8 Sheets--Sheet 1.

R. CLAY, Jr.
Printing-Presses.

No. 148,929. Patented March 24, 1874.

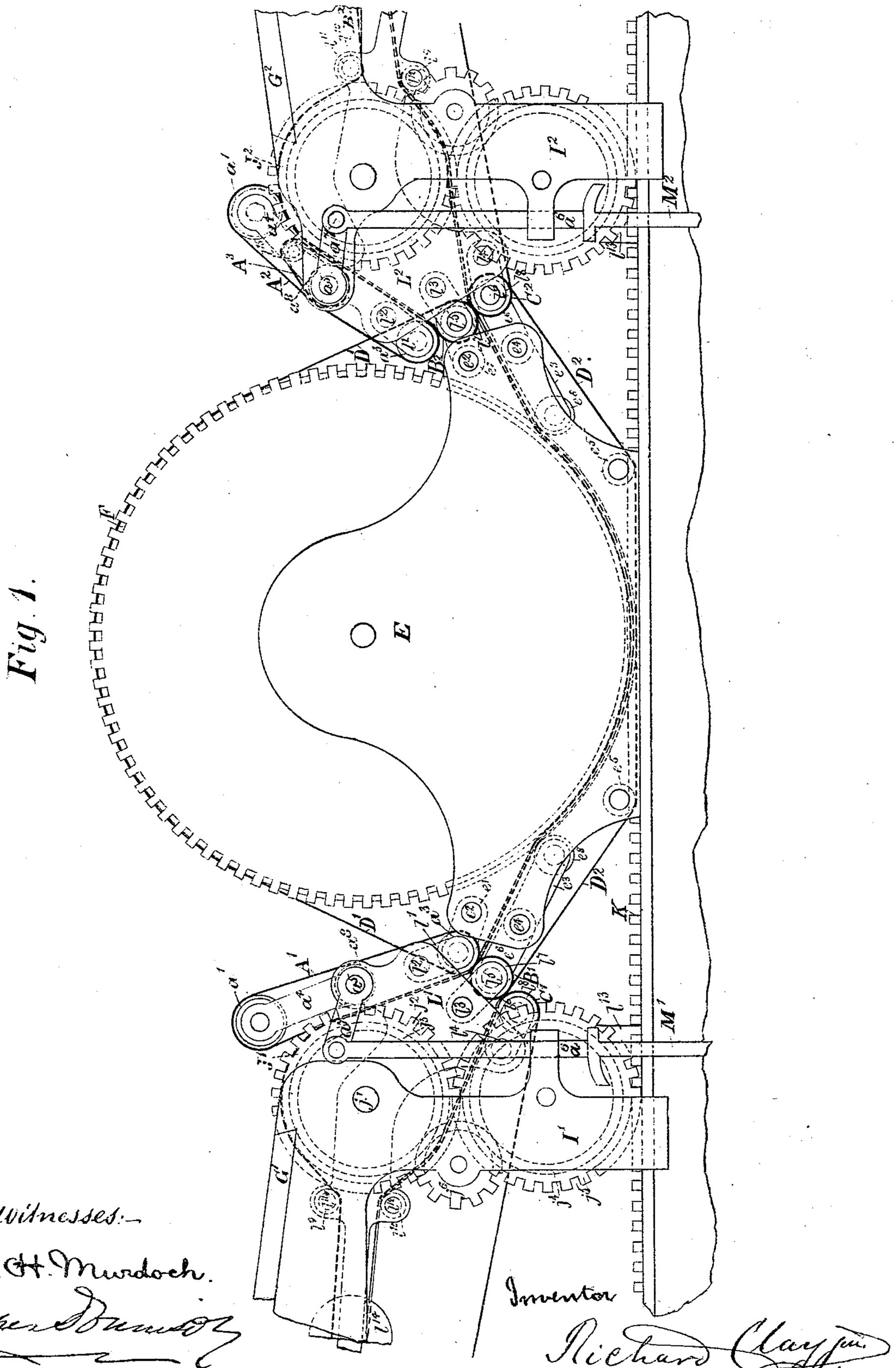


Fig. 1.

Witnesses:—

H. H. Murdoch.

Inventor

Richard Clay jun.

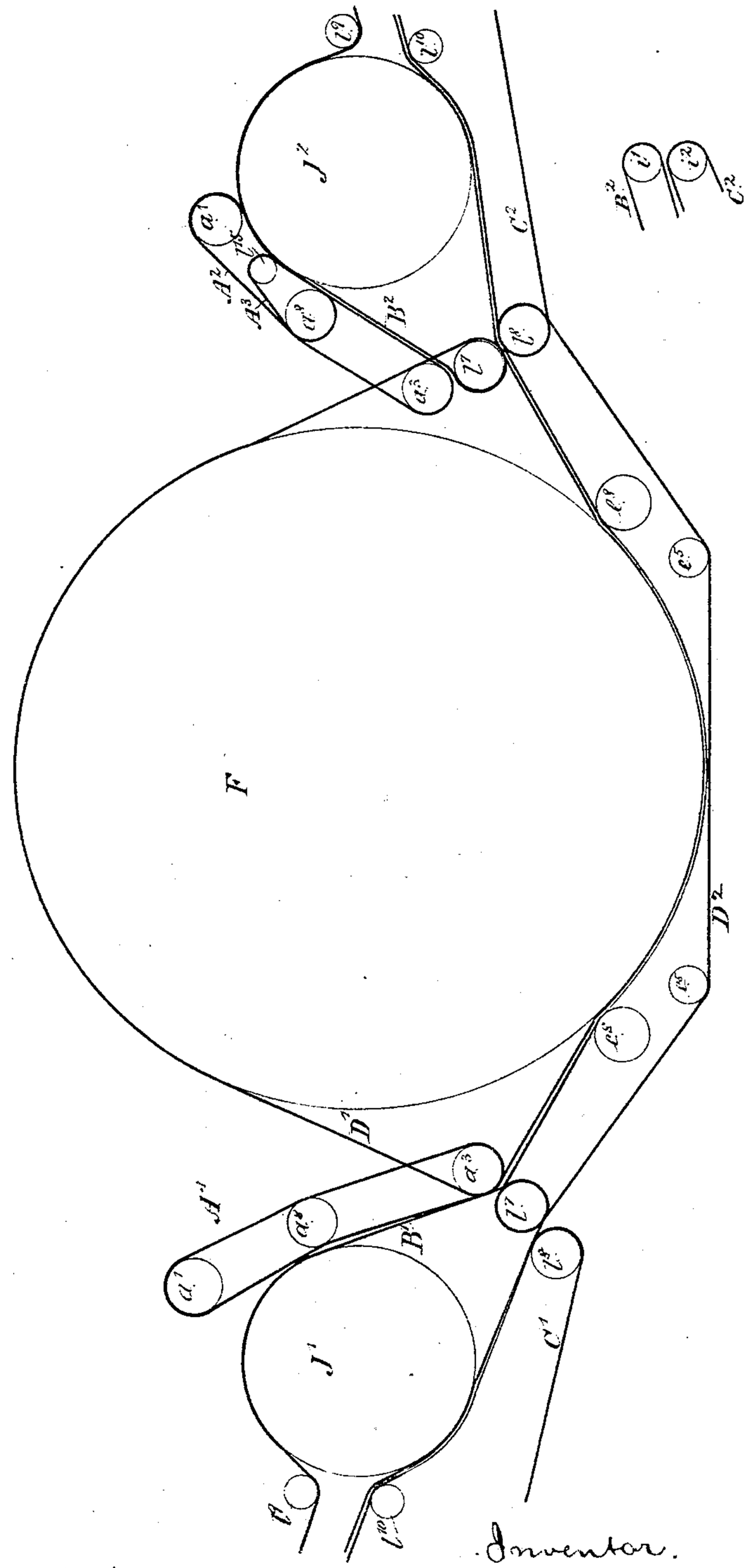
8 Sheets--Sheet 2.

