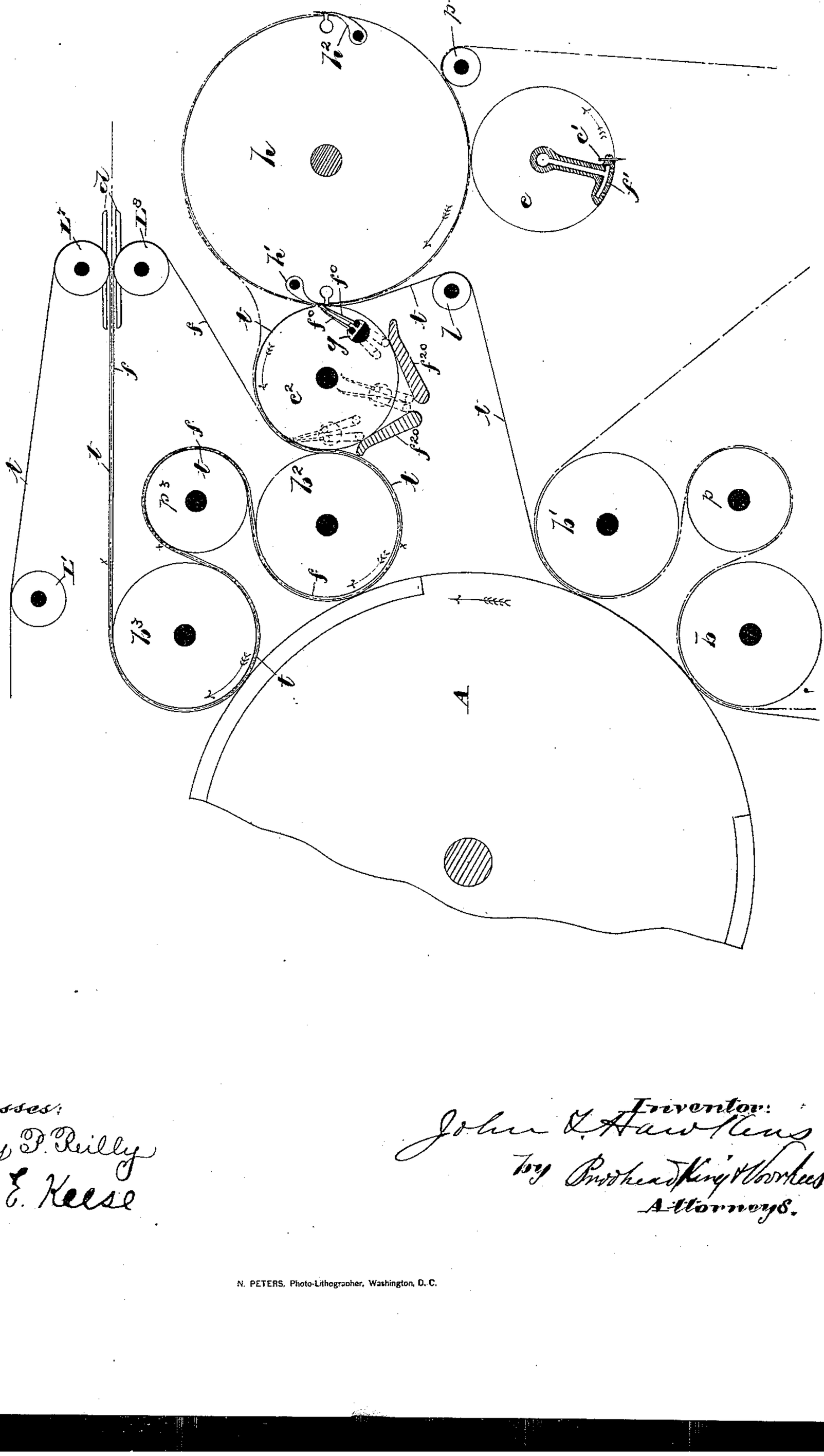
(No Model.) 4 Sheets—Sheet 1.

J. T. HAWKINS.

WEB PERFECTING PRINTING MACHINE.

No. 332,519. Patented Dec. 15, 1885.

Fig. 1



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(No Model.) 4 Sheets—Sheet 2.

J. T. HAWKINS.

WEB PERFECTING PRINTING MACHINE.

No. 332,519. Patented Dec. 15, 1885.

Fig. 3.

