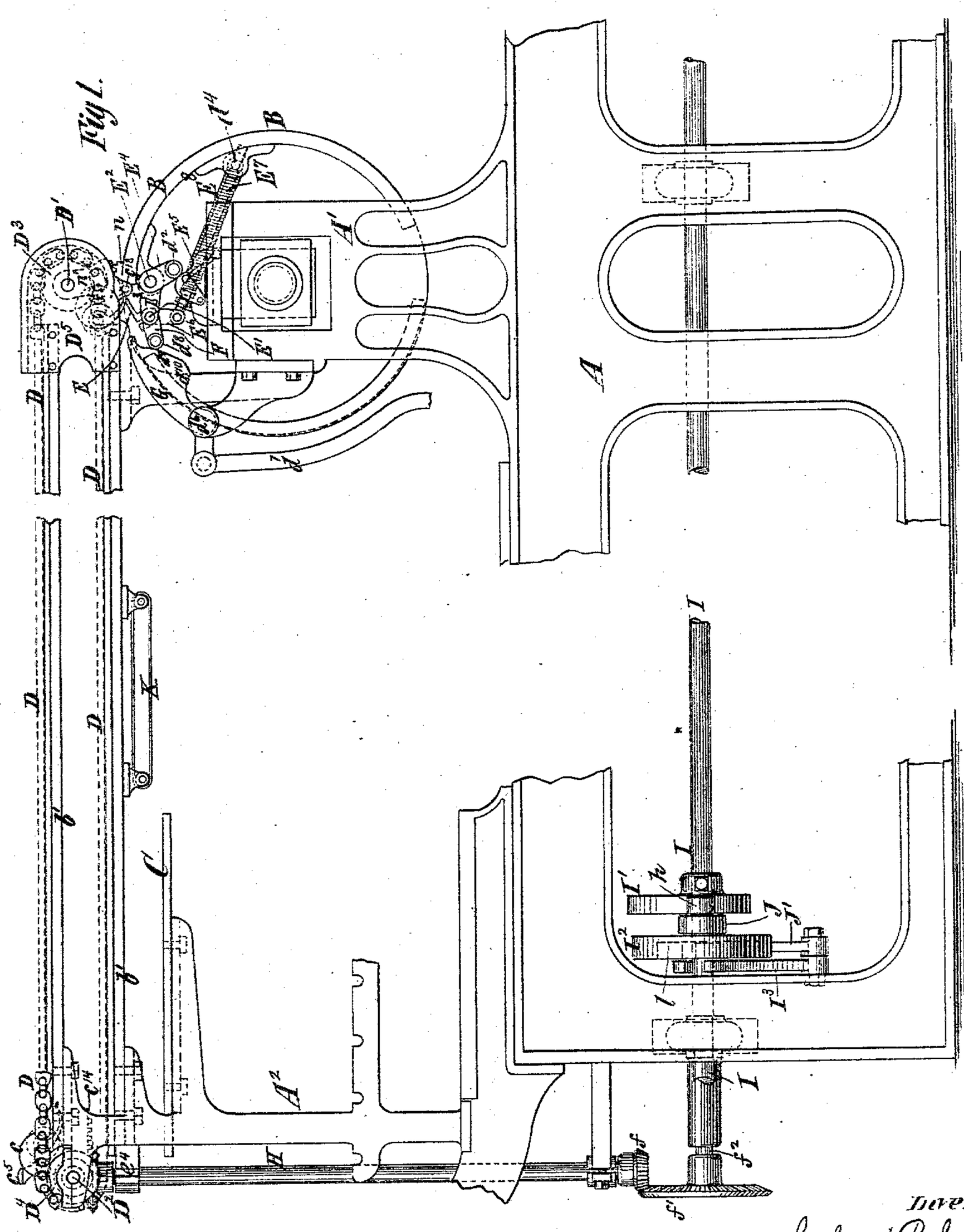
(No Model.) 6 Sheets—Sheet 1.

C. B. COTTRELL.

SHEET DELIVERY APPARATUS FOR PRINTING MACHINES.

No. 305,798. Patented Sept. 30, 1884.



Witnesses
Ed. L. Moran
Chandler Hall

Inventor
Calvert B. Cottrell
by his Attorneys
Brown & Hall

(No Model.) 6 Sheets—Sheet 2.

C. B. COTTRELL.

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Fig 2.