R. CLAY, Jr.

Printing-Presses.

No. 148,929. Patented March 24, 1874.

Fig. 2.



Witnesses
H. H. Murdoch.
Edward Brunson

Inventor.
Richard Clay, Jun.

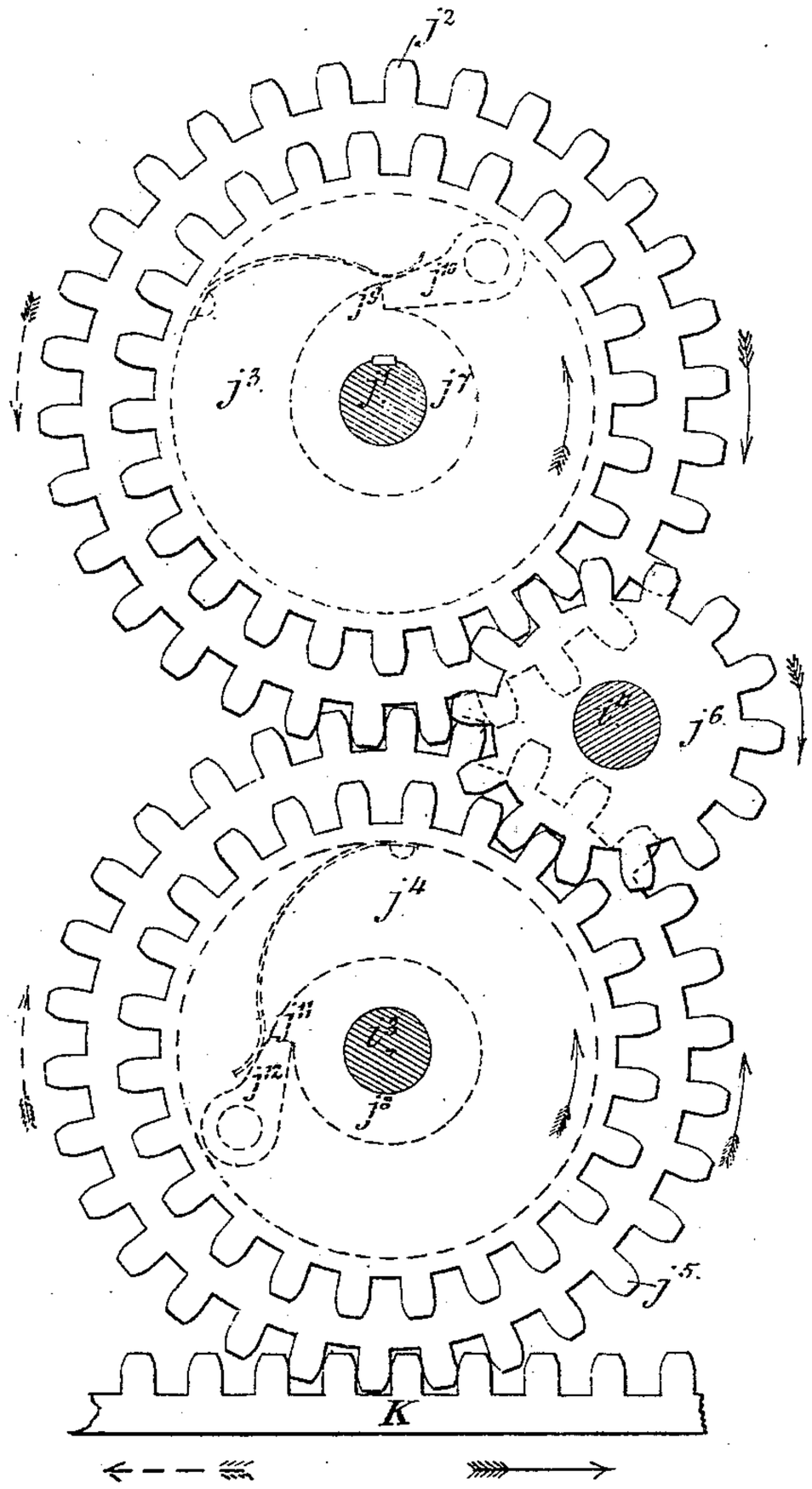
8 Sheets--Sheet 3.

R. CLAY, Jr.

Printing-Presses.

No. 148,929. Patented March 24, 1874.

Fig. 3.



Witnesses.

H. H. Lundoch

Inventor

Richard Clay Jr.

