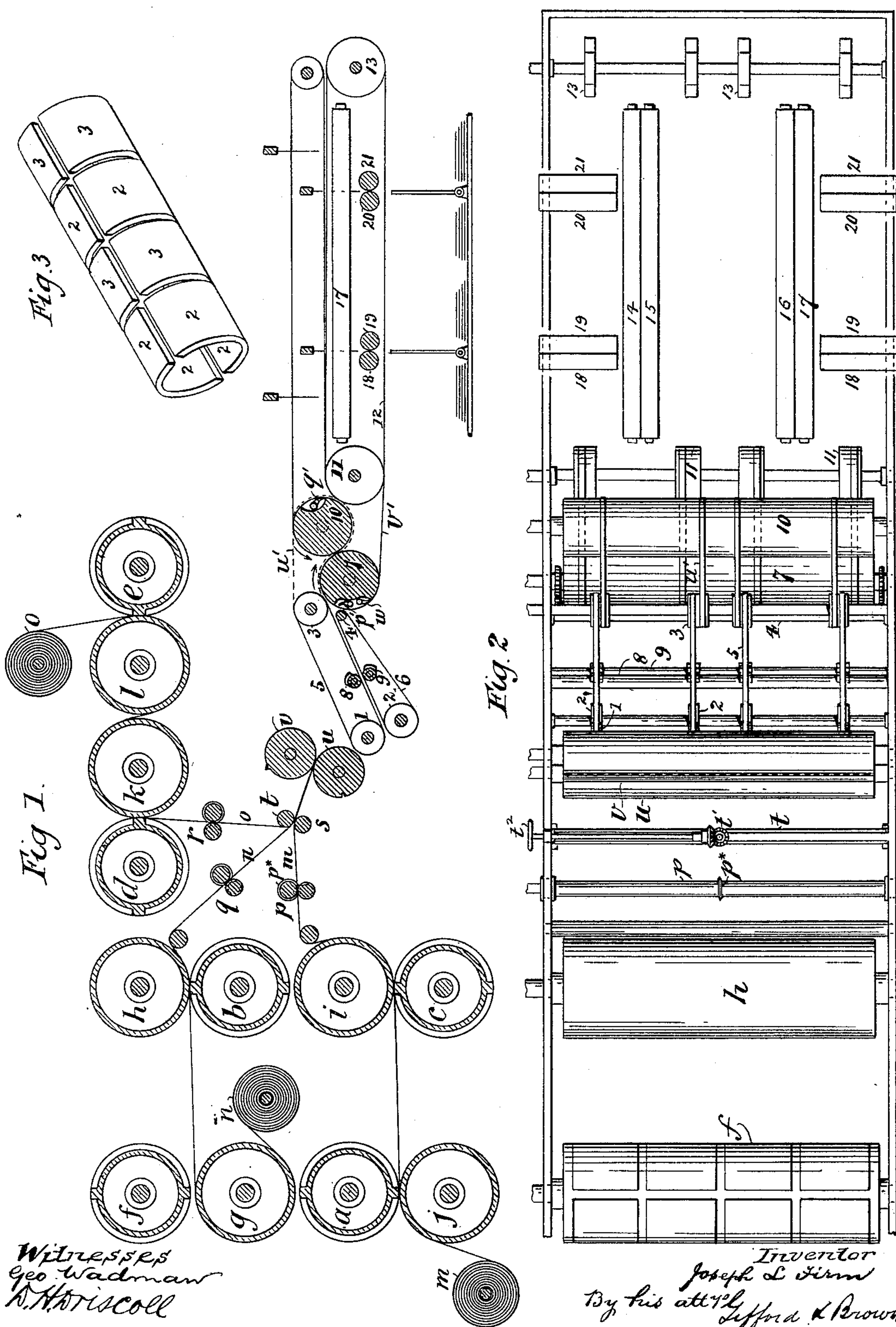


4 Sheets—Sheet 1.

No. 415,321.

Patented Nov. 19, 1889.



(No Model.)

4 Sheets—Sheet 2.

J. L. FIRM.
ROTARY PRINTING MACHINE.

No. 415,321.

Patented Nov. 19, 1889.