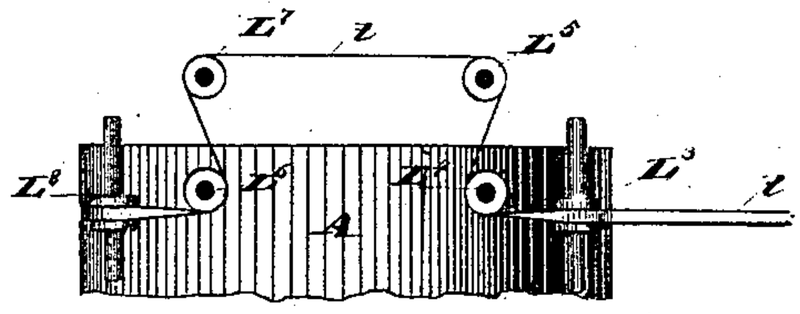
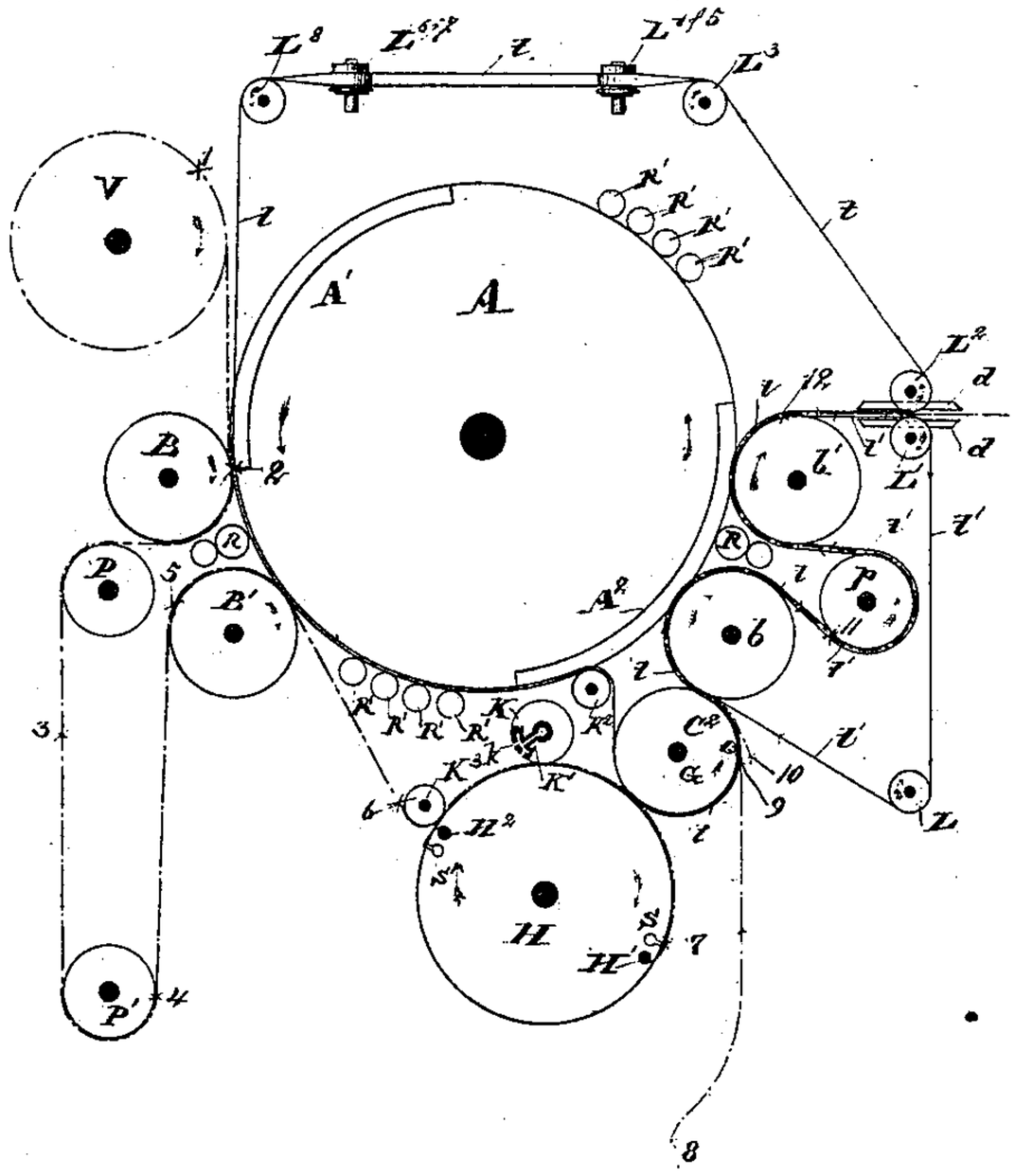


Fig. 2.