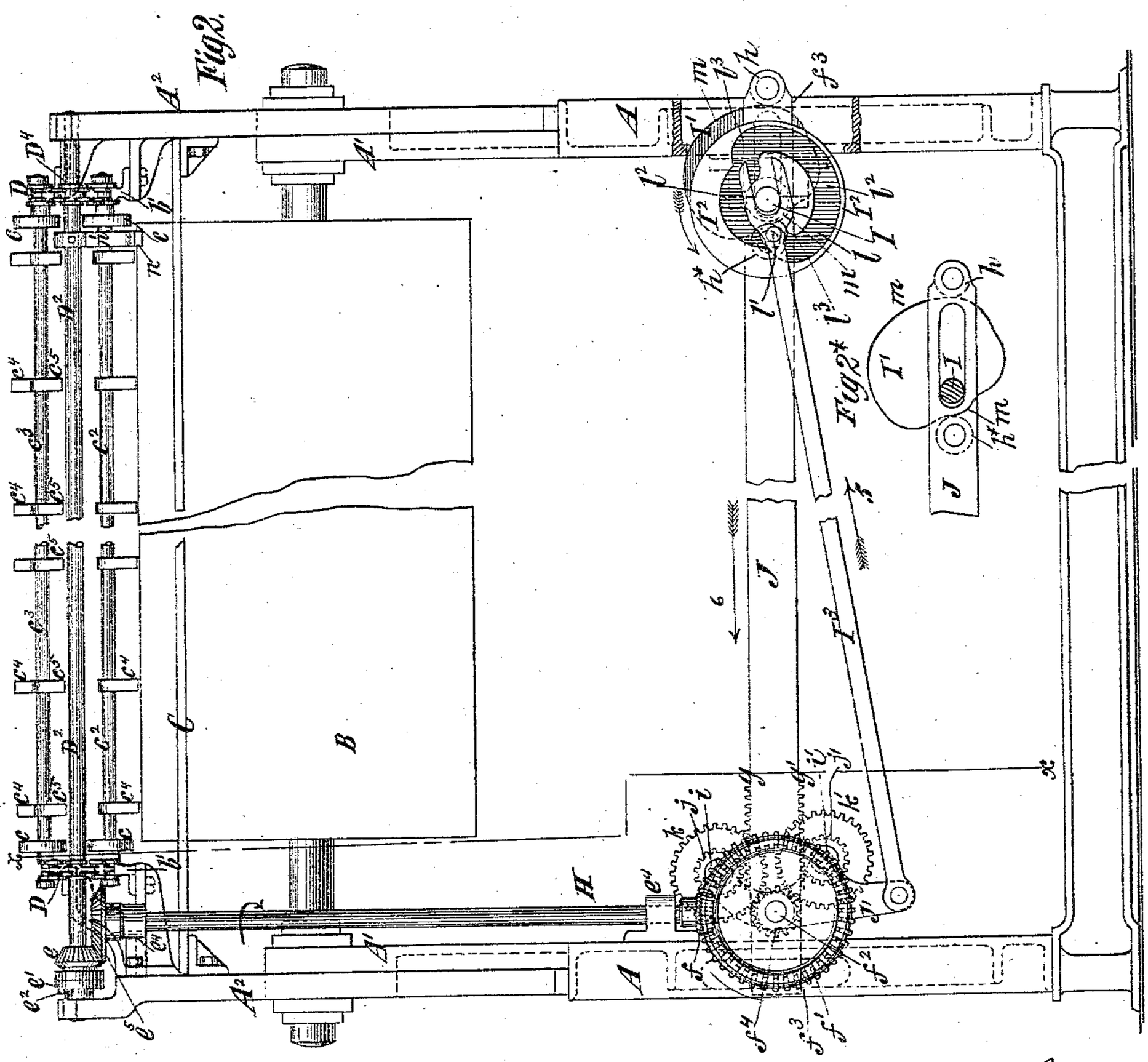
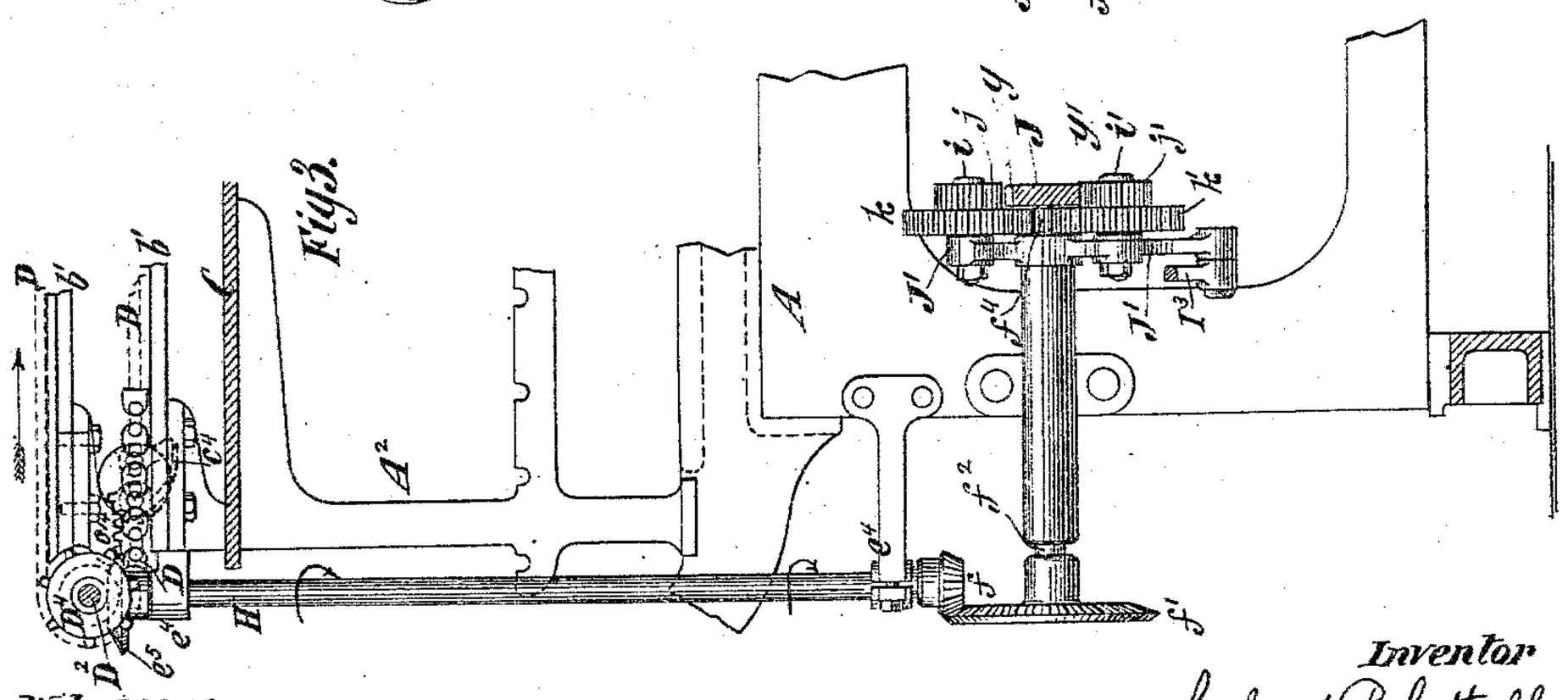


Fig 3.



Witnesses
Ed L. Moran
Chandler Hall

Inventor
Calvert B. Cottrell
by his Attorneys
Brown & Hall.

(No Model.) 6 Sheets—Sheet 3.

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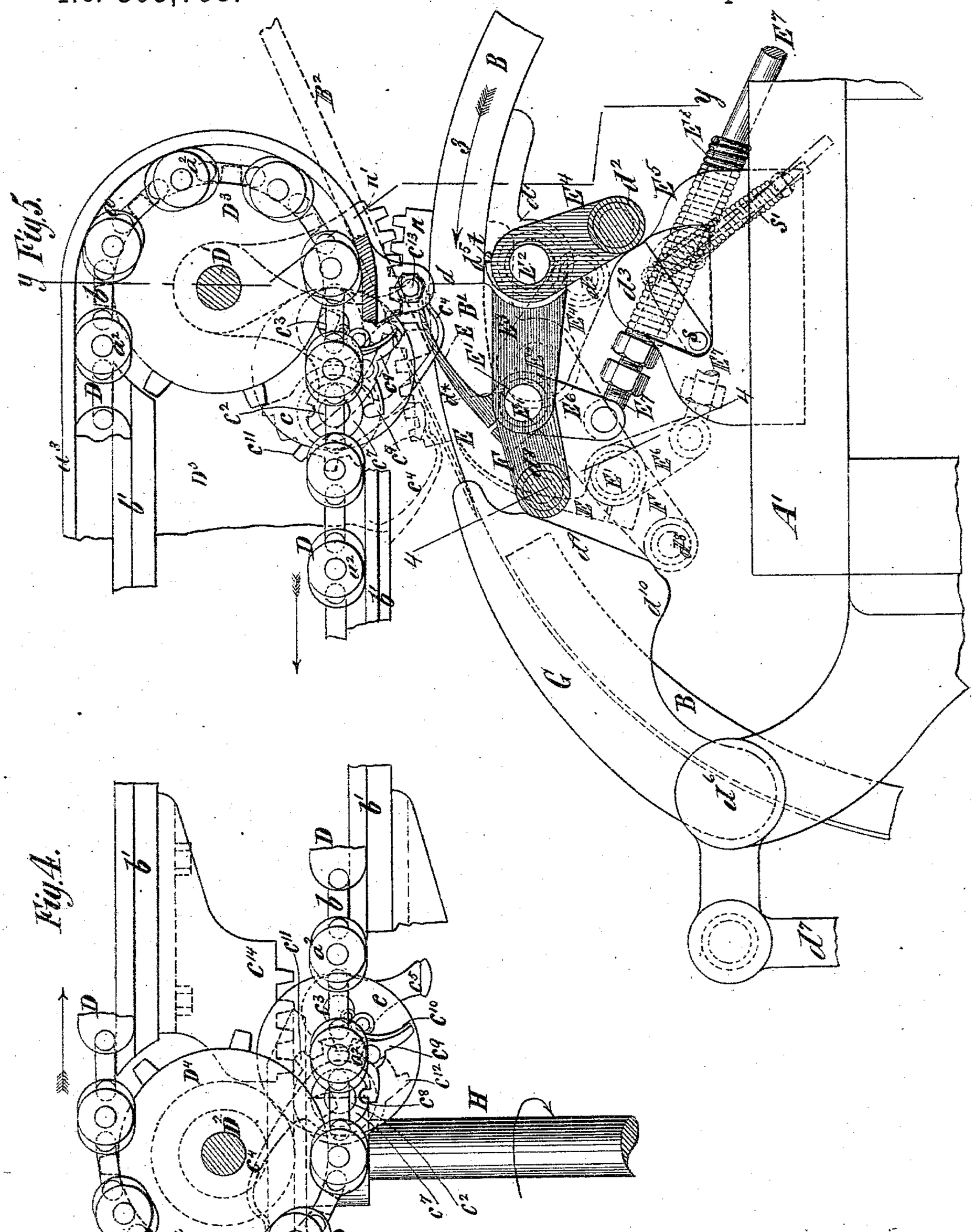