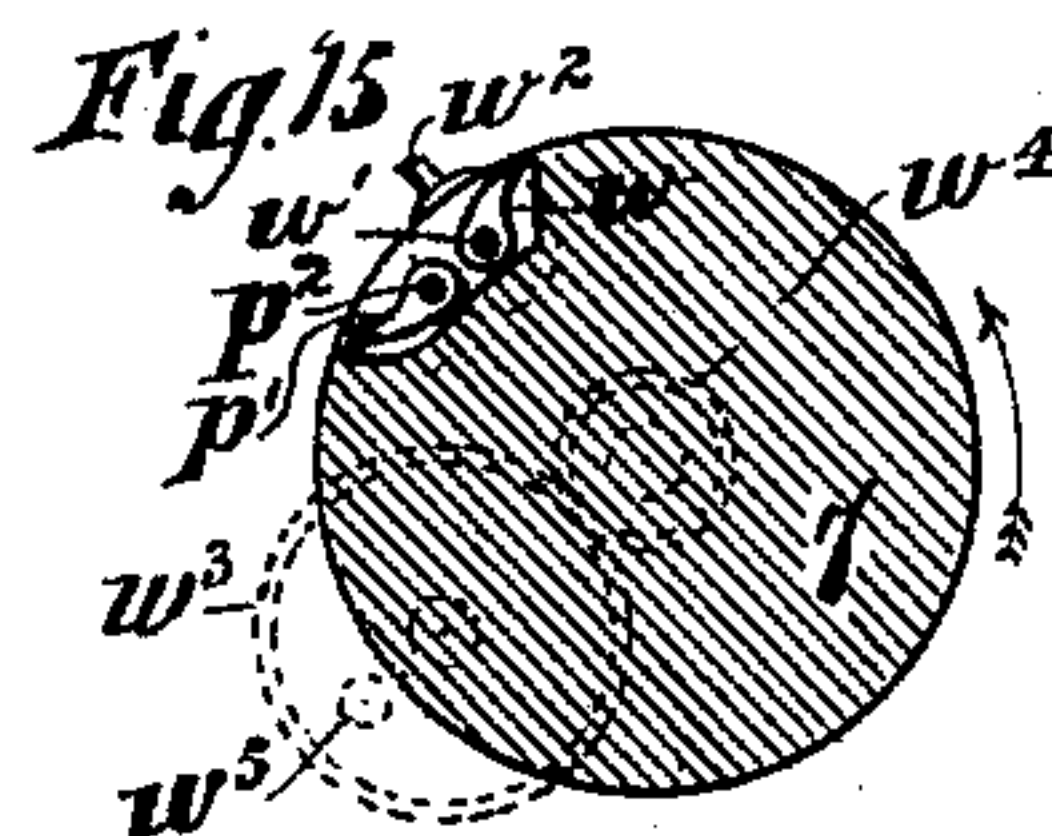
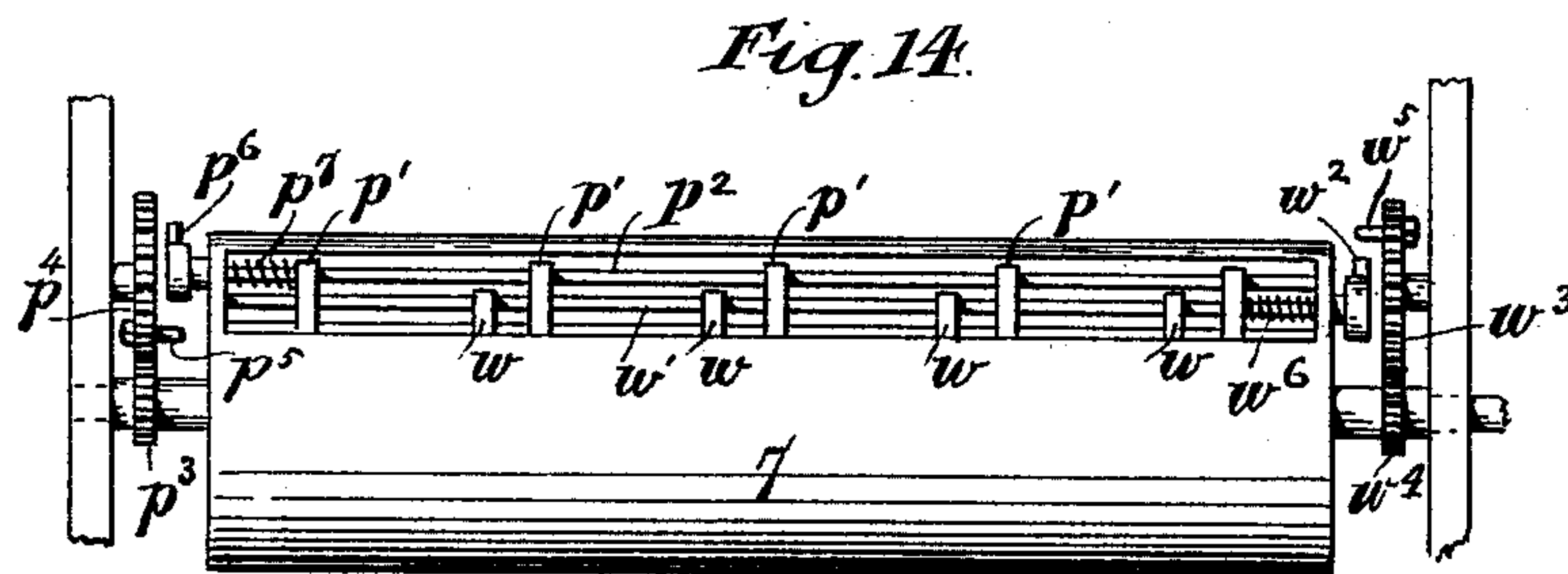
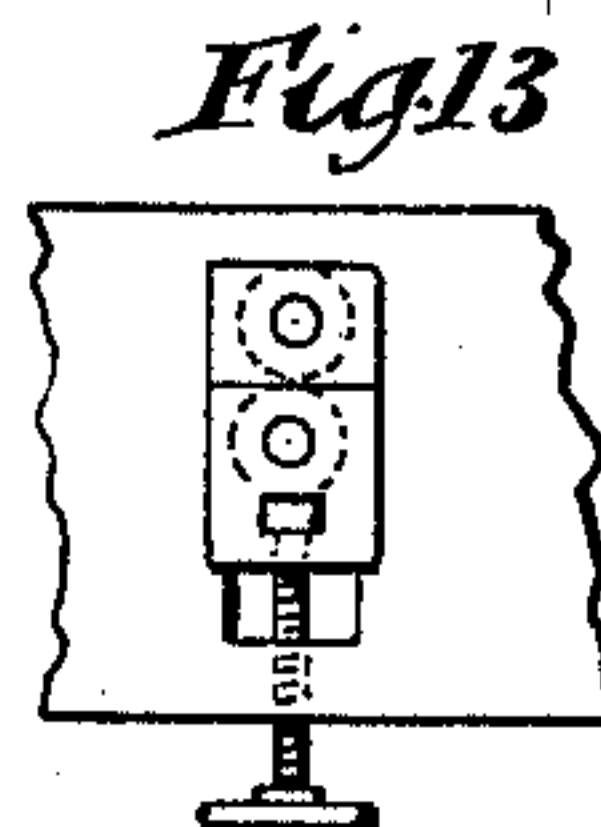
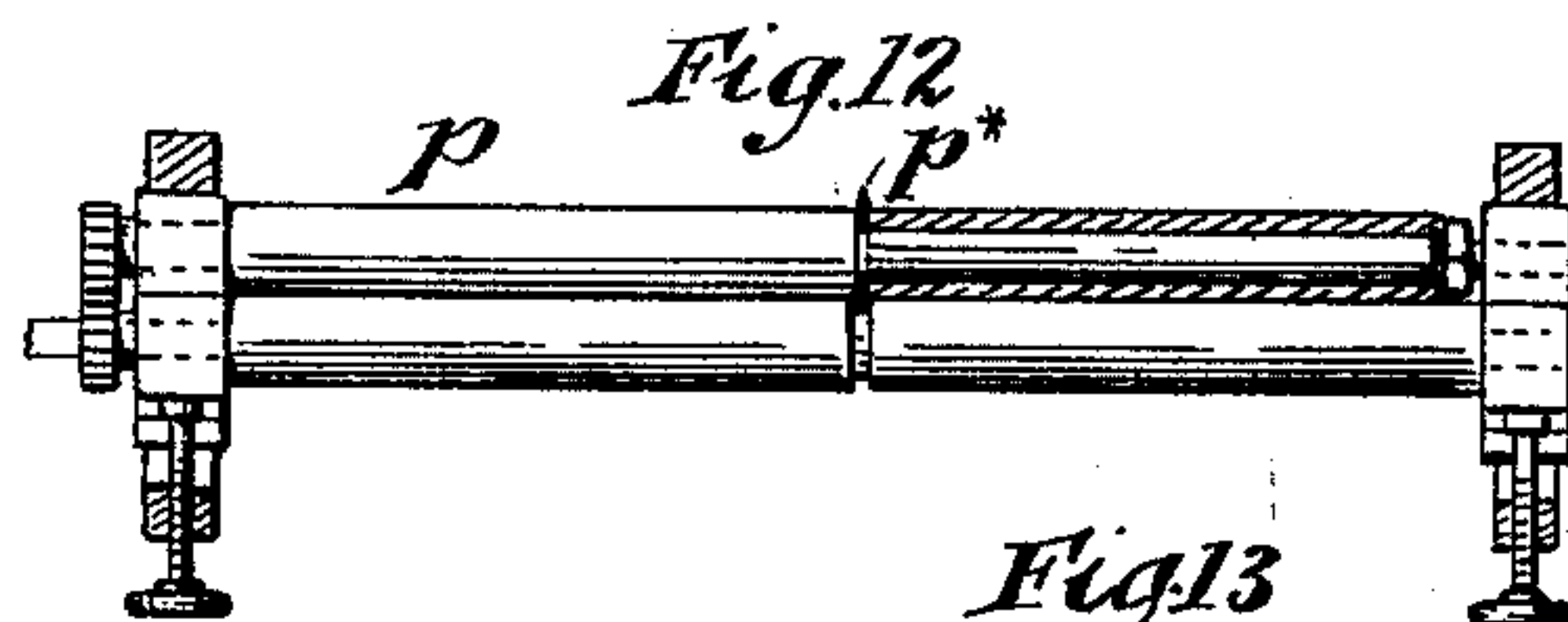
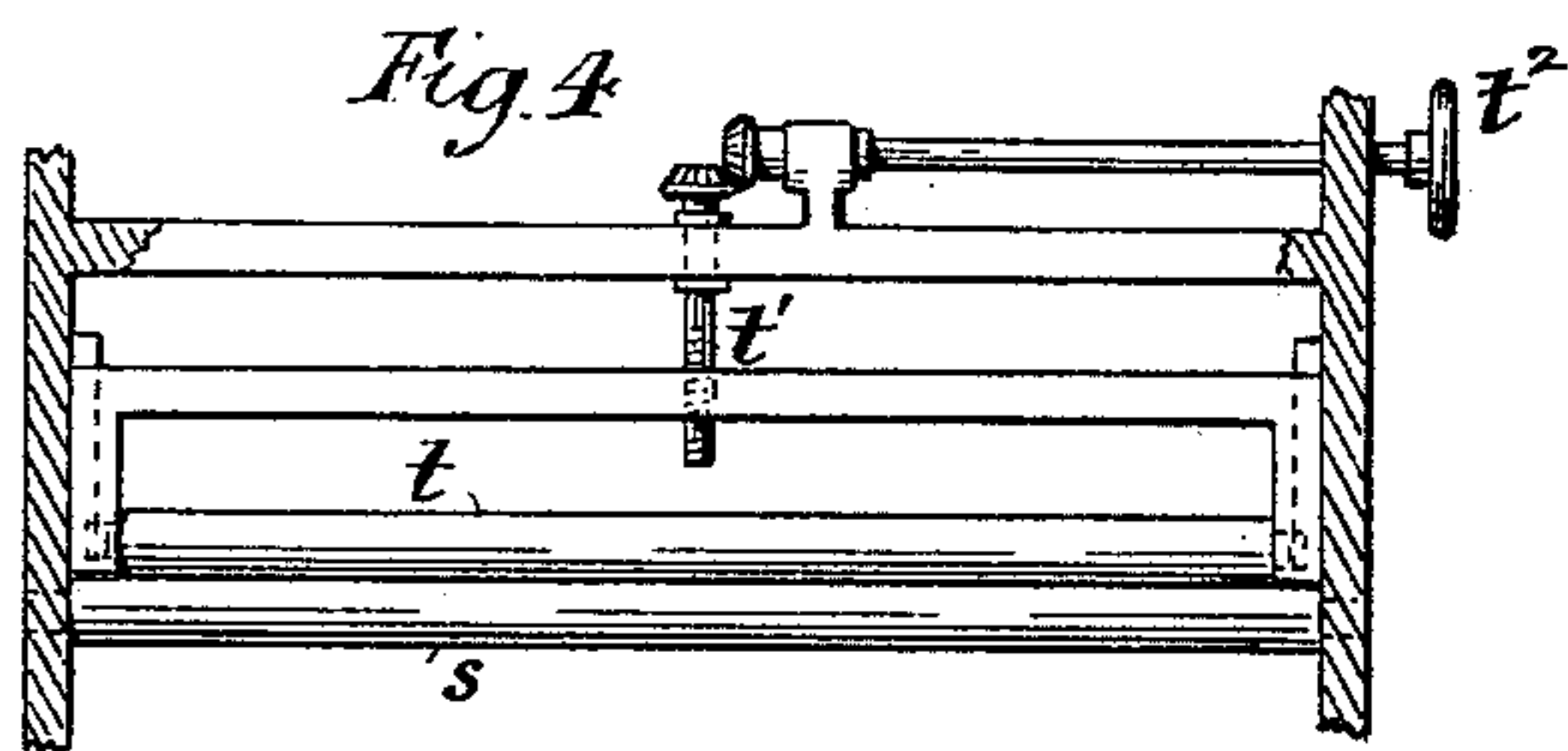