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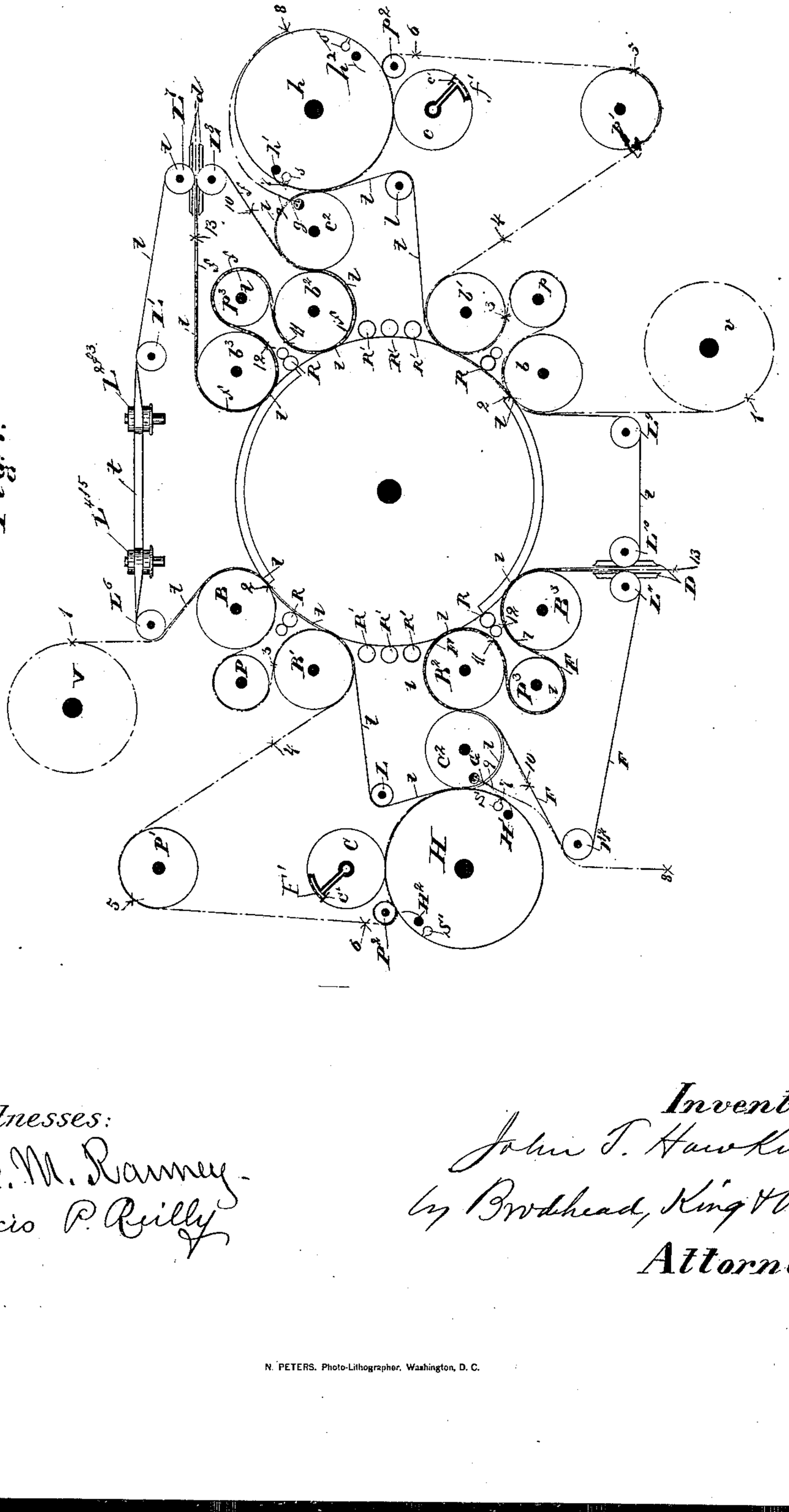
(No Model.) 4 Sheets—Sheet 3.

J. T. HAWKINS.

WEB PERFECTING PRINTING MACHINE.

No. 332,519. Patented Dec. 15, 1885.

Fig. 4.



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(No Model.) 4 Sheets—Sheet 4.

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WEB PERFECTING PRINTING MACHINE.