Witnesses
Ed. L. Moran
Chandlen Hall

Inventor
Calvert B. Cottrell
by his Attorneys
Brown & Hall

(No Model.) 6 Sheets—Sheet 4.

C. B. COTTRELL.

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Fig. 7.

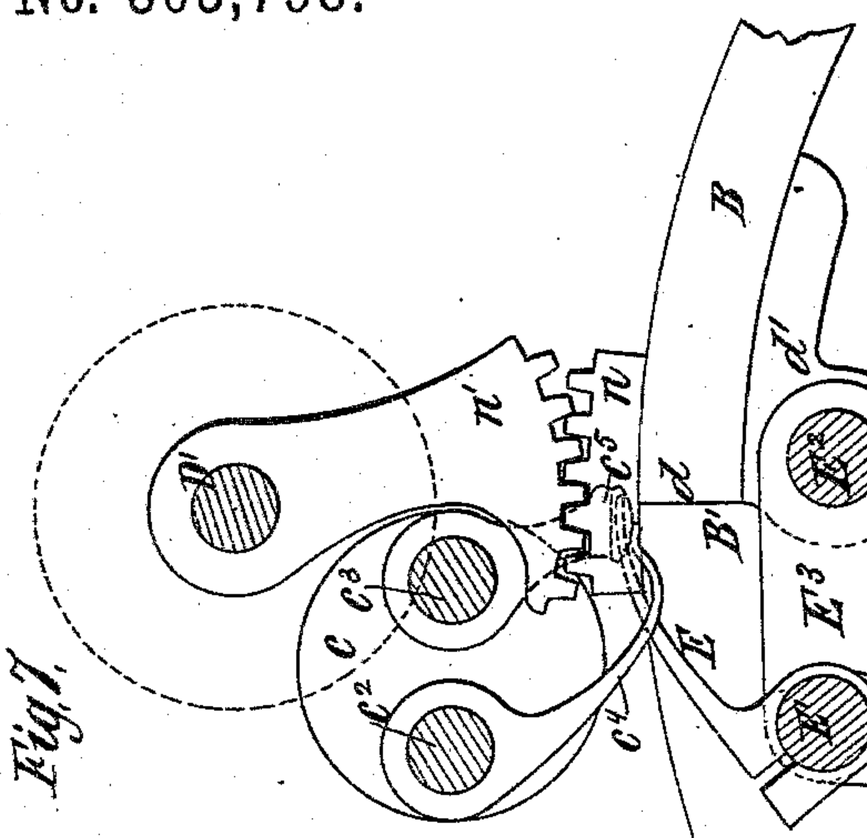


Fig. 8.