Fig. 17

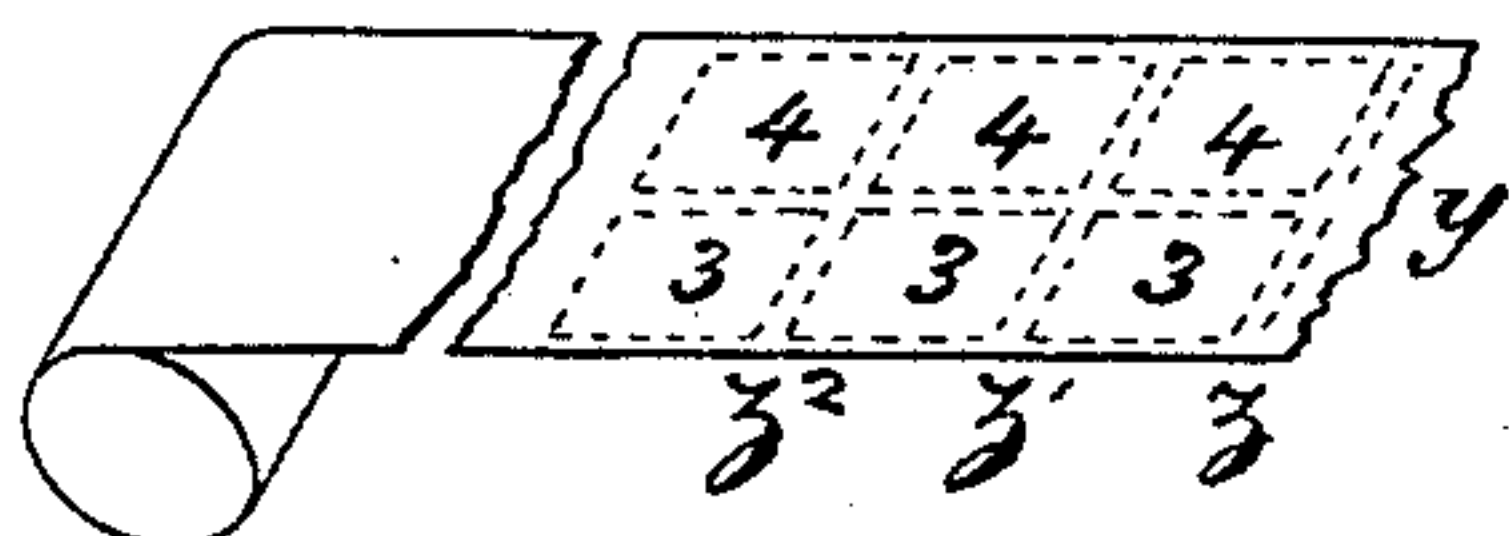


Fig. 16

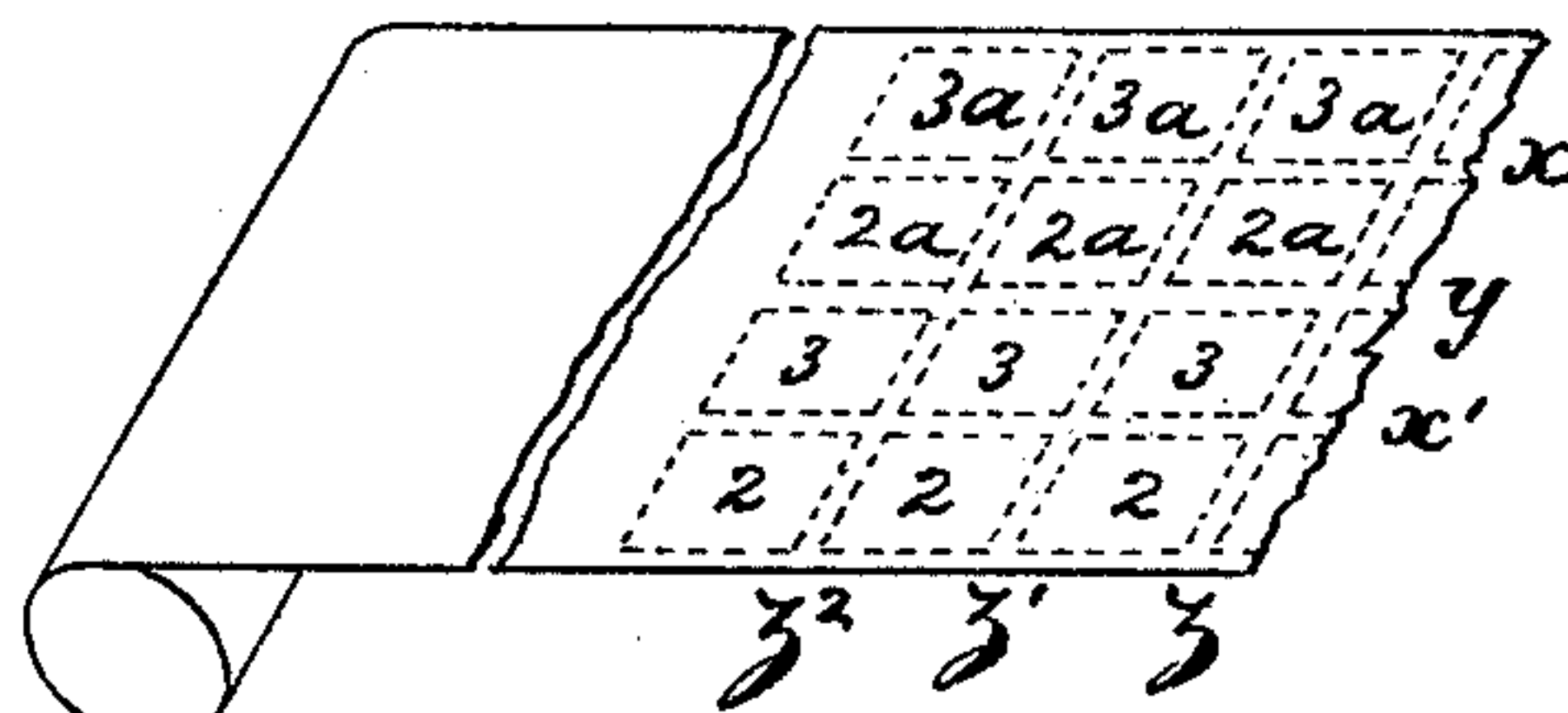


Fig. 19

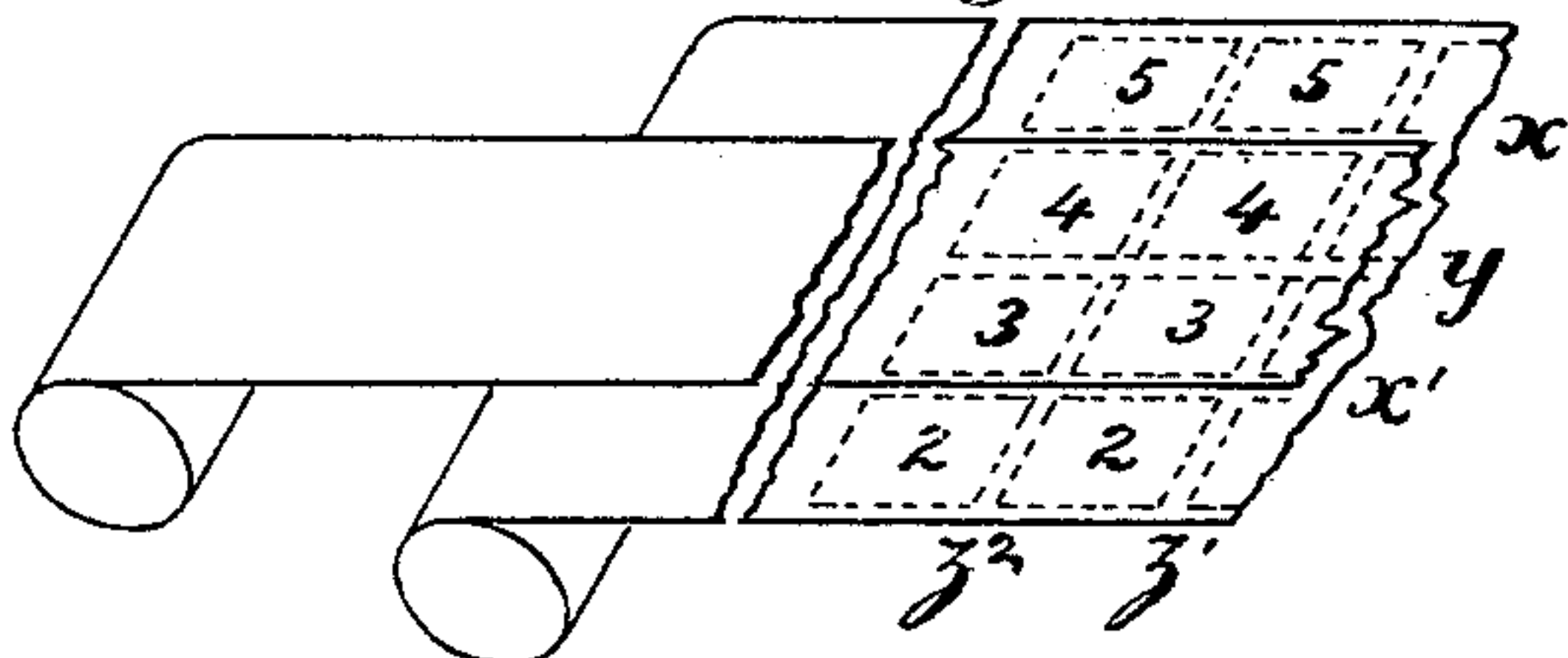


Fig. 18

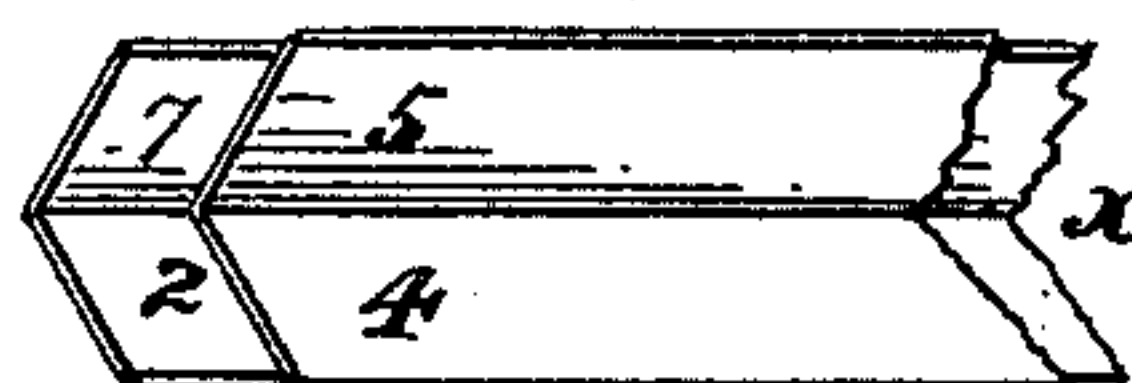
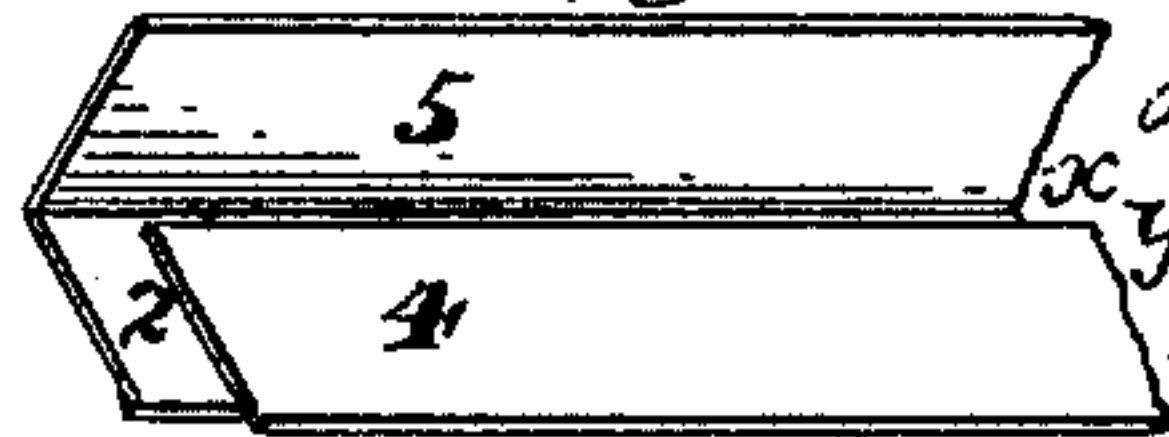


Fig. 20



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J. L. FIRM.
ROTARY PRINTING MACHINE.

No. 415,321.

Patented Nov. 19, 1889.