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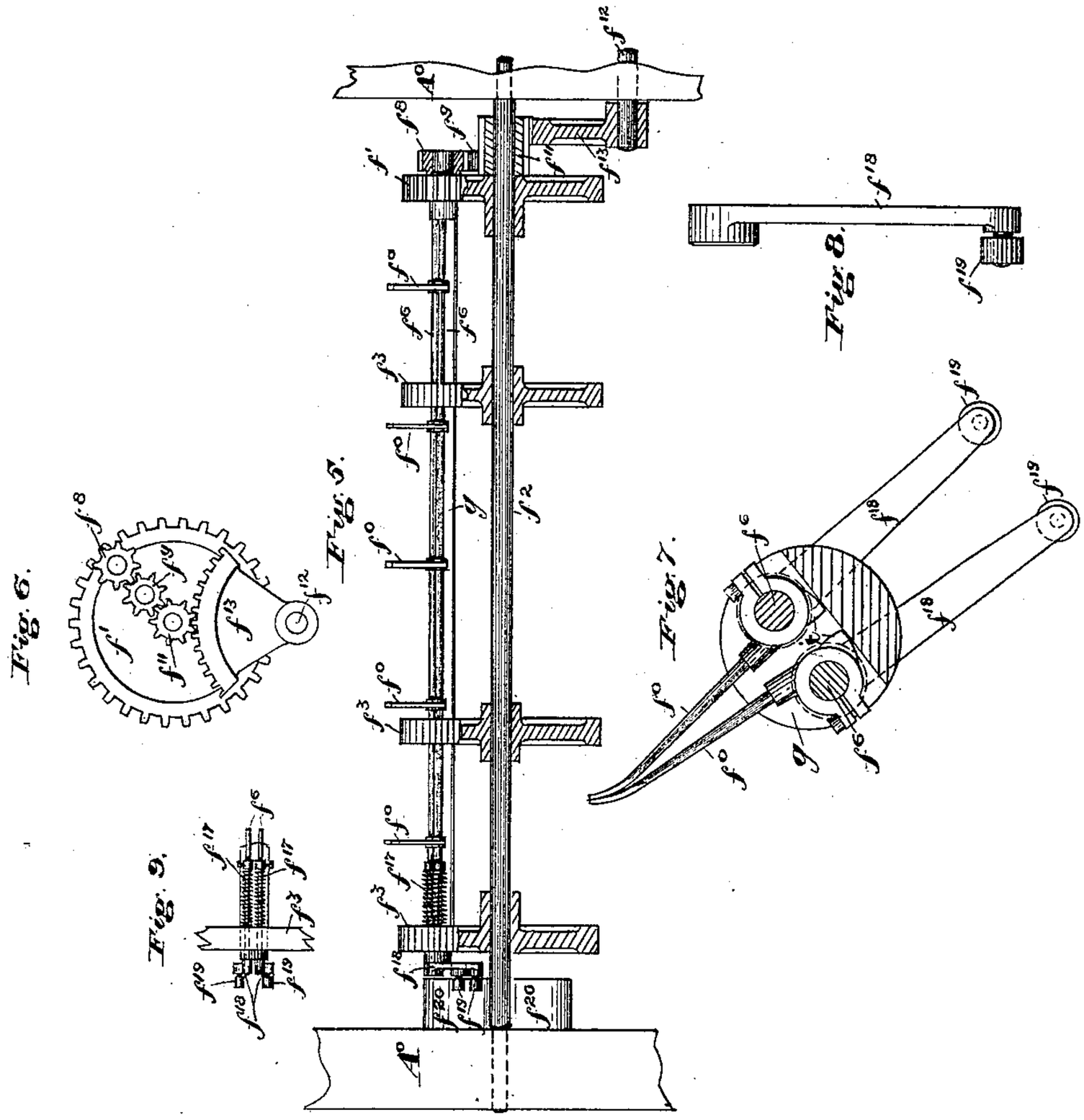

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UNITED STATES PATENT OFFICE.

JOHN T. HAWKINS, OF TAUNTON, MASSACHUSETTS.

WEB-PERFECTING PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 332,519, dated December 15, 1885.

Application filed February 18, 1884. Serial No. 121,084. (No model.)

To all whom it may concern:

Be it known that I, JOHN T. HAWKINS, a citizen of the United States, residing at Taunton, in the county of Bristol and State of Massachusetts, have invented certain new and useful Improvements in Web-Perfecting Printing-Machines, which invention or improvement is fully set forth and illustrated in the following specification and accompanying drawings.

The objects of the invention are as below stated.