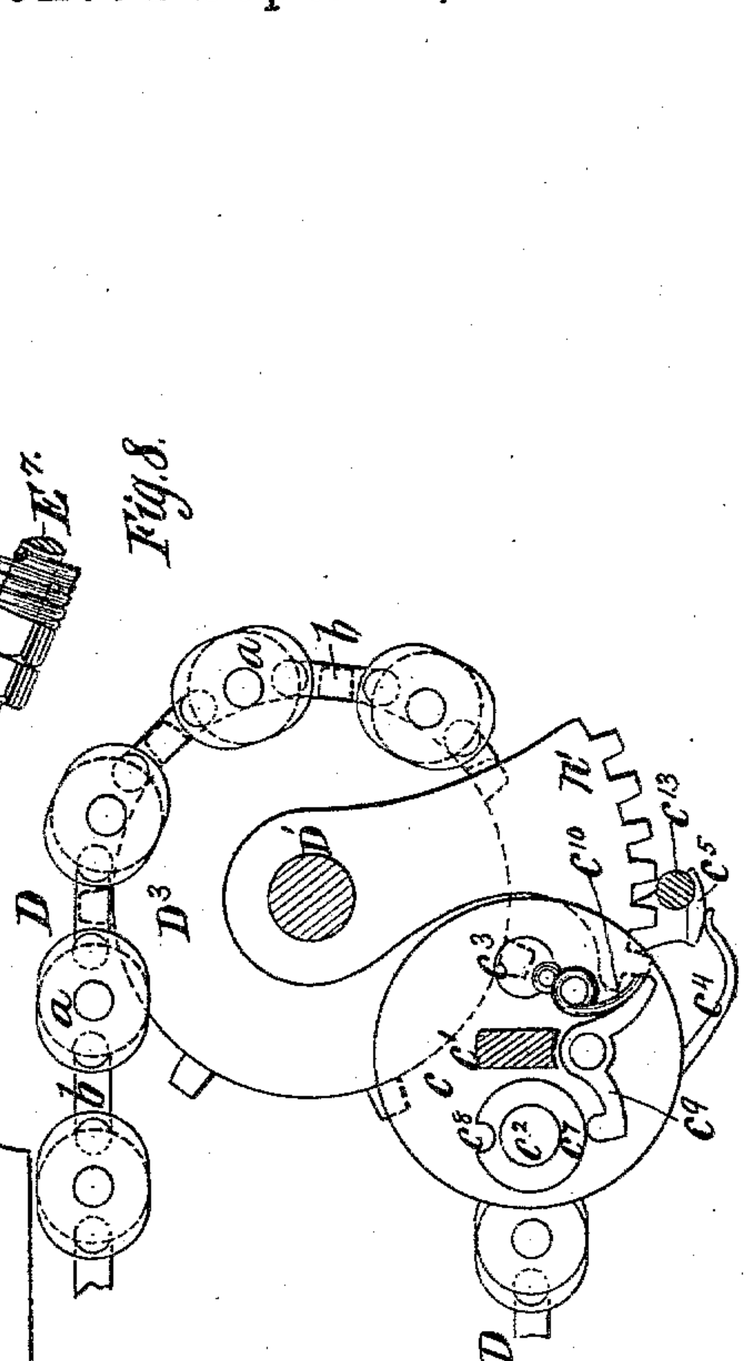
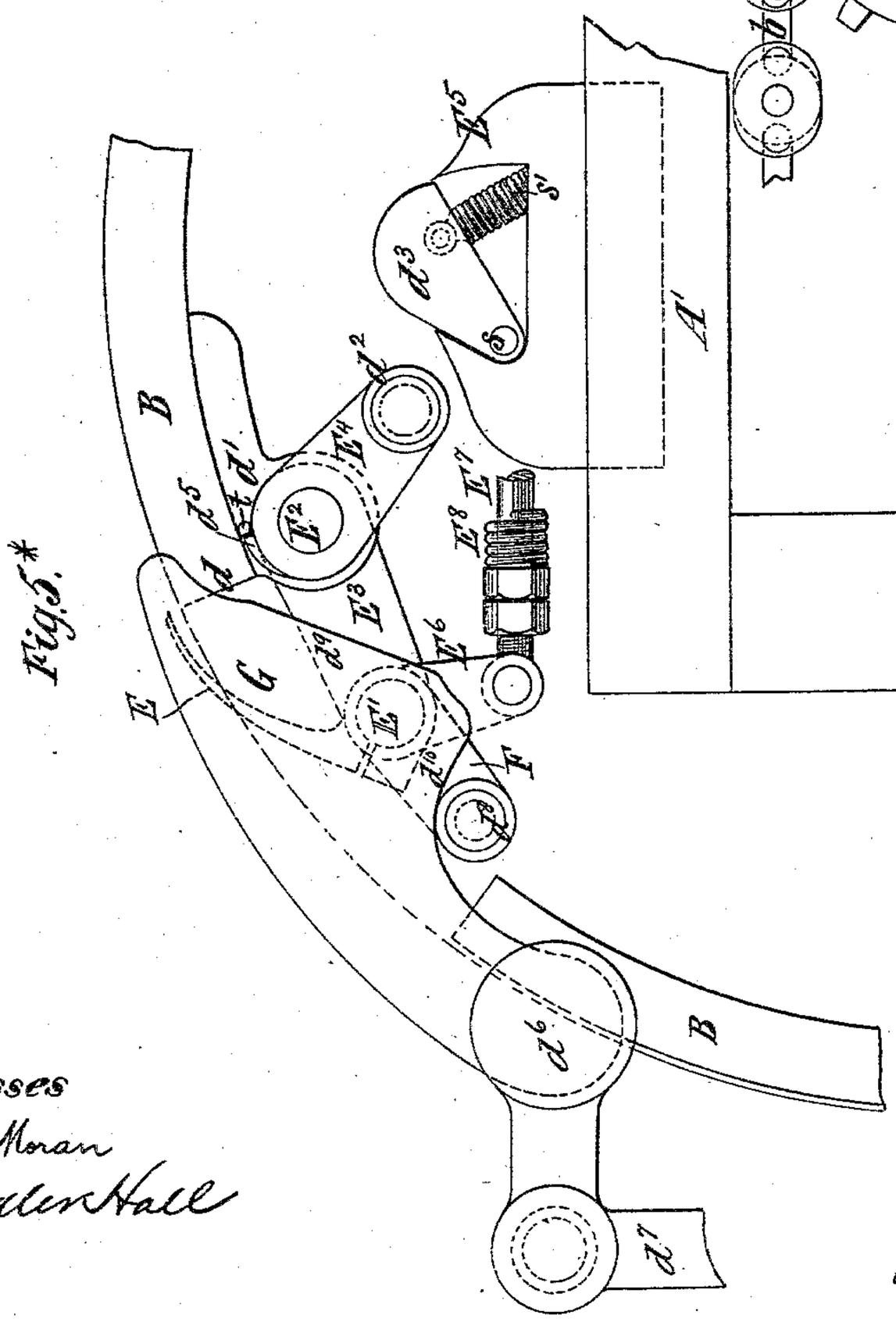


Fig. 5.*



Witnesses
Ed. L. Moran
Chandler Hall

Inventor
Calvert B Cottrell
by his Attorneys
Brown & Hall

(No Model.) 6 Sheets—Sheet 5.

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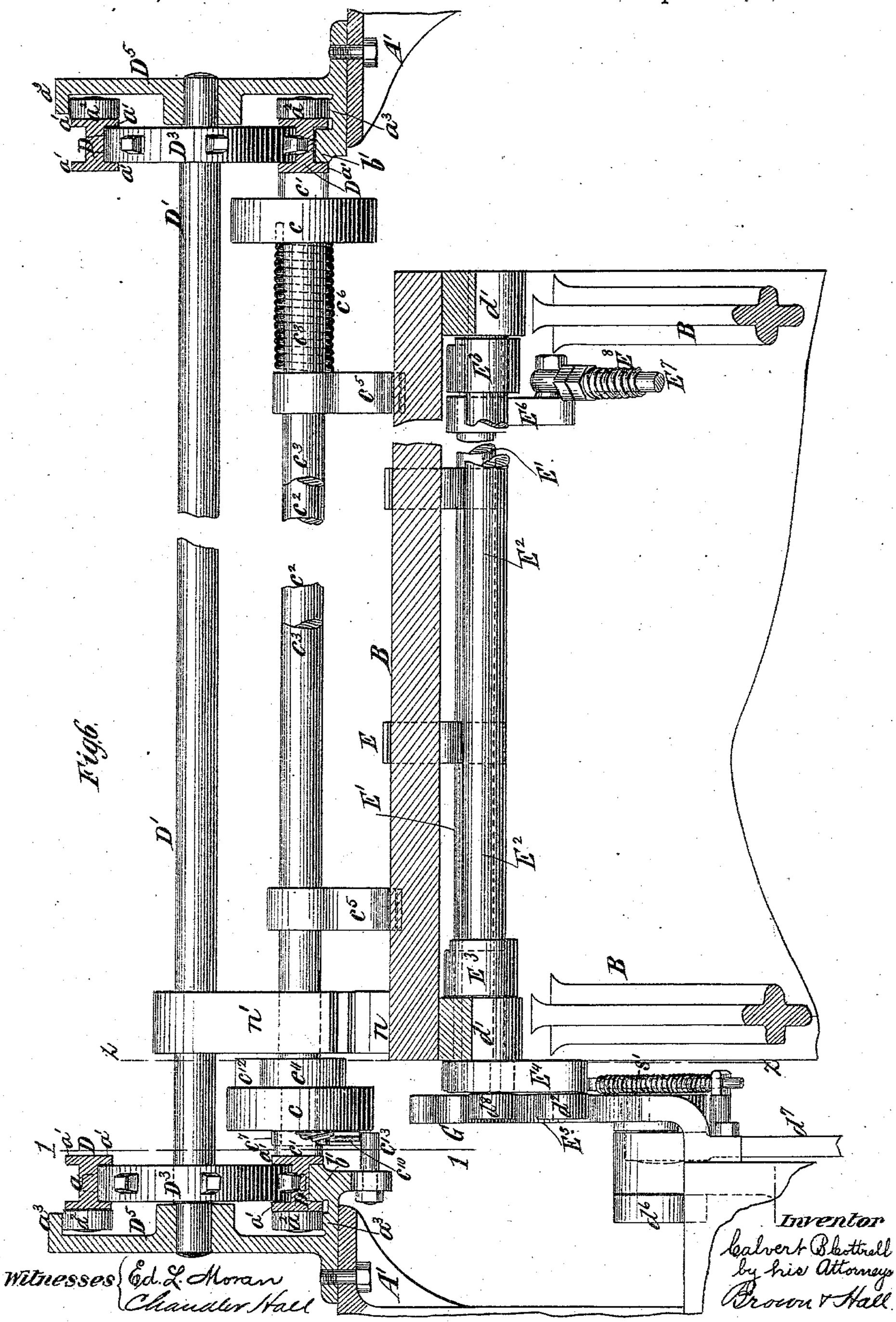
Fig. 6.