8 Sheets--Sheet 4.

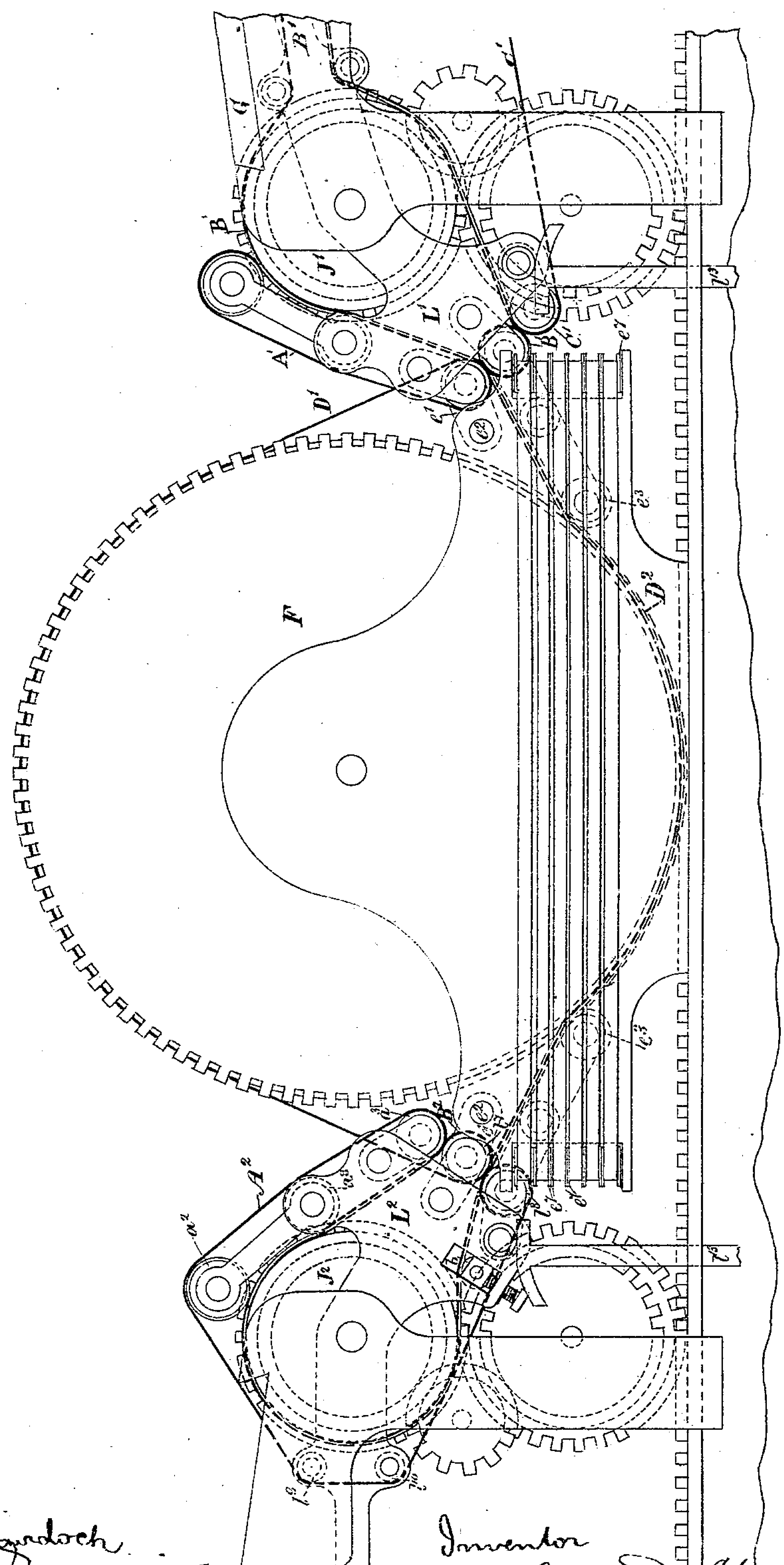
R. CLAY, Jr.

Printing-Presses.

No. 148,929.

Patented March 24, 1874.

Fig. 4.



Witnesses.

H. H. Murdoch

[illegible]

Inventor

Richard Clay jr

8 Sheets--Sheet 5.

R. CLAY, Jr.
Printing-Presses.

No. 148,929. Patented March 24, 1874.