First. To provide for the employment of double the number of impression-cylinders (shown in the application herewith filed by me, bearing the Serial No. 121,083) printing from one web, the effect being to print double the number of perfected sheets from one roll possible by means of the arrangement shown in said application. It is evident that in the above-mentioned case—as the sheets are cut before printing, and each sheet reversed immediately after receiving the impression upon one side, then printed upon the second side, and then delivered from the machine—no more than two impression-cylinders can print from one web; or that, if room could be found on a given type-cylinder for the employment of eight impression-cylinders, four rolls or webs of paper would require to be used; but in the arrangement of parts shown in Figures 2 and 4 of the accompanying drawings it is provided that four sheets may be printed from one web of paper at each revolution of the type or form cylinder—that is, four perfected sheets to a revolution of the type-cylinder, as in Fig. 2, and eight perfected sheets to a revolution of the type-cylinder, as in Fig. 4, in which latter figure two webs or rolls of paper are employed. This is accomplished while employing, principally, the methods shown in the above-mentioned application (Serial No. 121,083) for reversing the sheet by printing one side of each sheet on the continuous web before cutting it into sheets, then cutting the web or webs and reversing each sheet before printing its remaining side.

Second. It is also the object of this invention to provide a more complete means of reversing the sheets by combining with the rotary sheet-reverser a conveying-cylinder, so that the head of the sheet shall be conveyed away and controlled, while the tail of the sheet is conveyed and controlled by the rotary sheet-reverser, and to provide for said conveying-cylinder serving also as one of a pair of cutting-cylinders.

Third. It is the further object of this invention to dispense with grippers in the impression-cylinders by the use of a system of tapes for conveying the sheets after reversal.

In view of the general mechanism employed in such a machine having been fully illustrated in said application Serial No. 121,083, Figs. 1, 2, and 4 of the accompanying drawings are illustrations, only in outline, of longitudinal vertical sections through the machine—dispensing with all details—such outlines being sufficient to illustrate the invention herein claimed.

The invention consists of the parts and combinations of parts hereinafter described and set forth in the claims.

In the accompanying drawings, Fig. 1 is an outline horizontal vertical section through one-half, or nearly so, of Fig. 4 on an enlarged scale, showing the relative positions of the type or form cylinders, the rotary sheet-reverser and its cams. Fig. 2 is a similar longitudinal vertical section through a machine arranged for four impression-cylinders only. Fig. 3 is a view in plan of a portion of the top of the type-cylinder, showing the course of one of the margin-tapes, permitting of easy access to the forms for removal or replacement. Fig. 4 is a horizontal vertical outline section of the complete machine using eight impression-cylinders and printing from two rolls of paper. In these figures the sheet is first printed on one side, then severed from the web, reversed, and printed upon the other side. Figs. 5 to 9, inclusive, illustrate details of the same rotary sheet-reverser illustrated and described in application Serial No. 121,083, above mentioned. To make this case more complete in itself, however, a description of the parts constituting said rotary sheet-reverser and its mode of operation will be hereinafter given.

Referring to Figs. 5 to 9, inclusive, f^3 are three or any number of plain wheels secured to a shaft, f^2. A spur-gear, f', the diameter of whose pitch-circle is the same as the outside diameter of the wheels f^3, is also secured

to shaft f^2, said shaft being journaled in the main frames of the machine A^0. The gear f' engages corresponding gears upon the respective sheet-controlling cylinders H h, Figs. 1, 2, and 4, and upon the respective impression-cylinders B^2 b^2. Journaled in the wheels f' f^3 is an oscillating gripper-carrier, g, Fig. 1, or G g, Figs. 2 and 4. To the gripper-carrier g are journaled two gripper-shafts, f^6. On one end of gripper-carrier g is secured a spur-pinion, f^8. Upon a stud in the gear f' runs freely an intermediate pinion, f^9. On the shaft f^2, running freely, is a wide-faced pinion, f^{11}, gearing on one half its face with the intermediate pinion, f^9. On a short rock-shaft, f^{12}, (which is operated by means of a lever outside the frame A^0, carrying a roller engaging a suitable cam, as fully described in application Serial No. 121,083, above mentioned) is secured to its inner end a sector-gear, f^{13}, gearing with the other half of the face of the pinion f^{11}. On the pair of twin gripper-shafts f^6 are secured pairs of twin grippers f^0, closing upon each other by means of the springs f^{17}. The hubs of each of these grippers f^0 are so made as to form a stop, i, resting upon the flat part of the gripper-carrier g, to prevent one of each pair of grippers f^0 from following the other when either shall be opened, as hereinafter described, and as shown at i, Fig. 7. On each twin gripper-shaft f^6, outside of the outer wheel, f^3, is secured a lever, f^{18}, each carrying a roller, f^{19}. To one of the main frames A^0 is secured a pair of stationary cams, f^{20}, in position to engage the rollers f^{19}.