(No Model.) 6 Sheets—Sheet 6.

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Fig. 11.

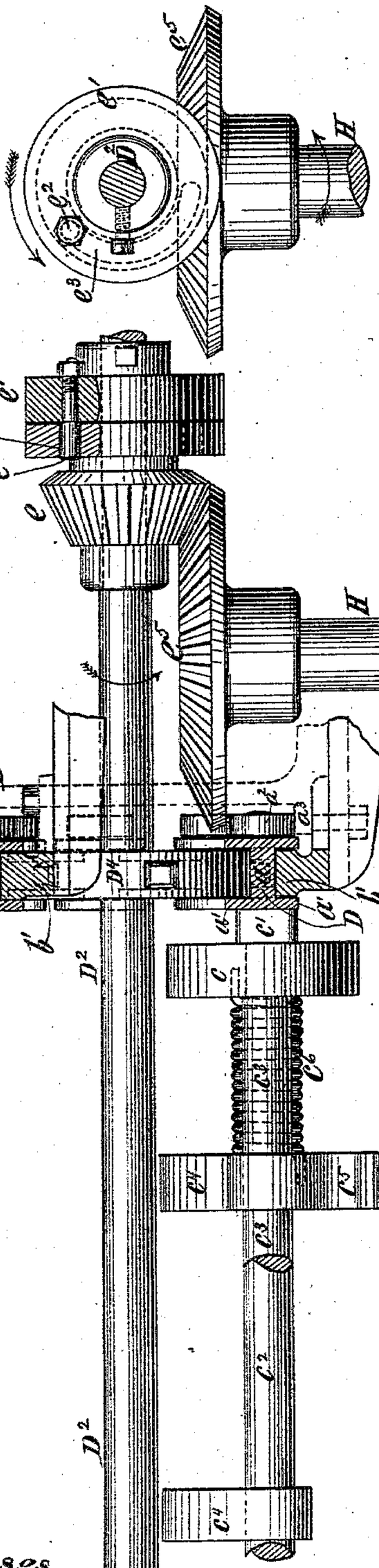

Fig. 12.

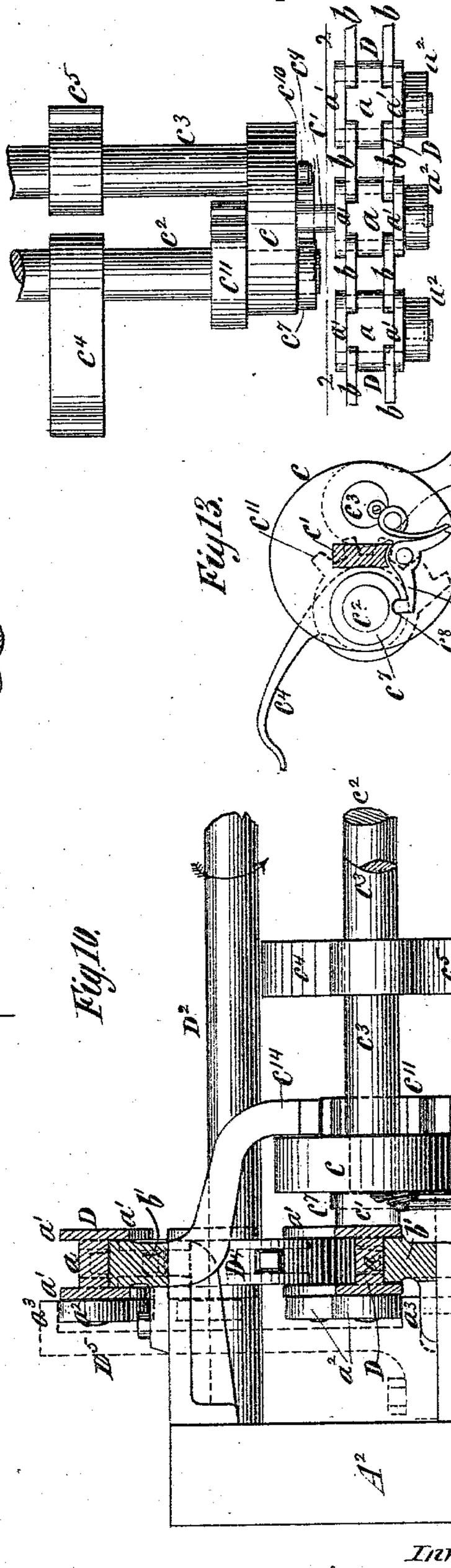

Fig. 13.

Fig. 9.

Fig. 10.

Witnesses
Ed. L. Moran
Chandler Hall

Inventor
Calvert B. Cottrell
by his Attorneys
Brown & Hall

UNITED STATES PATENT OFFICE.

CALVERT B. COTTRELL, OF STONINGTON, CONNECTICUT.

SHEET-DELIVERY APPARATUS FOR PRINTING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 305,798, dated September 30, 1884.

Application filed November 26, 1883. (No model.)

To all whom it may concern:

Be it known that I, CALVERT B. COTTRELL, of Stonington, in the county of New London and State of Connecticut, have invented a new and useful Improvement in Sheet-Delivery Apparatus for Printing-Machines, of which the following is a specification.

The invention relates to sheet-delivery apparatus comprising grippers which are employed to take the printed sheet from the front of the impression-cylinder and carry it to and deliver it upon the receiving board or table with its last-printed side uppermost. For effecting such a front delivery of the printed sheet there have been employed endless chains or carriers, to which the delivery-grippers are attached, and which have a continuous and uniform movement. In order to enable the delivery-grippers to take the printed sheet from the cylinder properly and without tearing it, and to deliver the printed sheet on the pile in a smooth condition and without rumpling it, it is essential that the grippers should have a variable movement—that is, that they should come nearly or quite to a standstill in a stop-cylinder press to take hold of the sheet, and that they should then move rapidly away from the cylinder in order to float or "kite" the sheet over the inking apparatus, and that they should slow down or come nearly or quite to a standstill to deliver or drop the sheet on the receiving board or table. These desirable and almost indispensable results could not, of course, be attained by the employment of endless chains or carriers having a uniform and invariable speed of movement; and an important object of my invention is to impart to endless chains or an endless carrier having the delivery-grippers attached and employed in a front-delivery apparatus such a variable travel or movement that the delivery-grippers will be slowed or stopped to alternately take and deliver the sheets, and between the taking and delivery of the sheets will be moved at quick speed to float or kite the sheet over the inking apparatus.