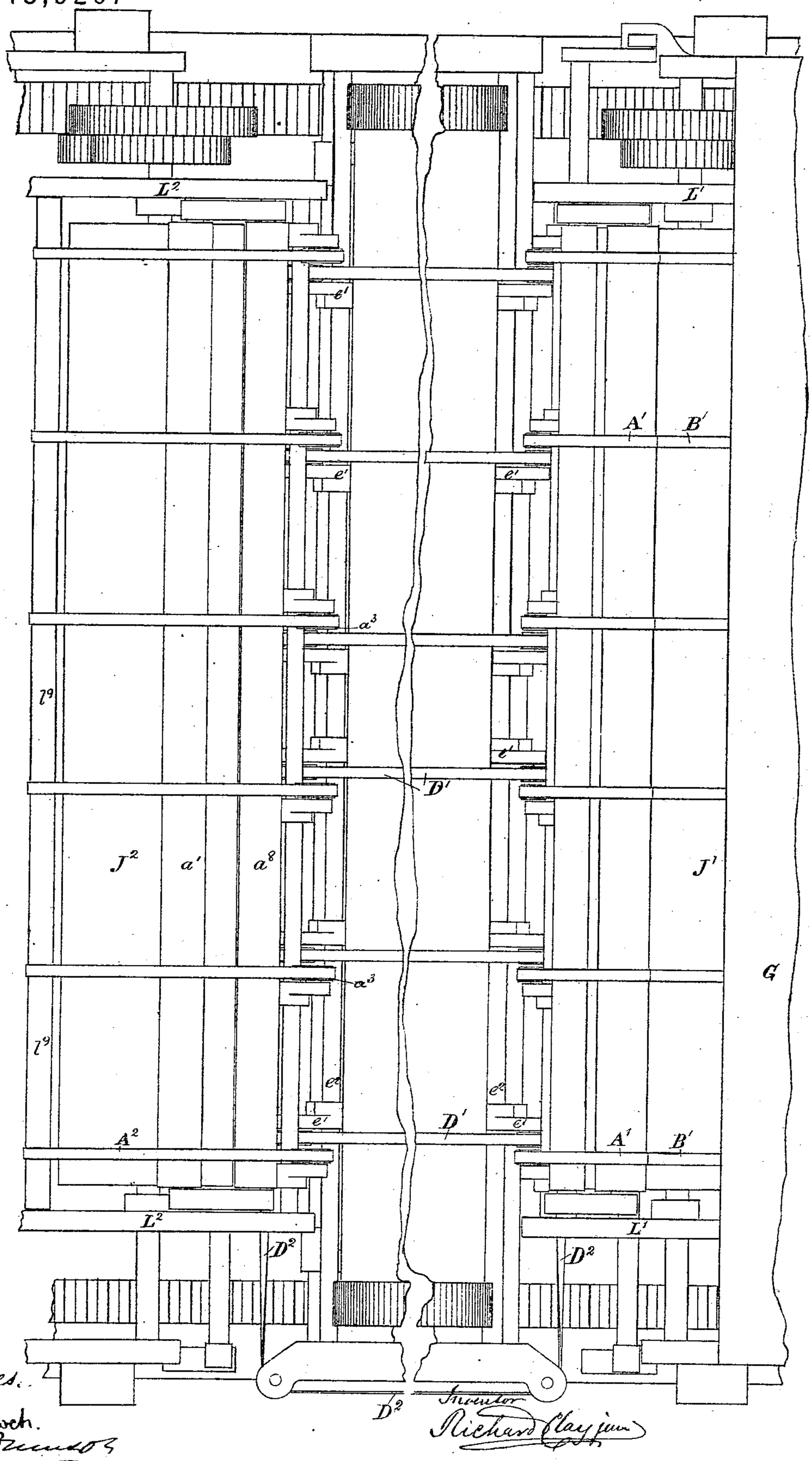


Fig. 5.

Witnesses.
H. C. Murdoch.
Agnes Burnside

Inventor
Richard Clay jun

8 Sheets--Sheet 6

R. CLAY, Jr.
Printing-Presses.

No. 148,929. Patented March 24, 1874.

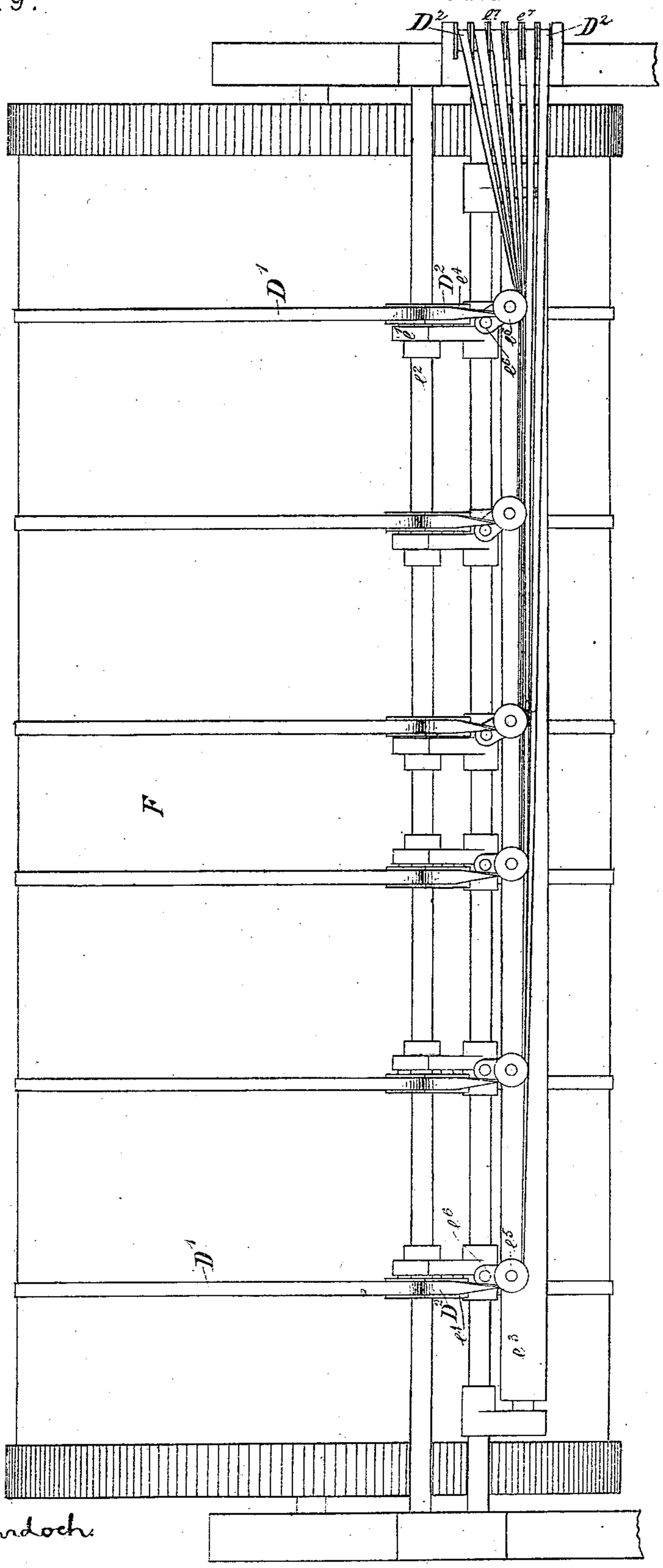


Fig. 6.

Witnesses
H. H. Murdoch
Chas. Burnett

Inventor
Richard Clay, Jr.

8 Sheets--Sheet 7.

R. CLAY, Jr.
Printing-Presses.

No. 148,929. Patented March 24, 1874.