In Fig. 1 the twin grippers f^0 are shown, in full lines, in position to receive the tail of the sheet from between the tapes t and the surface of the controlling-cylinder h, one of the grippers f^0 being partially opened by means of one of the cams, f^{20}, closing upon the under side of the sheet as the roller f^{19} is running off said cam f^{20}. Pursuing the course of the sheet-reverser c^2, as indicated by the arrow, until the roller f^{19} of the other twin gripper f^0 comes in contact with the other cam f^{20}, as shown in dotted lines, the other twin gripper is about to release the sheet into the path between tapes t and f. Continuing further, the dotted lines show the position of the twin grippers when both are opened away from each other by the action of both of the cams f^{20} preparatory to being brought into position to grasp the tail of the succeeding sheet, as at first shown in full lines.

Referring now to Fig. 2, the several letters therein indicate the respective parts below mentioned; A, the form-cylinder; A' A^2, the forms therein; V, the roll of paper; B B' b b', impression-cylinders geared to the form-cylinder A in the usual way; R R', inking-rollers; L L' L^2 L^3 L^4 L^5 L^6 L^7 L^8, each a series of tape-pulleys; P, P', and p, leading or register rolls, over which the sheet or web is led in passing from one to the other of each pair of impression-cylinders; C^2, the sheet-reverser, carrying the twin grippers G; H, a cylinder carrying grippers H' and H^2 and sheet-cutting recesses S and S'; K, a cutting-cylinder carrying a serrated severing-knife, K', which is caused to protrude from the cylinder at each second revolution only, by any suitable mechanism. Said cylinder is but one-quarter of the diameter of the cylinder H. The cutting-cylinder K is made hollow for the introduction of air therein, and is provided with perforations k, as shown partly in section, said perforations communicating with the axis upon which it rotates. By any suitable means air-jets are forced through these perforations to impinge upon the cylinder H immediately after severing a sheet, in order to keep the head of the web in contact with the surface of cylinder H until the grippers H' or H^2 have closed upon it. Where the proportions of the parts will admit, the cutting-cylinder K may be made one-half the diameter of the cylinder H, in which case the knife K' may remain sufficiently protruded at all times to enter the grooves or recesses S S' in the cylinder H, and thus dispense with mechanism necessary to protrude it only at each second revolution. K^2 and K^3, leading-pulleys for the web or sheets. A series of three tapes, t, run in line with the unprinted margins of the web or sheets. A series of three tapes, t', run in a line with tapes t. The path of tapes t, commencing at L^2, is upward to the left over L^3, thence around L^4, L^5, L^6, L^7, and L^8, thence downward in contact with type-cylinder A, thence to and partly around K^2, thence around the sheet-reverser C^2, around impression-cylinder b, around register-roll p, around impression-cylinder b' and L^2 to place of starting. The path of tapes t', commencing at L, passes to the left around impression-cylinder b, around register-roll p, thence around impression-cylinder b', thence around L' and downward to point of starting.

The path of the web, as indicated by the broken lines, is as follows: Leaving roll V, it passes downward, receives its first impression between cylinders A and B, thence it passes around register-rolls P and P' and receives another impression on the same side between cylinders A and B'. The register-rolls P and P' are so proportioned and placed that the cylinders B and B' will print from the forms alternating in pairs of sheets. Thus the web will issue from between cylinders A and B' printed wholly on one side, but from alternate pairs of forms. From this point it passes partly around leading-roll K^3, and at the point of contact with cylinders H and K is cut into separate sheets by the cutting-cylinder K and its knife K', immediately succeeding which the grippers H' or H^2 close upon the head end of the web and lift the tail of the just severed sheet from contact with cylinder H. Thence the severed sheet passes in contact with cylinder H until it meets the sheet-reverser C^2, where the grippers G of the sheet-reverser C^2 seize the tail of the sheet. From this point the sheet passes around sheet-reverser C until at

the point of contact of C^2 with the impression-cylinder *b* the tail of the sheet enters between tapes *t* and *t'*, at which point the twin grippers G of the sheet-reverser C^2 release the tail of the sheet, the head of the sheet having been previously released by the grippers H^2 of the cylinder H, and the sheet remains suspended in the air at that point, as shown in Fig. 2. The sheet is further conveyed between tapes *t* and *t'* until it issues from the machine. After entering between tapes *t* and *t'* at the point of contact of the sheet-reverser C^2 with the impression-cylinder *b* the sheets receive their respective impressions on their reverse sides from alternate pairs of forms by means of the impression-cylinders *b* and *b'*, the arrangement and relative positions of *b b'* and *p* being the same as that of B B' and P and P', except that but one register-roll, *p*, is used, and the path of the sheets is the length of two sheets shorter, so that the sheets issue from the machine between the guide-fingers *d* with alternate pairs of sides uppermost, but printed on both sides.