The invention consists in the combination, with the impression-cylinder of a printing-press, of an endless carrier provided with delivery-grippers arranged at the front of the cylinder, and having an alternately accelerated and retarded movement.

The invention also consists in novel combinations of parts, hereinafter described, and pointed out in the claims, whereby the desired variable motion is transmitted to the endless carrier from a shaft which has a simple rotary motion at a uniform speed.

The invention also consists in a novel combination of mechanism, also hereinafter pointed out, whereby the carrier is caused to move at exactly the same velocity as the cylinder at the time the cylinder-grippers release the sheet and the delivery-grippers take the same, whereby the cylinder and delivery grippers are caused to act in exact time relatively to each other.

The invention also consists in various other novel features of construction and combinations of parts, which are hereinafter described, and referred to in the claims.

In the accompanying drawings, Figure 1 is a side elevation of such parts of a press as are necessary to illustrate my invention, portions of the press between the cylinder and receiving-table being broken away to reduce the length of the drawing. Fig. 2 is an end elevation looking from the end at which the receiving-table is located toward the cylinder. Fig. 2* is a side view of a cam, also shown in Fig. 2. Fig. 3 is a vertical section on the line *x x*, Fig. 2, of portions of the press. Fig. 4 is a side view of the end portion of the delivery apparatus which is adjacent to the receiving-table. Fig. 5 is an end view of a portion of the cylinder and a side view of the end portion of the delivery apparatus which is above the cylinder, a hood which covers one side of the delivery apparatus being removed to enable the chain-wheel and chains to be shown in full lines. Fig. 5* is a view of the cylinder corresponding to Fig. 5, but showing the position of the gripper mechanism when the cylinder is stopped and the grippers are ready to take the sheet. Fig. 6 is a vertical section on the dotted line *y y* of the delivery apparatus and a portion of the cylinder in a plane parallel with the axis of the cylinder. Fig. 7 is a section of that portion of the delivery apparatus which is over the cylinder on the plane of the dotted line *z z*, Fig. 6. Fig. 8 is a similar section in the plane of the dotted line 1 1, Fig. 6. Fig. 9 is a vertical section of a portion of the delivery ap-

paratus at one side of the press and at the end of the press at which the receiving-table is located, looking away from the cylinder; and Fig. 10 is a vertical section, corresponding to Fig. 9, of the portion of the delivery apparatus at the other side of the press. Fig. 11 is an end view of certain of the parts shown in Fig. 9, looking toward the left of said figure. Fig. 12 is a plan of a portion of one of the endless delivery-chains and gripper mechanism connected therewith, and Fig. 13 is a sectional view on the dotted line 2 2, Fig. 12.

All the figures 4 to 13, inclusive, except Fig. 2*, are drawn to a larger scale than Figs. 1, 2, and 3.

Similar letters of reference designate corresponding parts in all the figures.

In the drawings I have represented only such parts of a stop-cylinder press as are necessary to illustrate my invention, and all the parts not shown may be of the usual or any other suitable construction.

A designates the main side frames of the press. A′ designates the standards which support the impression-cylinder B, and A^2 designates the standards which support the receiving table or board C.

Between the cylinder B and receiving table or board C is to be arranged the inking apparatus, which is not here shown, and in delivering printed sheets from the front of the cylinder they have to pass clear over the inking apparatus.

I will first describe the construction and arrangement of two endless chains, D, which in this example of my invention form the carrier for the delivery-grippers.

Over the cylinder B is arranged a shaft, D′, extending parallel with the axis of the cylinder, and at the farther end of the press adjacent to the receiving table or board C is a similar shaft, D^2.

Upon the shaft D′ are secured chain-wheels D^3, which are provided with teeth or projections to engage positively with the chains, and upon the shaft D^2 are similar chain-wheels, D^4, provided with projections which engage with the chains, and so impart motion to them.

The chains D are composed of links of two forms, (designated by the letters *a b*.) Alternate links *a* are milled, recessed, or channeled on the top and bottom to form flanges *a′* on opposite sides, and between the links *a* there extend pairs of links *b*. The links *a* are so formed that the space between the flanges *a′* is about equal to the thickness or width of the chain-wheels D^3 D^4, and they will therefore embrace the wheels, as shown in Figs. 9 and 10, and will be held against side movement thereon.

Between the chain-wheels D^3 D^4 there extend long straight guides or ways *b′*, which are of about the same width as the aforesaid chain-wheels, and which are also embraced by the pairs of flanges *a′* on the links *a*. By this means the two chains are maintained at a proper and uniform distance apart, and are prevented from spreading.

On the outer side of each link *a* is pivoted a roller, a^2, as shown best in Fig. 12, and these rollers serve to guide the chains on the inner sides of the flanges a^3, which are formed at the top and bottom of hoods D^5, that partially inclose the chains and the chain-wheels D^3 at the cylinder end, as best shown in Figs. 5 and 6, and dotted in Figs. 9 and 10. Two belts or bands of metal or other material might be substituted for the chains.

The chains have attached to them two sets of delivery-grippers, which are equidistant or arranged at opposite points in the chains, as indicated in Fig. 1. Obviously a single set of delivery-grippers could be employed; but in such case the chains would have to make a complete circuit at each delivery in order to bring the single set of grippers round to the point of taking the sheet at the proper time.

The distance from the cylinder to the receiving-table is considerable, and in order to make the complete circuit the grippers would have to travel at a very high speed. I therefore find it desirable to employ two sets of delivery-grippers, set equidistant from each other in the chains, and the chains will then effect the delivery of two sheets in each circuit. More than two sets of delivery-grippers might be employed; but the particular mechanism here shown for operating the chains is adapted for two sets only. A description of one set of delivery-grippers will apply to both.

Connected with opposite links *a* in the two chains D are heads or disks *c*, which are here shown as formed integral with such links, they being connected by necks *c′*, the form of which is shown in Figs. 12 and 13. The two heads or disks *c* are connected by a gripper rod or shaft, c^2, adapted to turn in them, and a gripper-bar, c^3, which is incapable of turning.

To the rod or shaft c^2 are rigidly attached the delivery-grippers c^4, and to the bar c^3 are rigidly attached the gripper-rests c^5, all as best shown in Figs. 12 and 13. The gripper rod or shaft c^2 is turned by a spring, c^6, applied to it, as shown in Figs. 6 and 9, to close the grippers c^4 on the rests c^5, and hold the printed sheet.