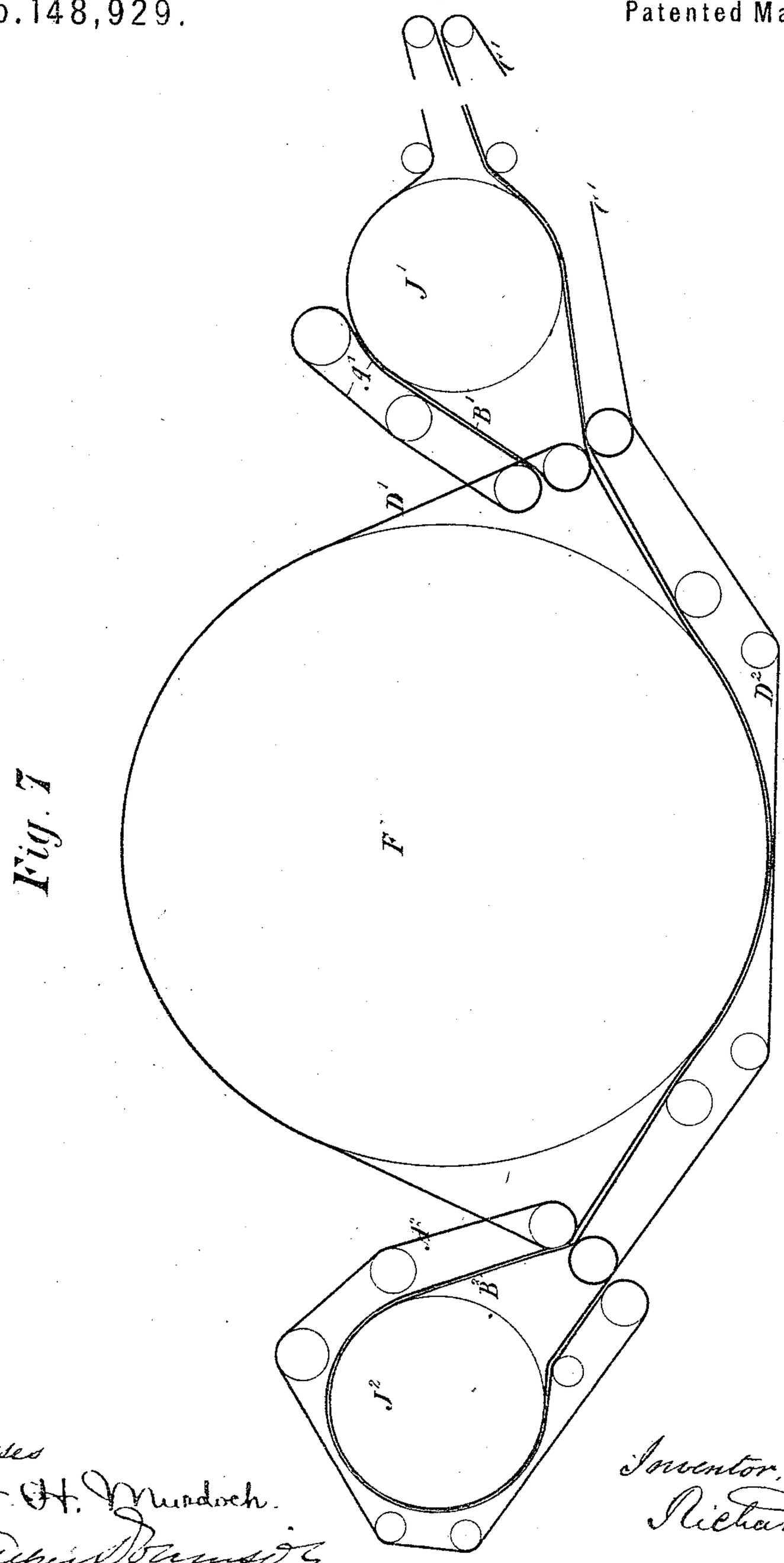


Fig. 7.

Witnesses
H. H. Murdock.
Agnes Dennehy

Inventor.
Richard Clay jun

8 Sheets--Sheet 8.

R. CLAY, Jr.
Printing-Presses.

No. 148,929. Patented March 24, 1874.

