the combination, with the printing-cylinders, of a paper-feeder at each side of the machine for acting on the edges of the paper, consisting of traveling co-operating tapes and cords, grooved supporting guide-rollers under the tapes, grooved pressing-rollers acting on the cords and pressing the paper and tapes into the grooves of the supporting-rollers, and oppositely-inclined guide-rollers which impose lateral strain on the cords as the paper is carried between the printing-cylinders, substantially as described.

3. In a printing-machine, the combination, with the printing-cylinders, of the grooved supporting-rollers R at each side of the machine, the traveling tapes T, the traveling cords C, and the grooved rollers R′, acting on the cords to curve the paper and tapes into the grooves of the supporting guide-rollers, substantially as described.

4. In a cylinder printing-machine, movable and adjustable inking apparatus having duplicate vibrating rollers, reversible ink-ducts, and the upper inking-rollers adjustable to suit cylinders of various diameters, substantially as described.

5. The combination, with the cylinders of a printing-machine, of shells A^3, having rings K′ and dovetailed grooves A^4, and adjustable dogs L, engaging the grooves for securing the type-forms, substantially as described.

6. In a cylinder printing-machine, the combination of a frame movable at will to and fro and supporting a horizontally-reciprocating table O, carrying a vertically-reciprocating knife N for cutting the paper, swinging levers P, pivoted to the movable frame for depressing the knife, and means for operating the levers and moving the table as the knife descends at the speed at which the paper is then traveling, substantially as described.

7. The combination, with the cylinders of a

printing-machine having crank-shafts, of rectilinearly-reciprocating frames having slots each engaging the cranks of two cylinders, substantially as described.

8. For adjusting to register a cylinder driven by cranks, the combination of a disk fixed on the cylinder-shaft with two annular disks bolted on the sides thereof, one of these carrying the crank-pin, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 3d day of December, A. D. 1889.

P. ODON LAFFITTE.

Witnesses:
OLIVER IMRAY,
Patent Agent, 28 Southampton Buildings, London, W. C.
JNO. P. M. MILLARD,
Clerk to Messrs. Abel & Imray, Consulting Engineers and Patent Agents, 28 Southampton Buildings, London, W. C.