Fig 5

2	3	2	3
2	3	2	3

1	4	1	4
1	4	1	4

Fig. 6

2	5	2	5
2	5	2	5

blank	4	3	blank
blank	4	3	blank

1	6	1	6
1	6	1	6

blank	3	4	blank
blank	3	4	blank

Fig 8

2	6	2	6
2	6	2	6

3	8	3	8
3	8	3	8

1	10	1	10
1	10	1	10

blank	5	6	blank
blank	5	6	blank

blank	6	5	blank
blank	6	5	blank

4	7	4	7
4	7	4	7

Fig 9

2	11	2	11
2	11	2	11

3	10	3	10
3	10	3	10

1	12	1	12
1	12	1	12

9	7	9	7
9	7	9	7

5	8	5	8
5	8	5	8

4	6	4	6
4	6	4	6

Fig 11

2	23	2	23
8	17	8	17

3	22	3	22
9	16	9	16

1	24	1	24
7	18	7	18

5	20	5	20
11	14	11	14

9	61	9	61
12	13	12	13

01	51	01	51
4	21	4	21

Fig. 7

2	7	2	7
2	7	2	7

1	8	1	8
1	8	1	8

3	6	3	6
3	6	3	6

4	5	4	5
4	5	4	5

Fig. 10

9	11	9	11
2	15	2	15

1	16	1	16
5	12	5	12

3	14	3	14
7	10	7	10

8	6	8	6
4	13	4	13

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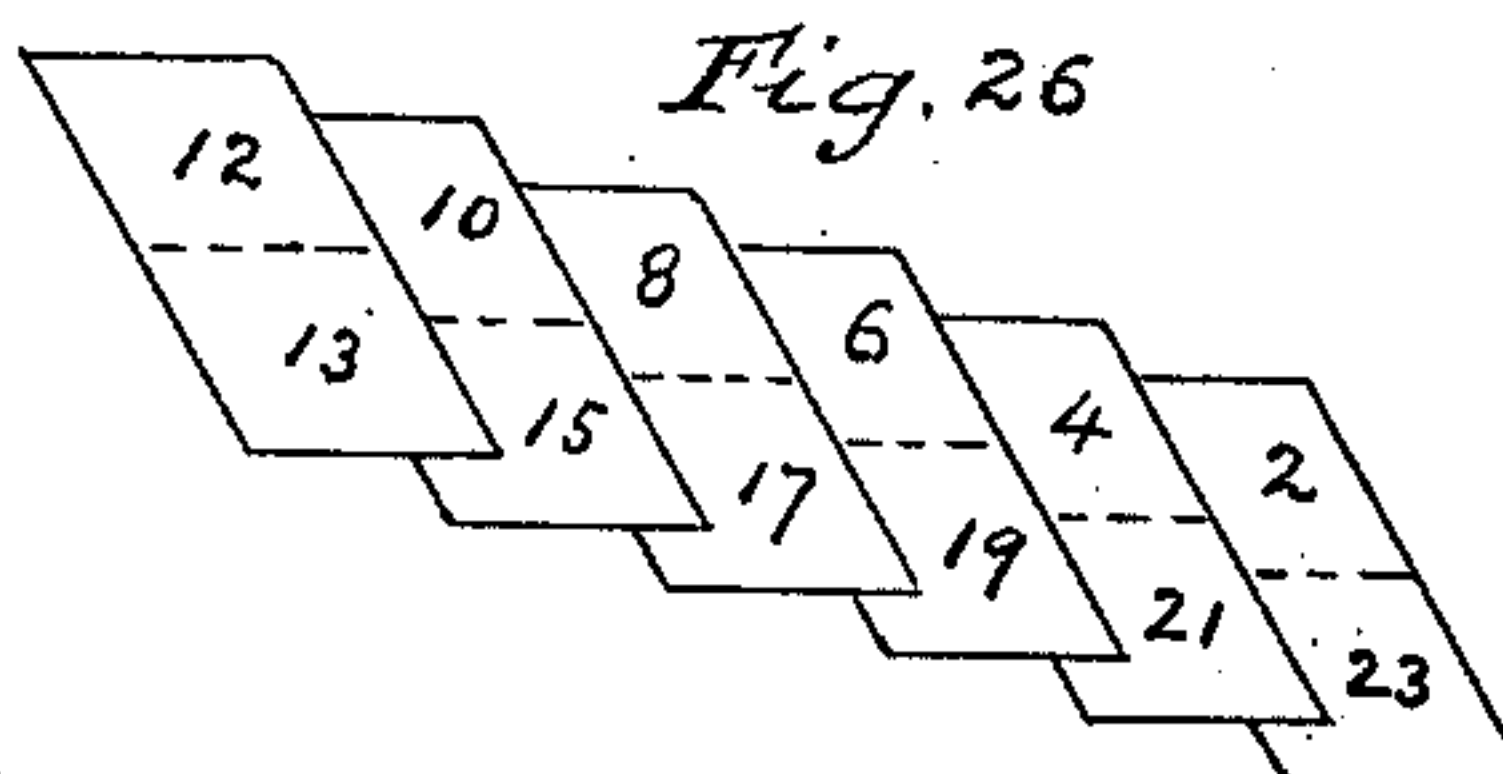
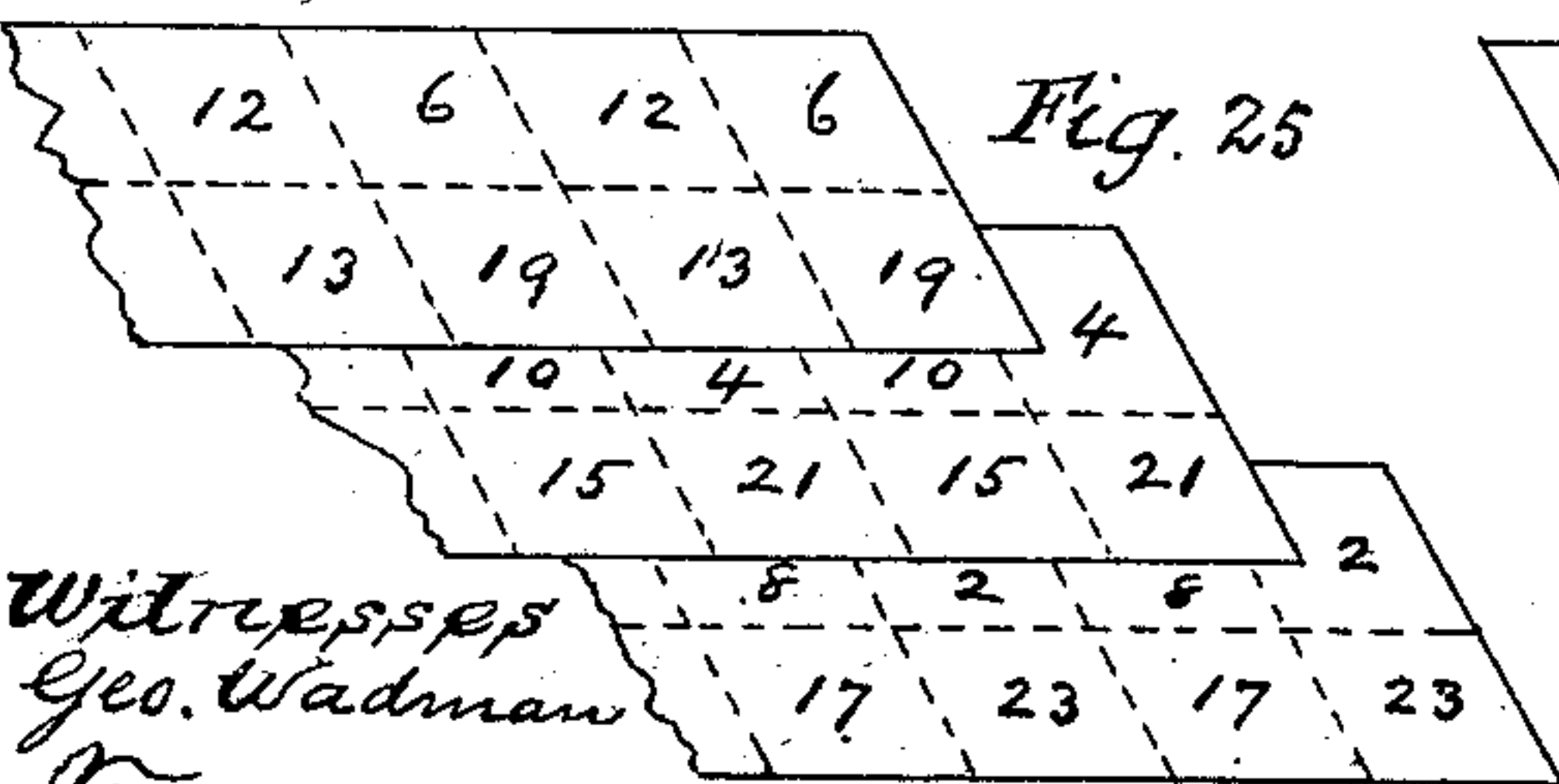