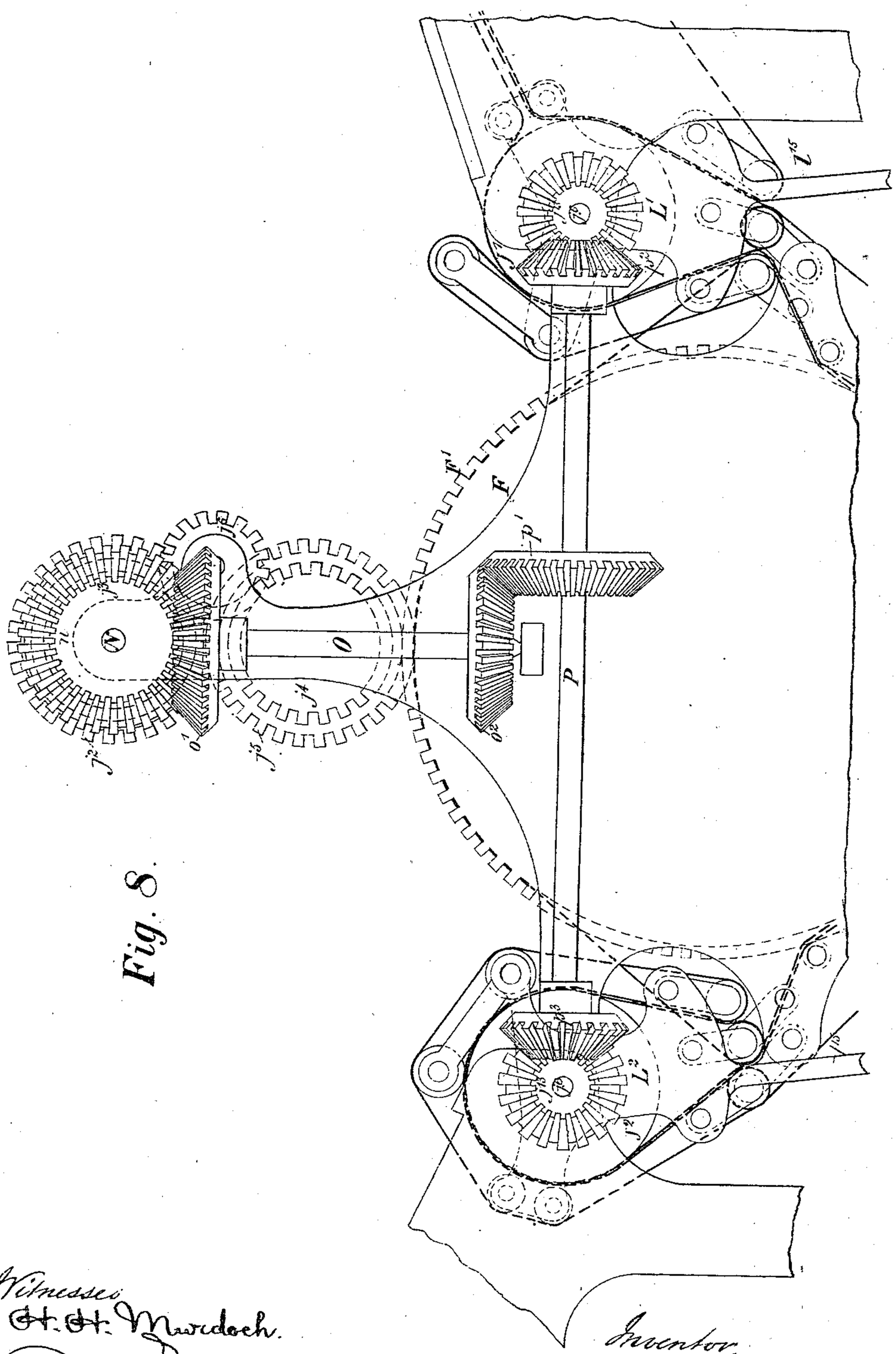


Fig. 8.

Witnesses:
H. H. Murdoch.

Inventor:
Richard Clay Jr

UNITED STATES PATENT OFFICE.

RICHARD CLAY, JR., OF LONDON, ENGLAND.

IMPROVEMENT IN PRINTING-PRESSES.

Specification forming part of Letters Patent No. **148,929**, dated March 24, 1874; application filed June 6, 1873.

To all whom it may concern:

Be it known that I, RICHARD CLAY, the younger, of Bread Street Hill, in the city of London, England, printer, have invented certain Improvements in Printing-Presses, of which the following is a specification:

My invention relates to the class of printing-machines known as double-feeding single-cylinder machines.

In such machines the sheets to be printed are fed alternately, one at each side of a single oscillating cylinder furnished with gripers, which seize, hold, and feed the said sheets. Such machines, as hitherto constructed, are only capable of printing (as double-feeders) sheets of the size or sizes for which each machine is constructed, and when it is wished to print sheets of larger or smaller size than that of the sheets for which the gripers aforesaid were last arranged, the said gripers have to be shifted on the cylinder and refixed.

My invention, which enables me to dispense with these gripers, essentially consists in the combination, with the endless main tapes for carrying the sheets under the cylinder, of endless feed and delivery tapes, mounted in sets at each side of the cylinder, and operated so that the feed and delivery tapes of each set will be alternately shunted into and out of communication with the main tapes, so as to convey to and take from the main tapes the sheets at the proper times, said arrangement being applicable both to presses for "white printing," in which blank sheets are supplied at each side of the press, and to so-called "perfecting" presses, in which the sheet supplied at one side of the press is, after having been carried to the other side, automatically reversed and fed back to the cylinder which it has just left.

The following is a general description of my invention as applied to a press in which the blank sheets are fed in at each side of the cylinder: For convenience of description I will designate the tapes by which the sheets are carried under the cylinder as the main tapes, and the tapes by which the said sheets are carried into and taken from the main tapes as the tapes A, B, and C. There are two sets of main tapes. One set passes around the cylinder and over tension-pulleys mounted on a fixed bracket at each side of the cylinder. The other set passes under the said cylinder and in contact with the first-named set of tapes, and over tension-pulleys which are mounted under the first-named pulleys. There are two sets of the tapes A, B, and C, one set at each side of the cylinder. The tapes A, B, and C are arranged one over another. The tapes A pass over pulleys carried by arms or sectors, (which are capable of alternate oscillatory motion in a vertical plane, for the purpose hereinafter described,) and over a dropping bar of the usual construction, by the action of which the sheets are drawn in between the tapes A and B at the proper moment, and the tapes B pass over pulleys mounted on the aforesaid sectors, (under and in proximity to the pulleys which carry the tapes A;) thence over a feeding-drum and over tension-rollers. The tapes C pass over pulleys mounted on a shaft carried by the sectors, (under and in proximity to the pulleys which carry the tapes B,) and over tension-rollers. The upper sides of the tapes B and the lower sides of the tapes A constitute the feeding-tapes, which carry the sheets to be printed to the main tapes, and the lower sides of tapes B and the upper sides of the tapes C constitute the delivering-tapes, which take the printed sheets from the main tapes and deliver the said sheets out of the machine. The sectors at opposite sides of the cylinder are caused to oscillate alternately by cams, or other suitable mechanism, so as to bring the axes of the pulleys carrying the tapes A B at one side of the cylinder into a line with the axes of the main tape-pulleys at that side, and the axes of the pulleys carrying the tapes B C at the other side of the cylinder into a line with the axes of the said main tape-pulleys at that side.

This oscillation of the tapes I term a shunting motion, it being similar in principle to the operation by which railway-trains are shunted from one line of rails to another.

The action of the machine is as follows: As the dropping bar at one side of the cylinder rises, a blank sheet is fed by the attendant between the tapes A and B at that side, which tapes, on the descent of the said bar, gripe the said sheet and carry it into the main tapes, the sectors at that side at which the said

sheet is fed being then in such a position that the axes of the pulleys carrying the tapes A B coincide with the axes of the pulleys carrying the main tapes at that side, which latter then carry the sheet under the cylinder, and deliver the said sheet (which has been printed while passing under the cylinder) to the tapes B C at the other side of the said cylinder, the axes of the pulleys which carry these latter tapes being brought to coincide with the axes of the main tapes by the oscillation of the sectors at that side. When the cylinder is reversed, the reverse action takes place, the next blank sheet being fed in at the side at which the last printed sheet has been delivered, and being delivered after the printing at the opposite side. By slightly modifying the arrangement of the tapes at one side of the cylinder, without, however, interfering with or changing the shunting action of the same, I convert the machine into a perfecting machine. For this purpose I substitute for the tapes A, B, and C at one side of the cylinder two sets of endless tapes, one set of which passes around the feeding-drum at that side, and round the middle pulleys carried by the sectors, hereinbefore described, the other set passing round the said drum, outside the first set, thence round the upper and under pulleys mounted on the said sectors, and thence over tension pulleys or rollers.