On the outer side of the head or disk *c*, at one end of the gripper-rod c^2, is a hub, c^7, notched at c^8, and to the head or disk is pivoted a catch, c^9, adapted to engage with the notched hub c^7, as shown in Fig. 13, and serving thereby to hold or lock the gripper-rod c^2 and keep the grippers c^4 open. This catch c^9 is held in engagement with the notched hub c^7 by a spring, c^{10}, as shown in Fig. 13, and to release the catch it is only necessary to press on the tail end thereof, whereupon the grippers will close automatically by the force of the spring c^6. On the gripper rod or shaft c^2 at the inner side of the disk or head *c* is fixed a toothed hub or sector, c^{11}, having a long tooth or projection, c^{12}, and to open the grip-

pers c^4 it is only necessary to turn the hub or sector c^{11} until the catch c^9 snaps into the notched hub c^7 on the end of the rod c^2.

The means employed for tripping the catch c^9 and for opening the grippers are simple and will be readily understood.

On one of the hoods D^5, which shield the chain-wheels D^3, is an inwardly-projecting pin, c^{13}, (best shown in Figs. 6 and 8, but also in Fig. 5,) and near the chain-wheels D^4, at the receiving table or board C, is a rack, c^{14}, which is fixed to one of the guides or tracks b', as best shown in Figs. 4 and 5. Just before the grippers c^4 reach the position shown in Figs. 5 and 8 the tail of the catch c^9 strikes against the pin c^{13}, thereby removing the catch from the notched hub c^7, and allowing the grippers to close onto and take the printed sheet. The grippers hold the sheet by the pressure of the spring c^6 until the receiving table or board C is reached, at which place the toothed hub or sector c^{11}, with its long tooth c^{12}, comes into engagement with the rack c^{14}, whereupon the grippers c^4 are swung open until the catch c^9 snaps into the notched hub c^7 to hold the grippers open, in which position they remain until they reach the position at which they take the sheet. As shown at Fig. 4, the sector c^{11} is just leaving the rack c^{14}, the grippers c^4 having been opened sufficiently far to enable the catch c^9 to snap into the notched hub c^7 and hold the grippers c^4 open.

I will now describe the construction and arrangement of the cylinder-grippers. (Shown in Figs. 5, 5*, 6, and 7.)

In Fig. 5 the cylinder B is shown in the position it occupies at the time the cylinder-grippers E have just been raised to release the printed sheet and allow it to be taken by the delivery-grippers c^4, and the cylinder rotates in the direction indicated by the arrow 3, Fig. 5, and comes to a stop when the receiving-edge d of the gripper-recess B′ reaches the position indicated by the dotted line 4 4, Fig. 5, where it remains until the printed sheet has been carried past the cylinder by the movement of the delivery-grippers c^4, and a new sheet has been taken from the feed-board B^2. After the cylinder-grippers E have released the printed sheet it is necessary to remove them from in front of it, in order that they will not be in the way of the sheet as it is carried off by the delivery-grippers, and to effect such removal I withdraw the cylinder-grippers into the gripper-recess B′. The cylinder-grippers E are fixed upon a gripper-shaft, E′, which, instead of being mounted in fixed bearings, as is usual, is so mounted that it may be moved or swung toward and from the center of the cylinder to withdraw the grippers into the gripper-recess.

E^2 designates a rock-shaft mounted in bearings d' and carrying arms E^3, in the outer ends of which the gripper-shaft E′ is journaled.

To the end of the rock-shaft E^2 is fixed an arm, E^4, carrying a bowl or roller, d^2, which makes contact with a cam, E^5, on the cylinder-standards A′ as the cylinder rotates. This cam E^5 has a section or portion, d^3, which yields under the roller d^2 when the latter moves backward over it, for a purpose hereinafter explained.

On the end of the gripper-shaft E′, at the side of the press opposite to the side on which is the arm E^4, is fixed an arm, E^6, to which is connected one end of a rod, E^7, having a gripper-closing spring, E^8, coiled upon it, and pivoted or fastened to the cylinder at the other end, d^4, as shown in Fig. 1. The outward movement of the arms E^3 and gripper-shaft E′ away from the center of the cylinder is limited by a stop, which may consist of a shoulder, d^5, on the arm E^4, bearing against a pin, t, fixed in the cylinder, as shown in Fig. 5.

G designates a cam, which is fulcrumed at d^6, and has connected with it a rod, d^7, whereby it is raised at the proper time to release the grippers and allow them to close, as hereinafter described. Just as the cylinder reaches the position shown in Fig. 5, the roller d^8 on the arm F has come in contact with the point of the cam G, and has turned the gripper-shaft E′ sufficiently to raise the grippers from the cylinder. Just as the grippers E are raised the roller d^2 on the arm E^4 comes in contact with the stationary cam E^5, and the continued rotation of the cylinder swings the arms E^3 and gripper-shaft E′ toward the center of the cylinder, and thereby withdraws the grippers E into the gripper-recess B′, the roller d^8 meanwhile running down on the inclined surface d^9 of the cam G. When the receiving-edge d of the gripper-recess comes to the point marked d^* in Fig. 5, which is half-way from the position indicated in full lines in said figure, to the stopping-point 4 4, the several parts of the gripper mechanism occupy the positions indicated by dotted lines in Fig. 5, and at that time the roller d^2 of the arm E^4 is just passing the greatest projection of the cam E^5. During the remaining part of the movement to the stopping-point 4 4 the roller d^8 on the arm F dwells on the surface d^{10} of the cam, and the arm E^4 being released from the action of the cam E^5, the gripper-shaft E′ and arms E^3 are swung outward, and the several parts assume the positions shown in Fig. 5*, with the grippers E in proper position to take the sheet, but raised, as in Fig. 5. The grippers remain raised until the sheet is fed to them, whereupon the cam G rises and the grippers are at once closed by the action of the gripper-closing spring E^8.

The yielding section d^3 of the cam E^5 is pivoted at s, and is held up in the position shown in Figs. 5 and 5* by a spring, s'.

Whenever it is necessary to back up the press, the roller d^2, moving backward over the section d^3, will depress it, and hence the cam-section will not prevent the backing up of the press, as it would do if made rigid and unyielding.

The mechanism for operating the chains D with a movement which is alternately acceler-

ated and retarded is shown in Figs. 1, 2, and 3, and parts of such mechanism are shown in Figs. 4, 9, and 11.

Upon one end of the chain-wheel shaft D^2 is a bevel-pinion, *e*, which is loose upon the shaft, and adjacent thereto is a disk, *e'*, which is fast on said shaft and carries a pin, e^2, entering a segmental slot, e^3, in a hub or disk formed on the wheel. This slot is shown dotted in Fig. 11. The shaft D^2 always turns in the direction indicated by the arrow in Figs. 9 and 10, and the connection of the loose pinion *e* and fast disk *e'* by the pin and slot enables the shaft to be turned in advance of the pinion for a time, while allowing of the shaft being turned by the pinion as soon as the rear end of the slot comes against the pin. The purpose of this connection will be hereinafter explained.

H designates an upright shaft, mounted in bearings e^4, and having at its upper end a bevel-wheel, e^5, which gears with and operates the pinion *e*. This shaft should turn in the direction indicated by the arrows, Figs. 2, 3, and 9, and it carries at its lower end a bevel-pinion, *f*, which gears with and receives motion from a bevel-wheel, *f'*, secured to a short horizontal shaft, f^2.