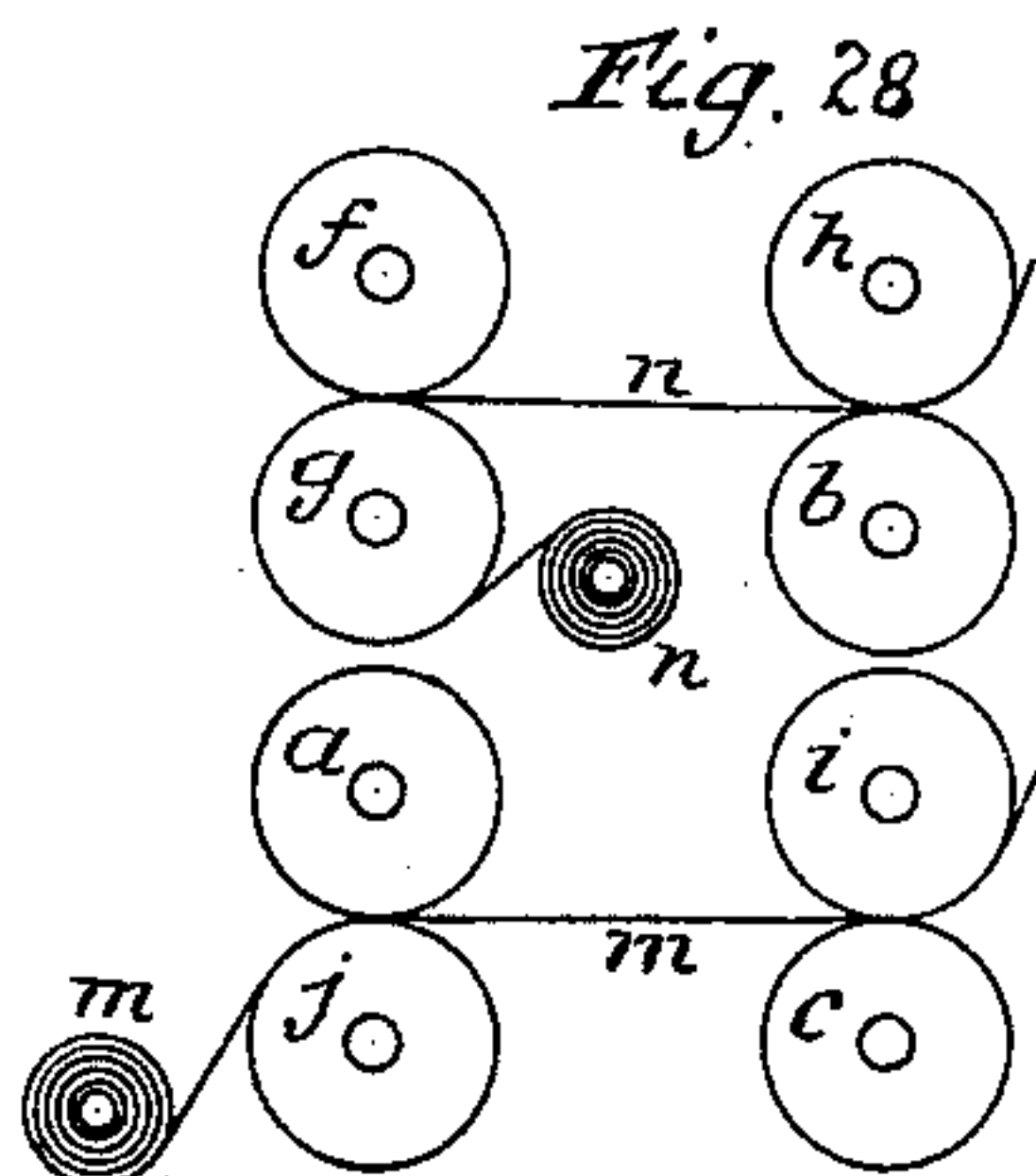
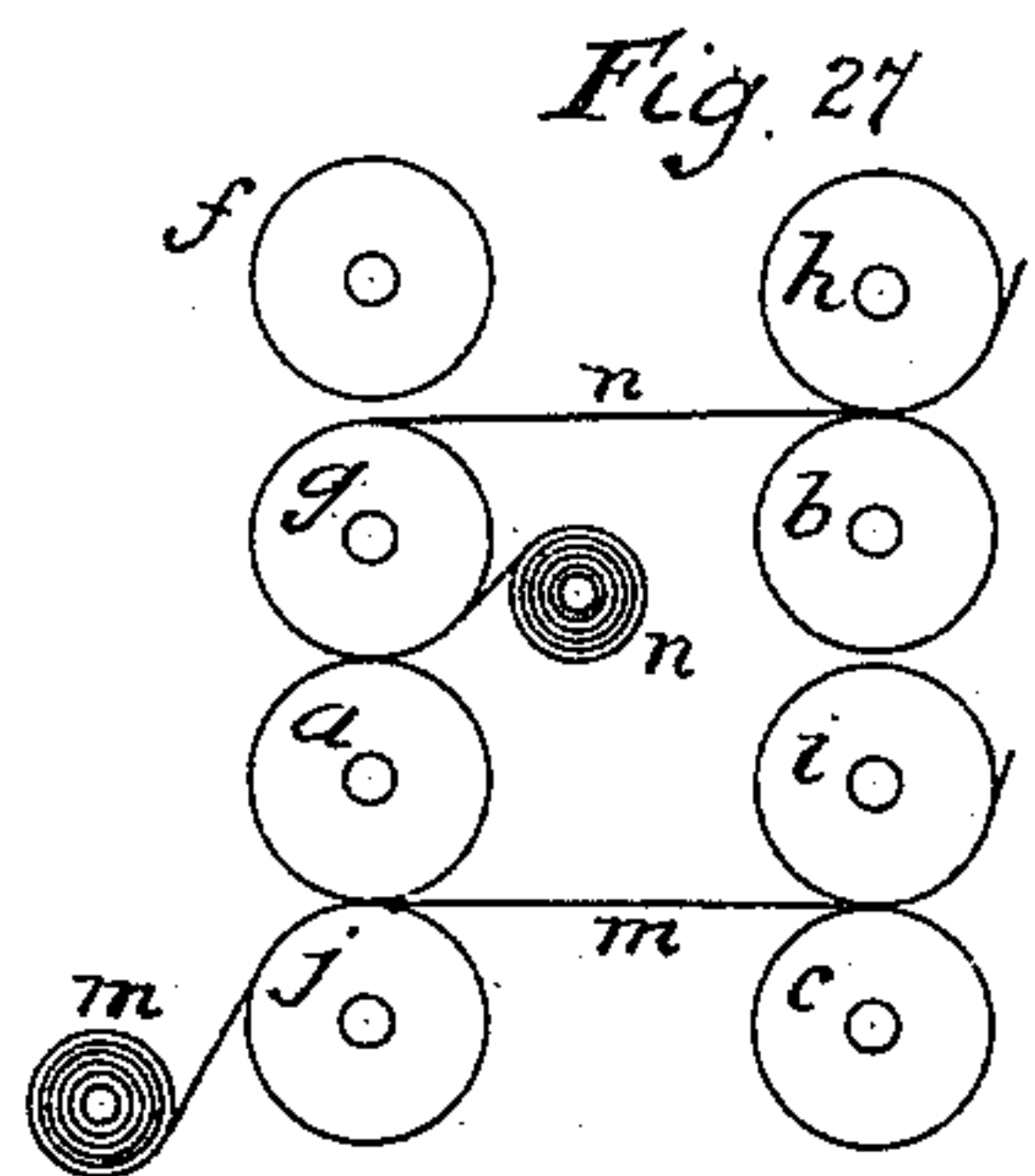
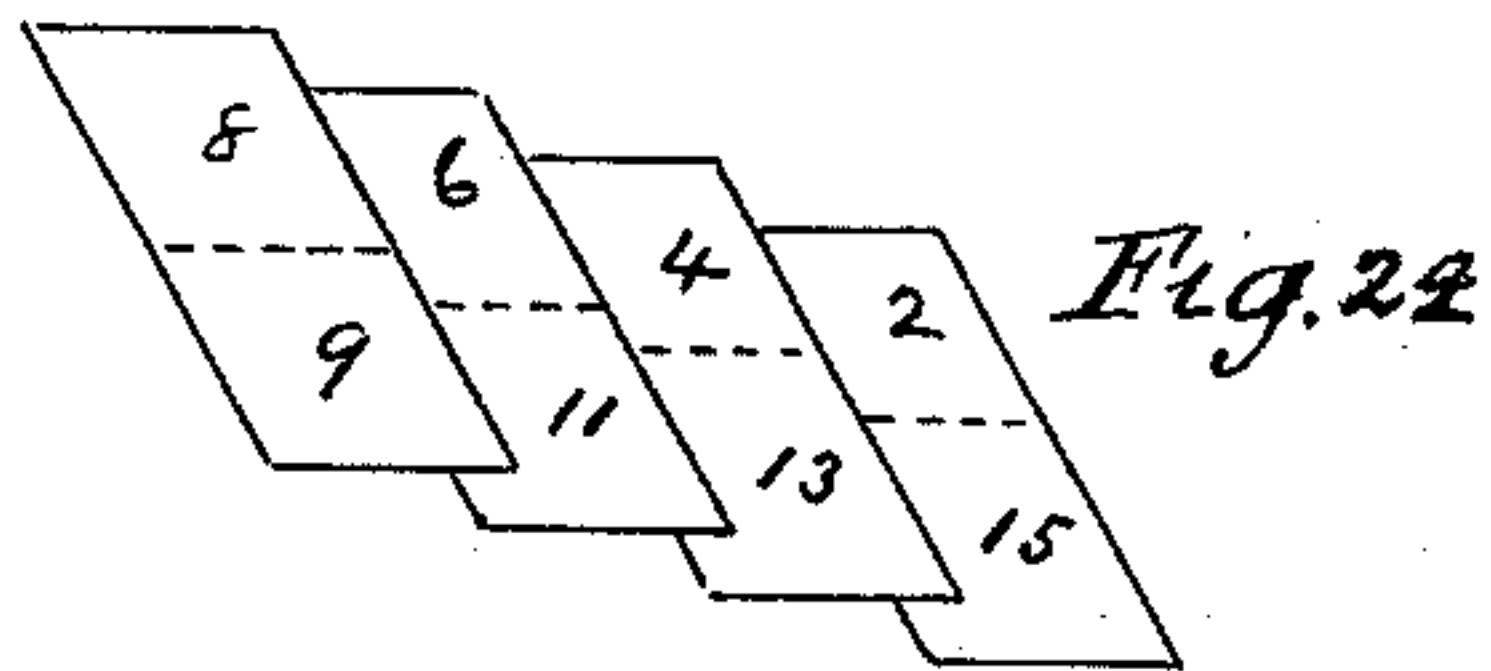
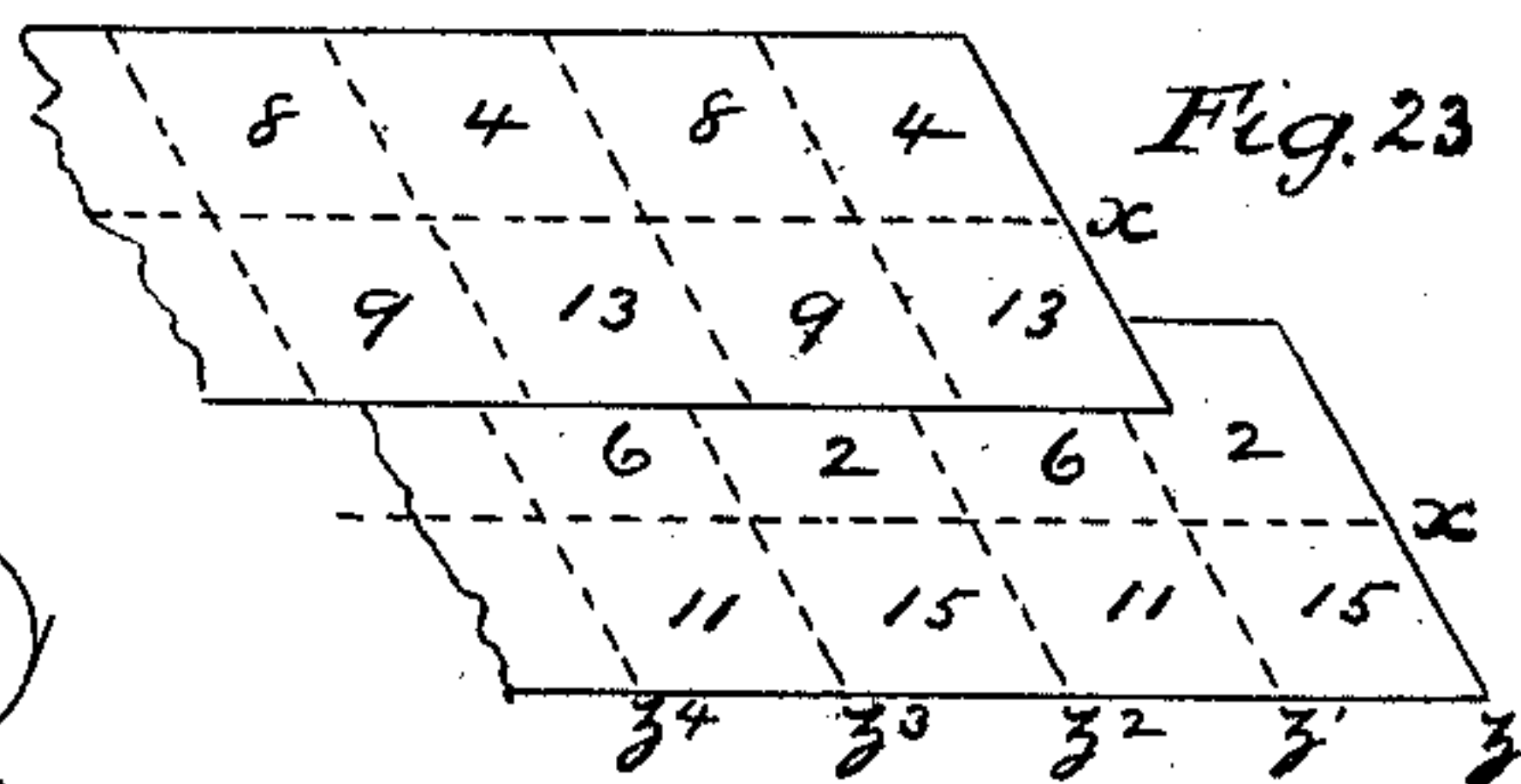
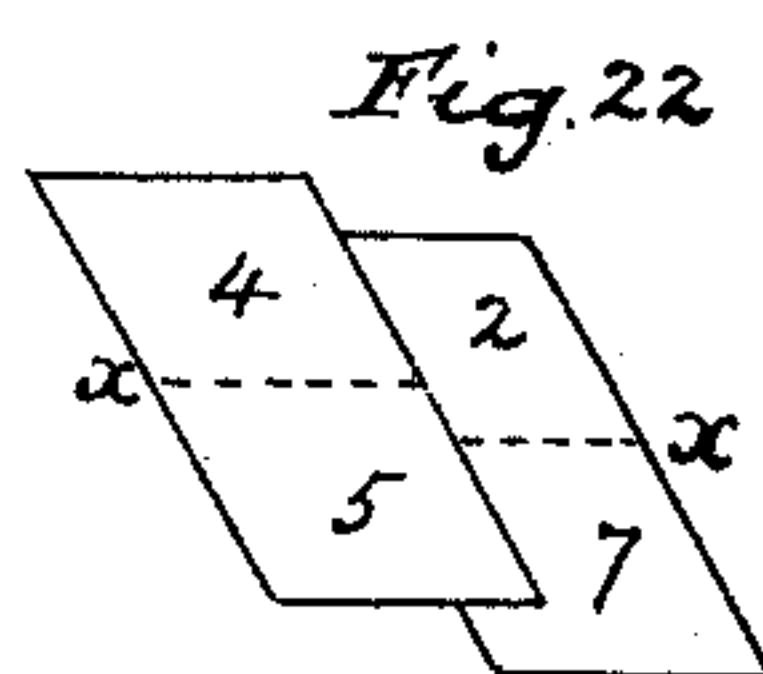
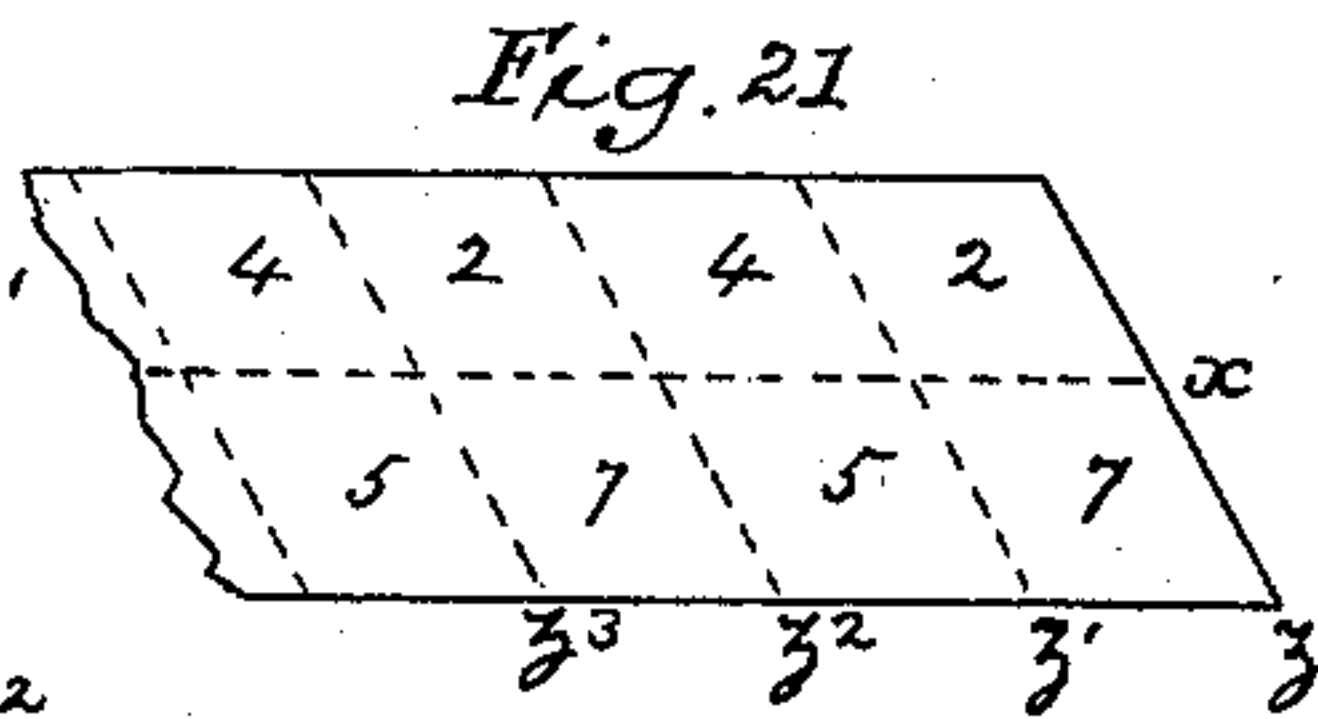
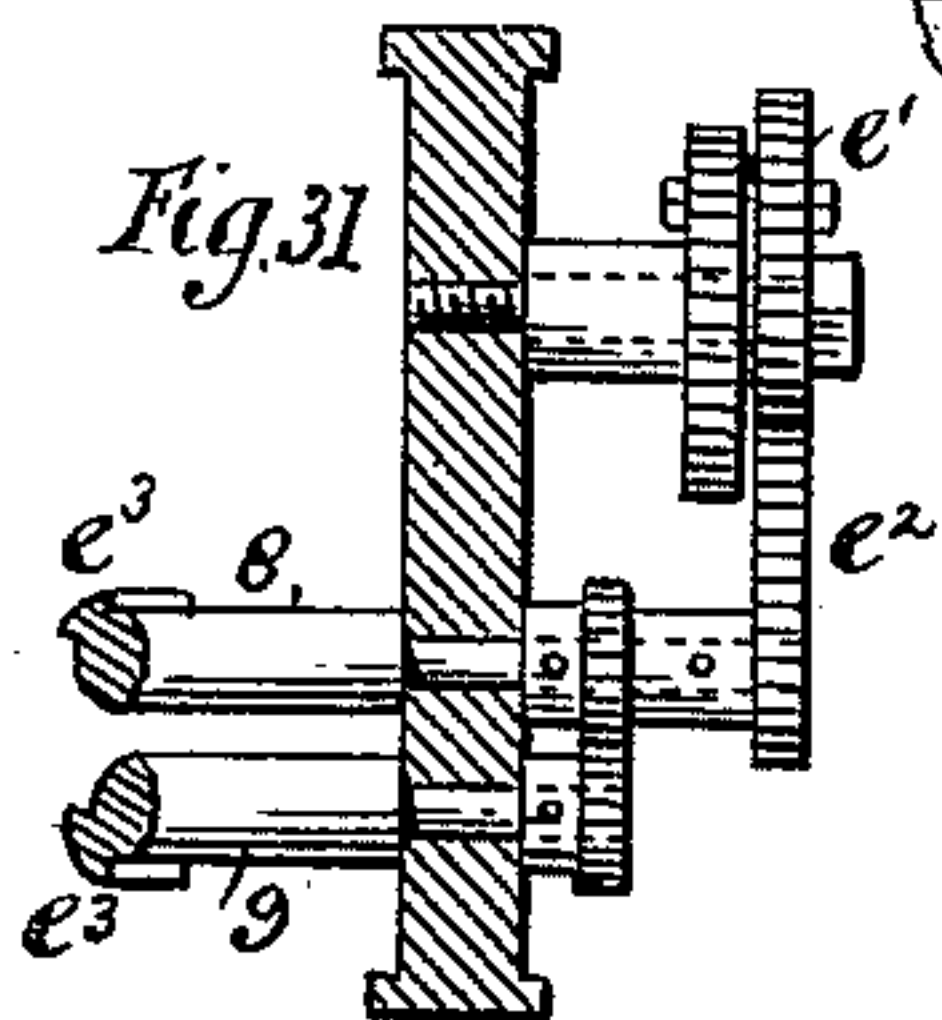
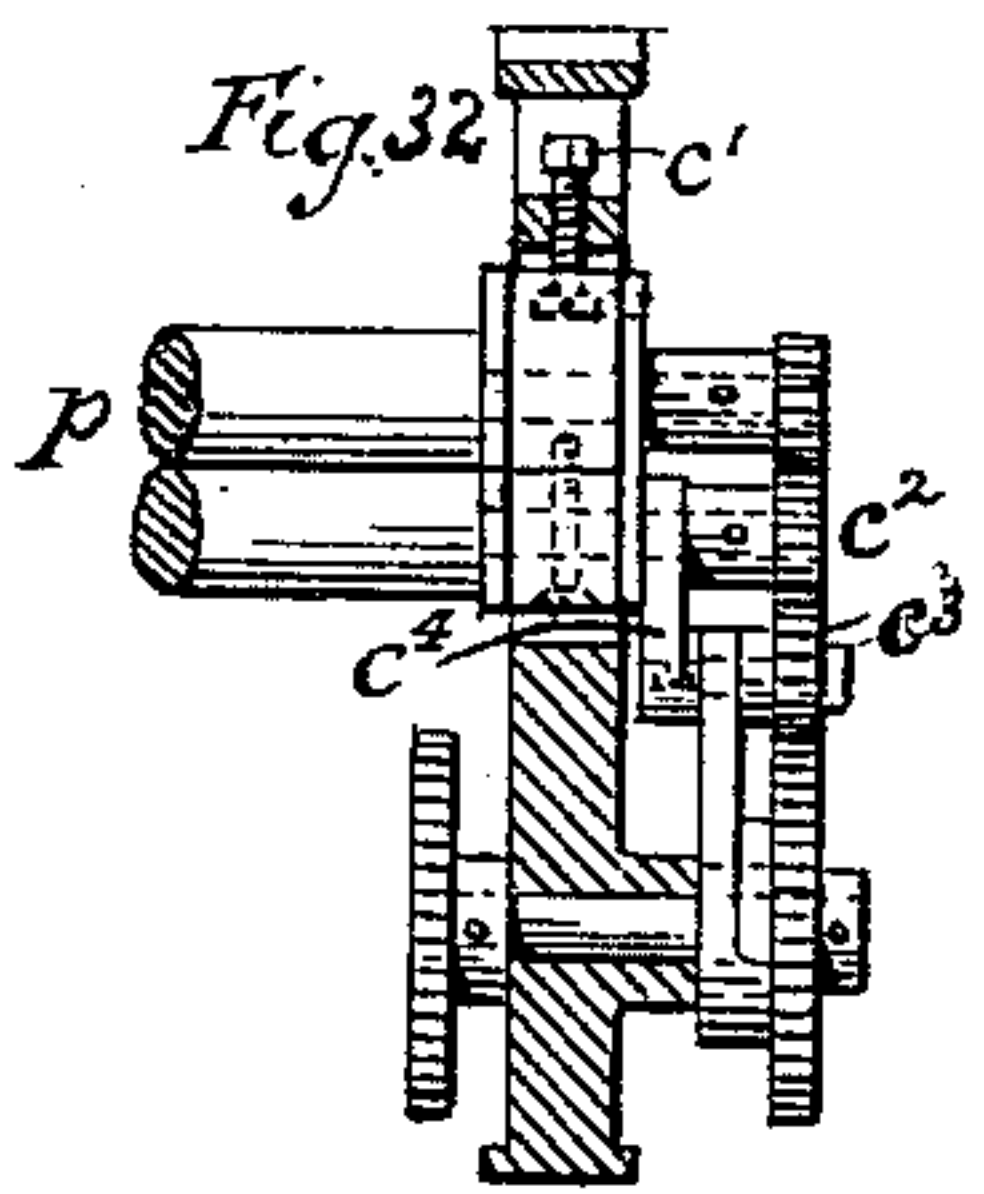
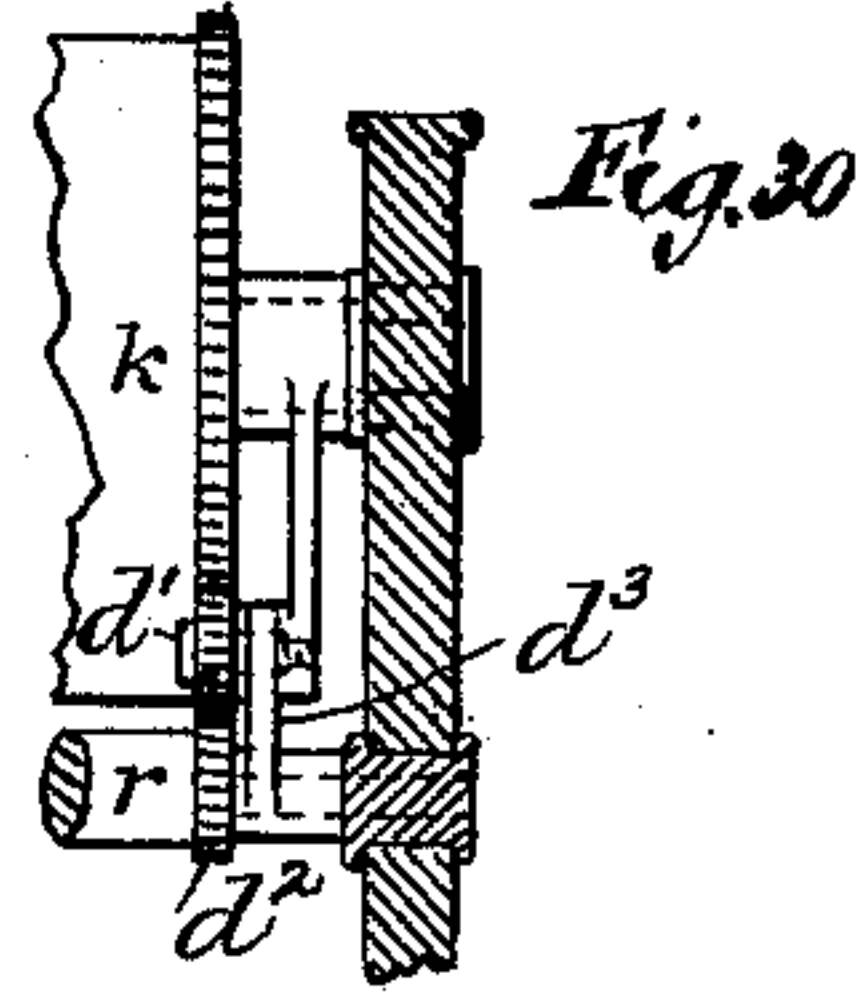
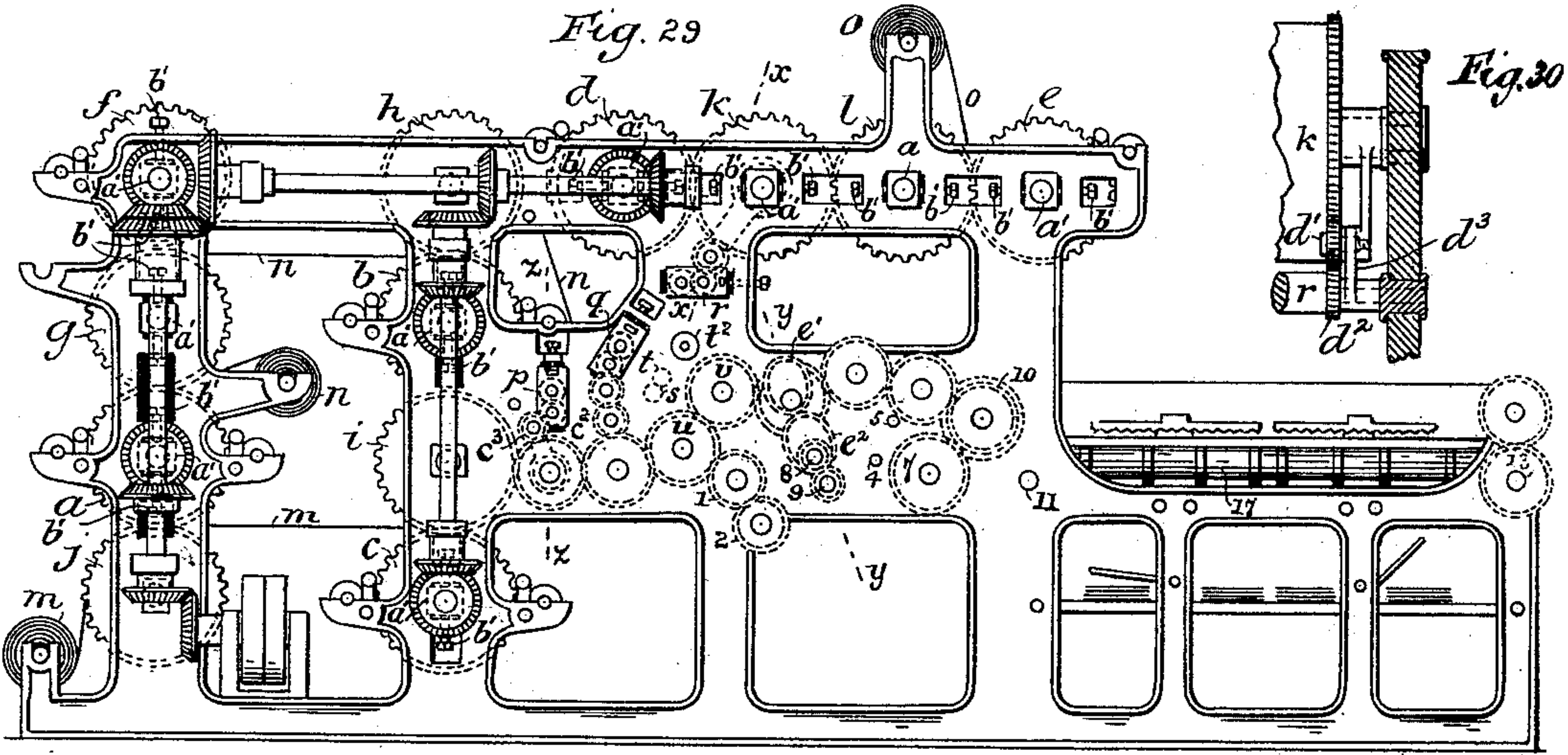
(No Model.)