The action of the machine thus modified is as follows: The blank sheet fed by hand between the tapes A and B is carried by them into the main tapes, by which it is carried under the cylinder. During its passage under the cylinder the sheet is printed on one side. The main tapes then carry the sheet so printed to the reversing-tapes at the other side of the cylinder, which tapes, instead of delivering the sheet out of the machine, as in the arrangement herein first described, carry the said sheet round the feeding-drum, thereby reversing the said sheet, and deliver it back to the main tapes, which, on the reversal of the machine, carry the said sheet under the cylinder, blank face downward. During this second passage under the cylinder, the said sheet is perfected by being printed on its blank side. The main tapes then carry the sheet, printed on both sides, to the delivering-tapes at that side of the cylinder from which the said sheet was fed, and the delivering-tapes deliver the said sheet out of the machine.

Having now described the nature of my invention, I will proceed to describe the manner in which the same is to be performed, reference being had to the accompanying drawings, and to the figures and letters marked thereon, with respect to which drawings I would premise that only such old parts are represented as are necessary to the description of my invention, the parts omitted being of the ordinary kind.

Figure 1 is a side elevation of part of a printing-press to which my invention is applied, the tapes being arranged for double-feeding or "white printing;" and Fig. 2 is a diagram representing the arrangement of the said tapes.

E E is the frame of the machine. F is the cylinder. G^1 G^2 are the feed-tables. I^1 I^2 are the frames supporting the said tables. J^1 J^2 are the feed-drums. j^2 j^3 j^4 j^5 j^6 are toothed wheels, hereinafter particularly described, by means of which the rack K, affixed to the reciprocating table, is caused to impart a continuous rotary motion to the said feed-drums. A^1 A^2 B^1 B^2 and C^1 C^2 are the tapes by which the sheets are fed into and taken from the main tapes D^1 D^2. In Fig. 1 I have represented two different arrangements of the feeding-tapes. The tapes A^1 pass round the bosses a^1 of the dropping bar or roller, and round pulleys a^3, carried by brackets l^1, fixed on a rod, l^2, which rod is carried by two sectors, L^1, which are mounted on the shaft j^1 of the drum J^1, one at each side thereof. These sectors are alternately raised, as required, by means of tappets l^{13} l^{13} at the opposite side of the machine, which bear against projections on the sectors at that side. The said tappets are worked by suitable cams. The dropping roller is carried by arms a^4, affixed to a shaft, a^5, turning in bearings on the sectors L^1, which shaft receives oscillatory motion from the tappet M^1, which raises a sliding rod, a^6, jointed to an arm, a^7, keyed to the said shaft. The tappet M^1 is raised and lowered, as required, by means of cams or by other suitable mechanism. a^8 is a roller on shaft a^5, which serves to keep the tapes A^1 in contact with the tapes B^1. l^3 l^4 are rods which carry brackets l^5 l^6, on which are mounted pulleys l^7 l^8. Other rollers l^9 l^{10} are mounted on rods l^{11} l^{12}, carried by arms formed on the sectors L^1, which arms carry counter-balances l^{14}. The tapes B^1 pass under the roller l^9, over the feed-drum J^1, round the pulleys l^7, thence under the said drum, over the roller l^{10}, and round a tension-roller, which turns in bearings in the frame I^1. The tapes C^1 pass over a roller, l^{10}, under the drum J^1, round the pulleys l^8, and thence round a tension-roller, i^2, Fig. 2, mounted under the aforesaid tension-roller i^1.

The main tapes D^1 pass round the cylinder F, round pulleys mounted on brackets e^1 e^1, fixed on the rods e^2 e^2, and thence over rollers e^8 e^8, mounted on brackets e^3 e^3, carried by the rods e^4 e^4, and under the said cylinder, in contact with it. The main tapes D^2 pass under rollers e^5 e^5, round pulleys mounted on brackets e^6 e^6, fixed on the rods e^4 e^4, and thence over the said rollers e^8 e^8. From these pulleys the said tapes pass under the cylinder, in contact with it. The construction and arrangement of the parts for working the tapes B^2 C^2 on the opposite feeding end are the same as those hereinbefore described with reference to the tapes B^1 C^1. I have, therefore, marked the parts which work the tapes B^2 C^2 with the same letters of reference as the corresponding parts at the other side of the cylinder, merely applying to the capital letters the numeral 2

instead of the numeral 1. The tapes A^2 (represented in the diagram, Fig. 2) pass round the bosses a^1 of the dropping bar or roller, and round the roller a^8, mounted on a shaft, a^5. The dropping roller is mounted on arms a^4, affixed to the shaft a^5, which turns in a bearing on the frame I^2, and is caused to oscillate as required by a tappet, M^2, which raises a sliding rod, a^6, jointed to an arm, a^7, keyed to the said shaft, on which is a roller, a^8, which serves to keep the tapes A^2 in contact with the tapes B^2. Tapes A^3 pass round a roller, l^{15}, carried by the sector L^2, and thence round pulleys a^3, mounted on brackets carried by the rod l^2, and over and under the roller a^8.

The feed-tapes at both sides of the cylinder may be arranged according to either of the plans hereinbefore described.

The action of this machine is as follows: As the dropping bar rises a blank sheet is fed by the attendant between the tapes A^1 and B^1, which, on the descent of the said bar, gripe the said sheet and carry it into the main tapes D^1 D^2, the sectors L^1 being then in their lowest positions. The main tapes then carry the sheet under the cylinder and deliver the said sheet (which has been printed while passing under the cylinder) to the tapes B^2 C^2, the sectors L^2 being then in their highest position. These tapes deliver the said sheet out of the machine onto the delivery-table. On the reversal of the machine, the reverse action takes place, the sheets being fed from the table G^2, and delivered onto the delivery-table at the other side of the machine.

Fig. 3 represents, in side elevation, the wheels by means of which the rack K, affixed to the reciprocating table, is caused to impart to the feed-drum rotary motion in the direction necessary for feeding the sheets to the cylinder. j^1 is the shaft to which the feed-drum is keyed. On this shaft are mounted gear-wheels j^2 j^3. i^3 is a pin or bearing-stud on the frame I, on which pin are mounted gear-wheels j^4 j^5. j^6 is a pinion, which is mounted on a pin, i^4, on the said frame, and gears with the gear-wheels j^3 j^4. The wheel j^3 is keyed to its shaft. The other wheels are capable of running loose on their axes. j^7 j^8 are the respective bosses of the wheels j^3 and j^5. The boss j^7 is formed with a tooth, j^9, which, when the rack K is traveling from left to right, bears against a pawl, j^{10}, carried by the wheel j^2, which is thus carried round with the wheel j^3; and the boss j^8 is formed with a tooth, j^{11}, which, when the said rack is traveling from right to left, bears against the pawl j^{12}, carried by the wheel j^4, which is thus carried round with the wheel j^5.