The several positions of the sheets before and after severance from the web in their progress through the machine are shown by the crosses numbered from 1 to 12. Thus the sheet from 1 to 2 is blank and will receive its first impression between form A' and impression-cylinder B. The sheet from 2 to 3 is blank and will receive its first impression between form A^2 and impression-cylinder B'. The sheet extending from 3 to 4 has been printed between form A^2 and cylinder B'; the sheet extending from 4 to 5 will be printed between form A' and cylinder B'; the sheet extending from 5 to 6 has been printed by form A' and cylinder B; the sheet from 6 to 7 is held by the head by the grippers H' of the cylinder H, and will be severed from the web by the cutting-cylinder K. The sheet from 8 to 9 has been released at its head by the grippers H^2 of the cylinder H, and is being conveyed around, tail first, by the twin grippers G of the sheet-reverser C^2, and hangs freely in the air, as just released by the grippers H^2 of cylinder H. The sheet extending from 10 to 11 is being printed on its second side between form A^2 and impression-cylinder *b*. The sheet from 11 to 12 is being printed between form A^2 and impression-cylinder *b'*. The sheets in this construction will issue at *d*, following each other in pairs—that is to say, two sheets issue with the sides uppermost printed from form A', then two with sides uppermost printed from form A^2, but all printed on both sides. The two outer margin-tapes are carried outward around pulleys L^5 and L^9 for the purpose of facilitating the placing of the form upon the form-cylinder A, as shown in Fig. 3. The center tape, *t*, is not so deflected, but runs straight across from L^3 to L^8.

Referring now to Fig. 4, the several letters therein indicate the respective parts below mentioned. B B' B^2 B^3 *b b'* b^2 b^3 are impression-cylinders running in the usual journal-boxes in the main frames of the machine, and so placed as to permit of the interposition of one or more inking-rollers, R, between each two adjoining cylinders; R', inking-rollers receiving in the usual way the ink from the fountains placed near them in the space within the tapes as led over leading-pulleys L^2 for that purpose. The remainder of the inking apparatus is not necessary to be shown here. P P' P^2 P^3 *p p'* p^2 p^3 are leading or register rolls adjustably journaled in the main frames for regulating the distance the web or sheet shall travel from the point of contact of one impression-cylinder with the type-cylinder to a similar point of contact of the next succeeding impression-cylinder; C, *c* each a cutting-cylinder carrying the cutting-knives C' *c'*; C^2 c^2, rotary sheet-reversers (such as described in Serial No. 121,083, above mentioned) carrying the twin grippers G and *g*, respectively; H *h*, cylinders, each carrying two sets of grippers, H' H^2 *h' h²*; L L' L^2 L^3 L^4 L^5 L^6 L^7 L^8 L^9 L^{10} L^{11} L^{12}, each a series of tape-pulleys upon their respective shafts; S S' *s s'*, slotted recesses in the cylinders H and *h* for the reception of the serrated severing-knives C' *c'*, carried, respectively, in the two cylinders C *c*; V *v*, two rolls of paper from which the webs are fed to the machine. D *d* are each a series of guide-fingers to prevent the issuing sheets from following the tapes. The impression-cylinders, form-cylinders, sheet-reverser, and cutting and conveying cylinders H *h* are geared together in the usual way. The power is applied to the main gear-wheel upon the axis of the form-cylinder A in any well-known way. F *f* are each a series of tapes, and F' *f'* each a series of holes through which air-jets are forced, as hereinbefore described, and shown in K, Fig. 2, and for the same purpose. A series of three tapes, *t*, run partly in contact with the type-cylinder A, the center one of which is used only when the sheet to be printed is in quarto form, in which case there will be an unprinted strip in the middle of the web or sheets in the direction of the web's path through the machine. There will also be an unprinted margin at each edge of the web or sheets in the same direction. The tapes *t* run upon these unprinted strips or margins between the web and the surface of the type-cylinder, where they touch the latter, the ink-plate being sunk at this point for their reception and to prevent their being inked by the ink-rollers. The path of the outer margin-tapes *t*, beginning at the bottom of Fig. 4 and passing to the right, will be around L^9, upward over impression-cylinder *b*, thence in contact with form-cylinder A over *b'*, thence around *b*, around sheet-reverser c^2, back around impression-cylinder b^2, between the latter and the form-cylinder A, thence around p^3, around impression-cylinder b^3, between the latter and form-cylinder A, upward over L^7, thence over L', around L^2 and L^3, thence around L^4, L^5, and L^6, downward over impression-cylinder B, between the latter and form-cylinder A, thence in contact with form-

cylinder A, around under impression-cylinder B′, thence to and around L, around sheet-reverser C^2, thence under impression-cylinder B^2, between it and form-cylinder A, thence downward around P^3 and impression-cylinder B^3, downward to and around L^{10} to place of starting. The three tapes *t* are deflected from contact with form-cylinder A at the bottom by the leading-pulleys L^9 L^{10} to give room for ink-fountains and concomitant inking apparatus. At the top the central tape *t* deviates from the path just described by being merely carried from L′ directly across to L^6 and downward to impression-cylinder B, while the two outer margin-tapes are deflected outward by the leading-pulleys L^2 L^3 L^4 L^5 in the same manner as shown in Fig. 3, so as to leave an unobstructed space for placing the "turtles" or forms upon the form-cylinder A.