4 Sheets—Sheet 4.

J. L. FIRM.
ROTARY PRINTING MACHINE.

No. 415,321.

Patented Nov. 19, 1889.



Witnesses
Geo. Wadman
Fred Kemper

Inventor
Joseph L. Firm
By his attorneys
Lyford & Brown.

UNITED STATES PATENT OFFICE.

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

ROTARY PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 415,321, dated November 19, 1889.

Application filed January 17, 1888. Serial No. 260,983. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH L. FIRM, of Jersey City, New Jersey, have invented a new and useful Improvement in Rotary Printing-Machines, of which the following is a specification.

This invention relates to that class of printing-presses known as "rotary perfecting," and the object is to print on continuous webs a plurality of copies of a newspaper or pamphlet, and to gather or assemble the sheets belonging to the respective papers or pamphlets in an expeditious manner, all of which will be fully understood from the following description.

In carrying out my invention many of the parts of the press are used as heretofore, and it will therefore only be necessary for me to describe and show sufficient of the operative parts of my press to point out the new features, so that a man skilled in the art may practice the invention.

Figure 1 shows in elevation the essential working parts of the machine. Fig. 2 shows a plan view of the same. Fig. 3 shows the arrangement of the forms on the form-cylinders. Fig. 4 shows the tension-rollers in detail. Figs. 5 to 11, inclusive, are the surfaces of the various form-cylinders developed to show the arrangement of forms on them. Fig. 12 is a detail side view, partly in section, of the rollers for splitting the paper. Fig. 13 is an end view of same. Figs. 14 and 15 are a side view and end sectional view of cylinder 7 and its nippers. Figs. 16, 17, 18, 19, and 20 show the relative position of the webs and the arrangement of pages upon them. Figs. 21, 22, 23, 24, 25, and 26 show the manner in which the pages are gathered by the gathering-cylinders. Figs. 27 and 28 show the positions of the form and impression cylinders according to the two adjustments of the cylinder *g*. Fig. 29 is a side view of the press complete, showing in dotted lines the arrangement of the various cylinders and the gearing for driving the same. Figs. 30, 31, and 32 are details.

In Fig. 16 I have shown a web of paper partly unrolled, with the position of the pages and margins indicated upon it as they appear after the web has been printed upon. Thus 2,

3, 2^a, and 3^a indicate the positions of separate pages, there being four pages printed abreast across the web. The pages on the opposite side of the web occupy corresponding positions to those shown.

y is the central margin running longitudinally from one end of the web to the other, and which divides the two pages belonging to one pamphlet from the two pages belonging to the other pamphlet alongside of it.

x is a margin running longitudinally the full length of the web, and which constitutes the central margin of one of the pamphlets. When this pamphlet is complete, the pages 2^a and 3^a will be folded together along the margin *x*.

x' is another margin running longitudinally the full length of the web, and when the pamphlet is complete the pages 2 and 3 will be folded together along this margin. After the web has been printed it will be split longitudinally along the margin *y*, so as to split the pamphlet-pages on one side of that margin from the pamphlet-pages of the other and permit the two to be treated and folded independently of each other.

z represents the margin at the forward end of the web. *z'* represents the next margin, running transversely, and *z*² represents the third margin, running transversely. Before the pamphlet is complete the web will be cut transversely across in each of the margins *z'*, *z*², &c., so that the web will be divided up into sections, each of which contains not more than two pages on one side and two pages upon the other side. The web above referred to is of full width.

When, as will be hereinafter described, a half-width web is employed, the arrangement of pages upon it and the margins may be illustrated in Fig. 17. Here there are only two pages abreast on each side of the web, and each of these two pages belongs to a different pamphlet. Thus page 4 belongs to one pamphlet and page 3 to another, they being split or separated, as before, along the longitudinal margin *y*. The web is likewise cut, as before, along the margins *z'* *z*². In this case each of the sections into which the web is cut contains only one page on each side, page 3 being on one side of the leaf and page 4 on the op-

posite side. When the pamphlet is complete, this leaf will be placed in the fold of two others, as shown in Fig. 20. When, as in the case of printing an eight-page pamphlet, two of these sections of the full-width web shown in Fig. 16 have to be brought over each other and be folded along the margins x and x' , they will, when the pamphlet is complete, occupy the position shown in Fig. 18, the folds along the said margins being brought over each other. When, as in the case of a six-page pamphlet, a section of the half-width web is to be brought over the section of the full-width web, as shown in Fig. 19, they will, when the pamphlet is complete, occupy the position indicated in Fig. 20; the margin of the section of the half-width web, which is formed where it is split along the margin y , being placed in the fold x of the full width of the web.

$a b c d e f$ are the form-cylinders. $g h i j k l$ are the impression-cylinders. Each of these form-cylinders is adjustable with reference to the impression-cylinder next to it. Means for accomplishing this adjustment is illustrated in Fig. 29, and consists in providing the sliding boxes severally lettered a' for the bearings of the cylinders, such sliding boxes being held in position by the set-screws severally lettered b' . On each of the form-cylinders are arranged places for eight forms. Each form occupies nearly a semi-circumference, and four forms are arranged side by side on each semi-circumference. Thus the relative position which the eight forms will occupy on the form-cylinder is shown in Fig. 3, where they are arranged for printing pages 2 and 3 of a pamphlet, so that each turn of the cylinder will print pages 2 and 3 for four pamphlets, as shown for cylinder a in Fig. 5.

The number of form-cylinders which I have shown is sufficient for printing two copies of a twenty-four-page newspaper or pamphlet; but by allowing certain of the cylinders to remain idle or altering the arrangement of the forms on the cylinders newspapers or pamphlets having a less number of pages may be printed, as I will now proceed to show.

For printing eight copies of a four-page pamphlet or paper the following arrangement of cylinders is to be employed: The web m runs between form-cylinder a and impression-cylinder j , and thence between form-cylinder c and impression-cylinder i . The web n runs between form-cylinder a and impression-cylinder g , as shown in Fig. 27, and thence between form-cylinder b and impression-cylinder h . The development of the surface of cylinder a in Fig. 5 will show the arrangement of the forms for the different pages on that cylinder, and the same is true of cylinders b and c , which are arranged alike. It will be understood that webs n and m are each of sufficient width to take four pages abreast.

For printing four copies of a six-page paper the following arrangement is to be employed: The webs pass as before; but the impression-

cylinder g , instead of pressing the web n against form-cylinder a , is adjusted so as to press it against form-cylinder f , as shown in Fig. 28, thus causing the cylinder a to print only on one web and bringing cylinder f into use. The arrangement of page-forms on the different cylinders is shown in Fig. 6. It will be observed that on cylinders b and f the end forms are omitted, the spaces for them on the cylinders being left blank. The web n is here reduced in width one-half, as shown in Fig. 17, so as to cover only the forms next the middle of the cylinders b and f .

For printing four copies of an eight-page paper the following arrangement of cylinders is to be employed: The webs pass as in printing four copies of a six-page paper and the same cylinders are employed. The web n , however, is here of full width, like the web m , so as to be wide enough to receive the impress of four pages abreast. The arrangement of forms upon the cylinders is shown in Fig. 7.

For printing four copies of a ten-page paper the cylinders are arranged as follows: Here an additional web o is employed, which runs between form-cylinder e and impression-cylinder l , and thence between form-cylinder d and impression-cylinder k . The webs m and n run between the same cylinders as for printing four copies of a six-page paper. The webs m and n are both of full width; but the web o is here of only half-width, so as to cover only the forms next to the middle line of cylinders d and e . The arrangement of the forms upon the cylinders is shown in Fig. 8. It will be observed that here there are only four forms each on form-cylinders d and e , the end form-spaces being left blank on each of these cylinders.

For printing four copies of a twelve-page paper the webs run the same as in the last case, excepting that here the web o , like the webs m and n , is of full width. The arrangement of forms upon the cylinders is shown in Fig. 9.

For printing two copies of a sixteen-page paper the following arrangement is employed: Only the webs m and n are necessary, and they run as did the same webs in printing four copies of a six-page paper. The arrangement of forms upon the cylinders is shown in Fig. 10, excepting where eight pages are printed on a single web, as in Fig. 21. It will be observed that here for the first time the forms for four different pages are upon each cylinder, whereas previously the forms of only two different pages were on each cylinder. In the present case, however, there are on each cylinder only two forms of a corresponding page, whereas previously there were on each cylinder four of a corresponding page.

For printing two copies of a twenty-four-page paper the following arrangement is employed: Here the webs m , n , and o are all employed of full width and run as described for

printing four copies of a twelve-page paper. The arrangement of the forms on the cylinders is shown in Fig. 11.

Having by the arrangement of the form and impression rollers above described printed two or three webs, as the case may be, on both sides, in a manner to be determined by the number of pages which the paper is to contain, I next proceed to gather the webs together, separate them into sheets belonging to the several papers, and, having arranged the sheets in their proper order, to fold them. The webs m , n , and o are brought from the last impression-rollers to the several cutting-rollers p , q , and r . A front view of one of these pairs of cutting-rollers is shown in Fig. 12 and an end view in Fig. 13, from which it will be seen that extending around the circumference of one of them in the middle is a circular knife p' , which enters a slight groove extending around the circumference of the opposite roller in the middle. As the web passes between these rollers it is split longitudinally through the middle by this knife. The position at which this knife comes on the web corresponds with the middle of the form-cylinders, so that the web is split on a margin y , which is at the middle, thus leaving two pages abreast on each side of the split. The position of these cutting-rollers may be made adjustable, if required. Means for accomplishing this adjustment, and also of driving the rollers p , q , and r , are shown in Fig. 29, and with reference to p and r in detail in Figs. 30 and 32. Thus (referring to Fig. 32) the rollers p are adjustable by means of the set-screw c' , from which the bearings of the rollers are suspended as in a stirrup, so that the two rollers may be raised or lowered bodily, as may be required. The arrangement of the gearing, it will be noticed, also provides for such adjustment, the gears c^2 and c^3 being connected by the arm c^4 , so that the center of one may move around the center of the other, as shown in Figs. 29 and 32. In Fig. 30 a similar arrangement is shown for the rollers r , the gear-wheels d' and d^2 being connected by the arm d^3 , so that the center of one may move about the center of the other. A like contrivance in gearing may be employed with reference to the rollers q . Having passed these cutting-rollers, the three webs are brought together with their corresponding margins coinciding between the rollers s and t , a front view of which is shown in Fig. 4. The roller t has its bearing in adjustable supports, so that it may be moved to and from the roller s by means of the screw t' , moved by the hand-wheel t^2 and the intermediate gearing. By the means described the rollers s t may be employed as tension-rollers to exert a greater or less amount of tension upon the webs, as required.

u and v are driven rollers which exert upon the webs the pull required to draw them from the last impression-rollers. These rollers u and v also act as cutting rollers or cylinders,

and for that purpose are provided with a severing or dividing knife similar to the cutting-cylinders in United States Patent to me, No. 374,355, dated December 6, 1887. This knife also, like the knife described in said patent, is provided with alternating cutting and perforating teeth, so that the paper will be cut for a portion of the distance across the web and perforated for the other portion of the distance. The diameter of each of the cylinders u and v is half that of the form and impression cylinders, so that the cut will be made across the webs in the margins z' z^2 , &c., Figs. 16 and 17, between the successive pages. The regulation of the tension upon the webs by means of the tension-rollers s t will be found very useful in securing the proper operation of the cutter between the rollers u and v . Furthermore, by arranging to split the webs before they are cut transversely the liability of wrinkling is reduced.

1 2 3 4 are rollers about which pass the tapes 5 6. The webs, after being partly separated by the knife between u and v , pass in between the tapes 5 and 6, and by them are carried forward toward the gripping-cylinder 7.