The action of these wheels is as follows: When the rack K is traveling from left to right, the wheels are caused to revolve in the directions indicated by the full arrows, and the wheel j^5 carries round with it the wheel j^4, which drives the wheel j^3 through the pinion j^6, and thus imparts the rotatory motion to the feed-drum, the tooth j^9 slipping past the pawl j^{10} at each revolution. When the rack K is traveling in the reverse direction, the wheels are caused to revolve in the directions indicated by the dotted arrows, and the wheel j^5 drives the wheel j^2, the pawl j^{10} of which engages with the tooth j^9, and thus carries round the wheel j^3 and the shaft of the feed-drum, the tooth j^{11} slipping past the pawl j^{12} at each revolution.

In order to prevent the pawls from missing the teeth aforesaid by reason of the backlash of the wheels, I make the rack with teeth slightly closer together near its ends, so as to cause it to overshoot its stroke, say one-fourth inch.

Figs. 4 and 5 represent, in side elevation and plan, respectively, part of a printing-machine to which my invention is applied, the tapes being arranged for feeding and perfecting. Fig. 6 is a front elevation of the cylinder and part of the frame of the said machine. Fig. 7 is a diagram representing an arrangement of the tapes for feeding and perfecting, this arrangement being similar to that represented in Fig. 4, with the exception of the main tapes, which are arranged as in Fig. 2.

The same letters of reference indicate the same parts in Figs. 4, 5, 6, and 7.

A^1 B^1 C^1 are the feeding and delivering tapes, and L^1 are the sectors by which they are worked. The arrangement and operation of these tapes are the same as those of the tapes A^1 B^1 C^1, Fig. 1. G is a portion of the feed-table, and J^1 is the feed-drum, and J^2 is the reversing-drum. D^1 D^2 are the main tapes. The tapes D^1 pass over the cylinder F, round pulleys mounted on brackets e^1 e^1, fixed on the rods e^2 e^2, and thence under the said cylinder. The tapes D^2 pass under the cylinder, over rollers e^3 e^3, over pulleys e^4 e^4, Fig. 6, thence under pulleys e^5 e^5, carried by brackets e^6 e^6 (see Fig. 6) at each side of the cylinder, thence round pulleys e^7 e^7 to their respective pulleys e^5 e^5 at the opposite side of the cylinder. A^2 B^2 are the reversing-tapes. The tapes A^2 pass over the dropping roller a^2, or over a stationary roller substituted for such bar, thence round the rollers l^9 l^{10}, thence round the pulleys l^8, thence back round the drum J^2, under the dropping bar and roller a^8, and thence round the pulleys a^3, and over the said roller a^8. The tapes B^2 pass round the drum J^2, (under and in contact with the tapes A^2,) and thence round the pulleys l^7. b is an adjusting-roller.

The action of this part of the machine is as follows: The sheet to be "perfected" is fed by the attendant into the tapes A^1 B^1, the sectors L^1 being then in their lowest position, as represented. These tapes feed the said sheet into the main tapes D^1 D^2, which carry it under the cylinder, and the said sheet is printed on one side during its passage. The main tapes then deliver the said sheet to the tapes A^2 B^2, the sectors L^2 being then in their highest position, as shown. These tapes carry the said sheet round the drum J^2, and by the time the said sheet has been reversed the sectors L^2 have

been lowered by the tappet l^{13} so as to bring the tapes A^2 B^2 from the position represented in Fig. 4 to the position represented in Fig. 7, thereby enabling the said tapes to return the said sheet to the main tapes, which carry it back under the cylinder, blank face downward, thereby effecting the perfecting of the said sheet, after which the said tapes deliver the said sheet to the tapes B^1 C^1, by which it is delivered out of the machine, the sectors L^1 being by this time raised by the tappet l^{13} so as to bring the tapes A^1 B^1 from the position represented in Fig. 4 to that represented in Fig. 7.

Fig. 8 is a side elevation of a printing-machine to which the improvements hereinbefore described with reference to Figs. 4, 5, 6, and 7 are applied in a modified form. In this machine the arrangement of tapes for feeding and reversing is the same as that of the tapes in the aforesaid figures. The main tapes may be arranged either as represented in Fig. 1, or as represented in Fig. 4. The sectors L^1 L^2 hang downward, and are actuated as required by levers l^{15} l^{15}, actuated by cams or otherwise. The feed-drums J^1 J^2 are driven by toothed gearing from the wheel F^1 of the cylinder F, which drives the wheels j^2 j^3 j^4 j^5 j^6, arranged and operating as described with reference to Fig. 3. These wheels give continuous rotatory motion to a shaft, N, on which is keyed a bevel-gear wheel, n, the motion of which is transmitted by bevel-wheels o^1 o^2 on the shaft O to a bevel-wheel, p^1, on the shaft P, on which are keyed bevel-wheels p^2 p^3, which drive bevel-wheels j^{13} j^{13}, keyed on the shaft j^6 j^6 of the feed-drums J^1 J^2.

The feed-drums of all the machines hereinbefore described may, if desired, be driven from the printing-cylinders, as described with reference to Fig. 8.

Having now described the nature of my invention, and the manner in which the same is to be performed, I wish it to be understood that I do not limit myself to the precise details hereinbefore described, as the same may be modified without departing from the nature of my said invention; but

I claim as my invention—

In single-cylinder printing-presses, whether for white printing or for perfecting, the combination, with endless "main tapes," by which the sheets are carried under the cylinder, of endless feed and delivery tapes mounted in sets at each side of said cylinder, and arranged and operated substantially as herein described, and illustrated in the accompanying drawings, so that in each set the delivery and feed tapes will be shunted into and out of communication with the main tapes, in order to convey to and take from the main tapes the sheets at the proper times, substantially as set forth.

RICHARD CLAY, JR.

Witnesses:

H. H. MURDOCH,

ALFRED DONNISON.