The path of tapes F is as follows: Commencing at L^{11} and passing to the left, Fig. 4, they pass around L^{12}, thence around sheet-reverser C^2, around B^2, thence around P^3, thence around impression-cylinder B^3, to and around L^{11} to point of starting, being in contact with tapes *t* from C^2 until they reach L^{11}. The path of tapes *f* is similarly: Commencing at L^8, passing downward, they pass partly around sheet-reverser C^2, around impression cylinder b^2, around p^3, around impression-cylinder b^3, to and around L^8 to point of starting, being in contact with tapes *t* from c^2 to L^8. Tapes *t* and *f* and *t* and F would of course be in contact through the distance mentioned, upon the supposition that no sheet was between them. With the sheets passing through the machine, however, it will be understood that the said sheets are between the two series of tapes and being conveyed by them. From the above, also, it will be understood that there are but three tapes in either of the series F and *f* corresponding in positions to the tapes *t*. Following the web from the roll V, it passes downward between impression-cylinder B and form-cylinder A, around register-roll P, around impression-cylinder B′, around register-roll P′ and register-roll P^2, thence between cylinders C and H, where it is severed into sheets. Immediately after the severing from the web the grippers H′ or H^2 come into position to close upon the head of the web, and in doing so serve as lifter-fingers for the tail of the preceding and just severed sheet, holding it up from contact with cylinder H, so that the twin grippers G may grasp it as they come into position. Thence it is conveyed partly around cylinder H until the tail is seized by twin grippers G of the sheet-reverser C^2, at which time the grippers H′ or H^2, as the case may be, release it. The twin grippers G release the sheet as it enters between the tapes F and *t*, and it is thus conveyed between tapes F and *t*, around impression-cylinder B^2, register-roll P^3, and impression-cylinder B^3, and until its issue from the machine at D. In this arrangement of course it will be understood that the sheets which are printed on their first sides by means of impression-cylinder B are printed on their second sides by means of impression-cylinder B^2, and for one side printed by means of impression-cylinder B′ the other side is printed by means of impression-cylinder B^3, and as the sheets are printed in either case on the first side head first and on the second side tail first the forms must be placed on the form-cylinder so that the one rotates head first and the other tail first.

In the same way as above described the web from the roll *v* is printed and delivered from the top of the machine at *d*.

I do not herein claim the parts illustrated in Figs. 5, 6, 7, 8, and 9, as the same are claimed in my pending application Serial No. 121,083, herewith filed.

Having thus fully described my said improvements as of my invention, I claim—

1. In a web-perfecting printing-machine, the combination, with a rotary sheet-reverser, as C^2, of a conveying-cylinder, as H, carrying grippers, as H′, constructed and arranged so as to close upon the head of the web and to lift the tail of a sheet as severed from said web from contact with said cylinder during the process of reversal of said sheet, substantially as and for the purposes set forth.

2. In a web-perfecting printing-machine, the combination, with a rotary sheet-reverser, as C^2, of a conveying-cylinder, as H, carrying grippers, as H′ H^2, and recesses, as S S′, for the reception of sheet-cutting knives, whereby said cylinder serves both as a conveying and cutting cylinder, substantially as and for the purposes set forth.

3. In a web-perfecting printing-machine, in combination with a form-cylinder, as A, a series of impression-cylinders, as B B′ *b b′*, and a rotary sheet-reverser, as C^2, a series of conveying-tapes, as *t*, running partly in contact with sunken portions of the type or form cylinder, and a series of tapes, as F, whereby the sheets, after being severed from the web, are conveyed through the process of being printed on their second sides, and the use of grippers in the impression-cylinders thereby avoided, substantially as set forth.

4. In a web-perfecting printing-machine, in combination with a type or form cylinder, as A, and a rotary sheet-reversing apparatus, as C^2, a pair of impression-cylinders, as B B′, and leading or register rolls, as P, P′, and P^2, for printing the first side while in the web, and a pair of impression-cylinders, as B^2 B^3, and a leading or register roll, as P^3, for printing the second side after the sheets have been severed from the web and reversed, substantially as and for the purposes set forth.

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