It is essential that before the webs shall reach the gripping-cylinder 7 they shall be completely severed along the margins z' z^2 , &c., and to that end I arrange the rollers 8 and 9 on either side of the path of the webs. These rollers 8 9 are formed so as to grip the webs between every two lines of severance (between margins z' and z^2 , for instance) and when the line of severance (as margin z^2) has just passed from between the rollers 1 2. In order to give these rollers 8 and 9 the irregular motion which is required to produce the effect of tearing the web, they are driven, as shown in Figs. 29 and 31, by the eccentric gearing e' and e^2 , the effect of which will be to cause the rollers 8 and 9 to move with a slower surface velocity than the rollers 1 and 2 for a portion of their rotation, but for another portion of their rotation to move with a greater velocity, so as to produce the tearing effect already referred to. The rollers 8 and 9, being provided on their surface, as shown in Fig. 31, with projections e^3 , are only in contact when those projections come opposite to each other, so as to bite the paper at that point, and the gearing is so arranged that these projections come opposite to each other when it is required to tear the web and when the rollers are moving at a greater speed than the rollers 1 and 2. By this arrangement the webs are only partially severed until they have passed beyond the rollers 1 2, so that each section of the web which is partially severed from the preceding one is led by the connection between it and the preceding one between the rollers 1 2; but as soon as its forward portion has been led between these rollers the action of the rollers 8 9 tears the preceding section from it, so that by the time the webs reach cylinder 7 the various sec-

tions or sheets are completely separated. In case the newspaper being printed contains anything less than sixteen or twenty-four pages, the cylinder 7, which is slightly over half the diameter of the form-cylinders, will revolve twice for every revolution of the form-cylinders. The tapes w' , passing around cylinders 3 and 10, and the tape v' , passing around cylinders 7 and 11, will carry the sheets smoothly from one cylinder to the other. These tapes will be omitted when the gripping mechanisms are in use upon the cylinders 7 and 10.

When two papers of sixteen or twenty-four sheets each or paper of eight pages from one web are printed, the operation of cylinder 7 has to be somewhat modified. In this case cylinder 7 is provided with two sets of nippers located about the same line of its circumference. The cylinder 7 makes a complete revolution and part of another before any of the sheets are removed from it by cylinder 10. On the first revolution one set of its nippers operate to draw the three layers of paper then presented around the cylinder 7. On the second revolution the second set of nippers operate to draw the three succeeding layers of paper around the cylinder, the second three layers being led exactly over the first three; but as soon as the six layers are thus brought over each other upon cylinder 7 the nippers on cylinder 10 operate to remove all six layers from cylinder 7 and pass them around cylinder 10. Then cylinder 7, having been relieved of these sheets, is ready to repeat its operations upon others.

I do not make any claim on the mechanism for moving the grippers, since, the required motions being explained, a mechanic can supply various devices for the purpose, as, for instance, similar to a patent to me, No. 366,388. I have, however, shown in Figs. 14 and 15 means on the same principle as that described in the said patent whereby the motions of the grippers may be accomplished. $w w w w$ are one set of grippers, which are all mounted on the same oscillating rod w' . At one end of this rod is a tumbler w^2 , similar to that described in said patent. w^3 is a gear-wheel driven from the gear-wheel w^4 on the shaft of cylinder 7. A pin w^5 projects from the face of the wheel w^3 , which pin is so placed as to engage the tumbler w^2 at the proper time and thus oscillate the rod w' and operate the set of grippers $w w w w$. A spring w^6 on the rod w' tends to operate the set of grippers in the opposite direction. $p' p' p' p'$ is another set of grippers on the oscillating rod p^2 and operated similarly to the first set, but by the gear-wheels p^3 and p^4 , the pin p^5 , the tumbler p^6 , and spring p^7 . The first three layers of paper that come along will be gripped by the grippers w and held by them through one revolution and until the second three layers are gripped by grippers p' . The second three layers of paper that come along will be gripped by the grippers p'

and held by them until all six layers are brought to grippers q' on cylinder 10. To accomplish this, the grippers w will be alternately in position to grip and let go during the successive revolutions of cylinder 7, whereas the grippers q' will only be in position to grip on alternate revolutions of cylinder 7 from the point at which they are received by cylinder 7 to the point at which they are delivered to cylinder 10.

In order that it may be more thoroughly understood what I intend by the operation of gathering the different sections of the webs, I will refer to Figs. 21 to 26, inclusive, where, for simplicity, the manipulation of one-half of a web is illustrated in each case. In Fig. 21 is illustrated the manner of printing an eight-page pamphlet from a single web, which is the simplest form requiring the accumulation of sections on the gathering-cylinder. Upon the first section of the web, between lines z and z' , are printed, on one side, pages 2 and 7, and on the opposite side pages 1 and 8. On the second section of the web, between the lines z' and z^2 on one side, are printed pages 4 and 5, and on the opposite side pages 3 and 6. In Fig. 22 these two sections are being brought over each other in the position which they assume on the gathering-cylinder, and it will be observed that when they are folded on the line x the pages will read in their regular order from 1 to 8. In Fig. 23 two webs are shown adapted for a pamphlet of sixteen pages. The gathering-cylinder serves to bring the second sections from both webs over the first sections from both webs, as shown in Fig. 24. In Fig. 25 the employment of three webs is shown to make a pamphlet of twenty-four pages; but here the gathering-cylinder operates to bring the second sections from all three webs over the first sections of all three webs, as shown in Fig. 26. Of course by adding an additional web to the operation the number of pages might be increased in multiples of eight indefinitely until the number of thicknesses of paper become too great to be handled by the machine.

$p' p' p' p'$ is another set of nippers on the oscillating rod p^2 and operated similarly to the first set, but by the gear-wheels p^3 and p^4 , the pins p^5 and p^6 , and the spring p^7 . The positions of the pins w^5 and p^6 on their respective cylinders are diametrically opposite. The first three layers of paper that come along will be gripped by the grippers p' and held by them through one revolution and until the second three layers are gripped by grippers w . The second three layers of paper that come along will be gripped by the grippers w and held by them until all six layers are brought to nippers q' on cylinder 10, by which they are transferred to cylinder 10. To accomplish this, the wheels $p^3 p^4$ are so geared that the nippers p' will be alternately in position to grip and let go during the successive revolutions of cylinder 7. The wheels $w^3 w^4$ are geared so that the nippers w will only be

in position to grip on alternate revolutions of cylinder 7 from the point at which the sheets are delivered to cylinder 7 to the point at which they are delivered to cylinder 10. This may be done in relation to grippers p' by gearing, so that the wheel p^1 shall revolve once for every two revolutions of cylinder 7, and arranging pins p^5 and p^6 so that they will be engaged during one-half the revolution of wheel p . In reference to grippers w the wheel w^3 may be so geared as to revolve once for every two revolutions of cylinder 7, and the pins w^2 w^5 may be so arranged as to engage only during so much of the revolution of wheel w^3 as corresponds with the passage of the grippers w from the point where the sheets are received by cylinder 7 to the point where they are delivered to cylinder 10.

The series of grippers q' are operated by mechanism similar to that already described for operating nippers w or p' , or by any other of the well-known gripper-operating mechanisms. The operation of grippers q' is, however, so timed that these grippers are ready to receive and grip the sheets of paper only upon every alternate revolution of the cylinder 7. Thus two successive cuts from the webs will accumulate, one on top of the other, upon the surface of cylinder 7 before any pass onto cylinder 10. This mode of operation is necessary in the case of a sixteen or twenty-four page pamphlet or newspaper, because, as will be seen by an inspection of Figs. 10 and 11, the arrangement of forms upon the form-cylinders is such that the pages belonging to a single paper or pamphlet are not all printed abreast, but are printed so that every two successive rows of pages upon each web belong to the same paper or pamphlet. Thus it is necessary, after these rows have been separated transversely, to retard the first row until the second row has overtaken and been placed upon it. This is accomplished by the operations of cylinders 7 and 10, as above described. When the sheets pass onto cylinder 10, all of the pages belonging to the same newspaper or pamphlet will occupy the proper relative positions. The sheets, whether they be one or more, having been drawn around cylinder 10 by the nippers thereon, are delivered by it to the gripping band or tape 12, constructed as described in my United States Letters Patent No. 176,401, which gripping-band runs around cylinders 11 and 13.

14 15 16 17 are two pairs of folding-rollers which are located beneath the position in which the sheets will be carried by the gripping-band 12. It will be observed that the sheets comprising two newspapers will come upon the gripping-band 12 abreast, having been split apart by the knifed rollers p , q , and r . The folding-rollers 14 15 are arranged beneath the middle margin of the sheets comprising one paper, and the folding-rollers 16 17 are arranged beneath the middle margin of the sheets comprising the other paper. A folding-knife constructed as described in

my United States Patent, No. 341,740, descends upon the middle margin of the sheets comprising one paper, so as to force them down between the rollers 14 15, and another knife of similar construction descends upon the middle margin of the sheets comprising the other paper and forces them down between the folding-rollers 16 and 17.

In the drawings I have shown the rollers 14, 15, 16, and 17 of sufficient length to fold the sheets comprising four papers simultaneously, the knives not descending until the sheets comprising four papers have been carried over the rollers. After being folded by the rollers 14, 15, 16, and 17 the papers are caught by suitable bands and brought horizontally over the rollers 18, 19, 20, and 21, by which an additional and final fold at right angles with the first is given to each paper.

I make no claim on the folding mechanism, and extended description of it is unnecessary, since its construction is well known.

The art or process set forth herein being the subject of a separate application, Serial No. 275,265, no claim is made to the same herein.

I claim—

1. The combination of a plurality of impression and form cylinders and web-holders, the form-cylinders having forms for two pages pertaining to the same pamphlet, book, or newspaper on each half or semi-circumference so arranged that the page on one semi-circumference shall, when placed in its proper order in the pamphlet, book, or newspaper, be separated from the page on the opposite side of the form-cylinder by the same number of pages as there are form-cylinders employed, and the printing being done without the turning over of the web, together with mechanism for severing the web transversely at proper points and superposing the cuts one upon another in their proper relation for folding or binding, substantially as set forth and described.

2. The combination of a plurality of impression and form cylinders and web-holders, the form-cylinders having four forms on each semi-circumference, those on one side of the middle line of the cylinder pertaining to one newspaper or publication and those on the other side to a different one, whereby the printing is done without turning over the web, together with mechanism whereby the web is severed longitudinally through the center and mechanism whereby it is severed transversely at suitable points, and pages pertaining to the same pamphlet or newspaper are superposed one upon another in proper relation and order for folding or binding, substantially as set forth and described.

3. In combination with the impression-cylinders, six form-cylinders, each having four page forms on each semi-circumference, whereby forty-eight pages may be printed for each revolution of the form-cylinders on three webs, mechanism whereby said webs are

brought together, mechanism whereby the same are cut on the central longitudinal margin, and mechanism whereby the same are severed on the transverse margins, substantially as described.

4. In combination with the impression-cylinders and a plurality of web-holders, a plurality of form-cylinders, each provided with four forms for the same newspaper or pamphlet, the forms for odd and even pages being arranged side by side in an axial direction, whereby when the paper is folded on the central longitudinal margin an even page and an odd page will be on opposite sides of the fold, mechanism whereby the web is severed transversely, and mechanism whereby the successive cuts are superposed upon one another, substantially as described.

5. In a printing-press in which the printing is done upon a web, in combination with mechanism by which the web is severed transversely, a cylinder containing two sets of grippers, said sets of grippers being adapted to receive and hold successive cuts from said web and to superpose them upon each other on said cylinder, substantially as described.

6. In a printing-press for printing upon a web, mechanism whereby the web is severed transversely, a cylinder containing two sets of grippers adapted to receive and hold successive cuts from said web and to superpose one above the other on said cylinder, and mechanism whereby the said cuts are together removed from said cylinder, substantially as described.

7. In a rotary printing-machine in which the several pages of a book or newspaper are printed upon a plurality of webs, in combination, the impression-cylinders, the form-cylinders, page-forms thereon, the rolls whereby the webs after being printed are guided into position on top of one another, and cutters by which said webs are severed transversely between the succeeding rows of pages, the page-forms being arranged upon the several form-cylinders with their heads pointing all in the same direction around the cylinder, the forms for those pages to constitute the first half of the book being located upon corresponding zones of the various form-cylinders and the forms for those pages to constitute the last half of the book being arranged upon other corresponding zones on the various cylinders side by side with the zones in which the forms for the pages of the first half of the book are located, whereby when the webs are run out over one another without turning or reversing the several pages belonging to the first half of the book will arrange themselves above each other and the several pages belonging to the last half of the book will arrange themselves above each other side by side with those belonging to the first half, substantially as described.

JOSEPH L. FIRM.

Witnesses:

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W. A. RABAU.