I designates a shaft having a continuous and uniform rotary motion, and from it an alternately accelerated and retarded motion is transmitted to the horizontal shaft f^2 by the following mechanism:

J designates a horizontal bar extending across and capable of being reciprocated in bearings f^3. At one end its upper and lower edges are toothed to form racks *g g'*, and at the other end it is provided with bowls or rollers *h h**.

J' designates a frame or hanger loosely mounted on the shaft f^2, and provided with pivots or studs *i i'* above and below the bar J.

On the pivot or stud *i* are loosely mounted a pinion, *j*, and wheel *k*, and on the pivot or stud *i'* are loosely mounted a similar pinion, *j'*, and wheel, *k'*. Each pinion and wheel are connected together so as to rotate as one, and both wheels *k k'* are in constant engagement with a pinion, f^4, on the shaft f^2, while the pinions *j j'* are adapted to be alternately engaged with the racks *g g'* by the swinging of the frame or hanger J' to receive motion from the reciprocation thereof. When the hanger J' is swung into the position shown in Fig. 2, the pinion *j'* is engaged with the rack *g'*, and the pinion *j* is disengaged from the rack *g*; but when the hanger is swung into the other position the pinion *j* is engaged with the rack *g* and the pinion *j'* is disengaged from the rack *g'*. The rack-bar J is slotted so as to straddle the shaft I, and on said shaft is a cam, I', which engages with the rollers *h h** on the rack-bar J. The form of this cam is clearly shown in the view Fig. 2*, the position of the cam being the same as in Fig. 2, and this cam serves to reciprocate the rack-bar J at a variable speed.

On the shaft I, and as shown in Fig. 2, in front of the cam I', is a grooved cam, I^2, *l* designating the groove thereof, and I^3 designates a rod, which is forked to straddle the shaft I, and is connected with the lower portion of the swinging frame or hanger J'.

On the rod I^3 is a roller, *l'*, which engages with the groove *l* of the cam I^2 and imparts motion to said rod. Each rotation of the cam I' produces a forward and backward movement of the rack-bar J, and each rotation of the cam I^2 produces a forward and backward movement of the rod I^3.

At opposite points in the cam I' are two portions, *m m*, which are concentric to the shaft I, and at each end of its movement the rack-bar J dwells, while the portions *m* pass the rollers *h h**. The groove *l* of the cam I^2 has also opposite portions, l^2, concentric with the shaft I; but these portions form the principal portions of the groove, and between them are steps or offsets l^3 in the groove *l*, which effect the movement of the rod I^3 first in one direction and then in the other.

The cams I' I^2 are shown in Fig. 2 in the positions which they occupy when the cylinder B and the chains D, with their delivery-grippers c^4, are in the positions shown in Fig. 5, and it will be understood that the cam I^2 has just moved the rod I^3 in the direction of the arrow 5, Fig. 2, and by swinging the frame or hanger J' has moved the pinion *j'* into engagement with the rack *g'* and the pinion *j* out of engagement with the rack *g*.

The swinging frame or hanger and the pinions *j j'* are held in the positions just described while the portion l^2 of the cam I^2, which is of least radius, passes the roller *l'*.

During the time that the pinions *j j'* were being shifted into and out of engagement with their respective racks, as just described, the concentric portions *m m* of the cam I' have been passing the rollers *h h**, and the rack-bar J has had a short dwell; but as soon as the pinions *j j'* have been thus shifted the cam I' commences to act upon the roller *h**, and so moves the rack-bar J toward the left, as indicated by the arrow 6 in Fig. 2, at an accelerated and comparatively quick speed. The rack *g'* being now in engagement with the pinion *j'*, the latter is rotated, and through the wheel *k'*, pinion f^4, shaft f^2, and bevel-wheel and pinion *f' f* imparts a corresponding rotation to the shaft H in the direction indicated by the arrow thereon. At the termination of its movement in the direction of the arrow 6 the bar J dwells while the concentric portion *m* of the cam I', which has the larger radius, passes the roller *h**, and during this dwell the cam I^2 moves the rod I^3 toward the left hand of Fig. 2, in order to shift the swinging frame or hanger J', and thereby to move the pinion *j* into engagement with the rack *g* and the pinion *j'* out of engagement with the rack *g'*, and when the pinions *j j'* are so moved the rack-bar J is moved toward the right hand of Fig. 2 at an accelerated and comparatively quick speed.

The rack *g* being now in engagement with the pinion *j*, the latter is rotated, and, through the wheel *k*, pinion f^4, shaft f^2, and bevel-wheel and pinion $f'f$, imparts a corresponding rotation to the shaft H in the direction of the arrow shown thereon in Figs. 2 and 3. The dwells of the rack-bar J at each end of its movement are to enable the toothed pinions *j j'* to be moved into and out of engagement with the racks *g g'*, and during such dwells of the rack-bar the shaft H is stationary and does not impart any movement to the chains D.

From the above description it will be seen that one rotation of the cam I' produces a complete circuit of the chains D. It is of importance that the movements of the chains D and delivery-grippers c^4 should be absolutely synchronous with the speed of the cylinder at the time the gripper takes the printed sheet, and that the delivery-grippers should always have the same relation to the cylinder-grippers E at the time the said cylinder-grippers are raised to release the sheet, as shown in Fig. 5.

On the cylinder B is a toothed sector or rack, *n*, and on the chain-wheel shaft D' is a sector, *n'*, both of which are best shown in Figs. 6 and 7, but also in Fig. 5. Just at the time the cam I' has nearly completed the movement of the rack-bar J in one direction, the chains D then having a very slow movement, the sector c^{11} on one of the gripper-shafts c^2 comes into gear with the rack c^{14}, adjacent to the delivery-table C, and the printed sheet is delivered thereon. Immediately after and when the chains D are just about to stop, the sector or rack *n* on the cylinder B comes into gear with the sector *n'* on the chain-wheel shaft D', and the cylinder then carries the chains along at its own speed until the cylinder-grippers have released the printed sheet and the delivery-grippers have taken it. The pin-and-slot connection e^2 e^3 between the loose pinion *e* and the fast disk *e'* enables such forward movement of the chains, shafts D' D^2, and chain-wheels D^3 D^4 to be produced by the cylinder, and the pin e^2 moves ahead in the segmental slot e^3; but just as the cylinder has come to a stop at the line 4 4 and the sector *n* has moved out of engagement with the sector *n'* the cam I' has commenced to move the rack-bar J, and through the intermediate mechanism has moved the loose pinion *e* ahead, so as to cause the end of the segmental slot e^3 to act upon the pin e^2, and thereafter the chains D and delivery-grippers receive their accelerated movement from the cam I' alone until the printed sheet is delivered on the table or board C. During the time required to transfer the printed sheet from the cylinder to the receiving-table, the cylinder has taken a fresh sheet which has been printed, and when the chains have completed half their circuit the delivery-grippers and cylinder-grippers again come to the positions shown in Figs. 5, and the printed sheet is transferred to the delivery-grippers to be taken off.

From the foregoing description it will be seen that the delivery-grippers take the sheet when the chains are moving very slowly, after which they move at an accelerated and comparatively quick speed to kite or float the sheet over the inking apparatus, and finally are slowed down or brought nearly to a standstill to deliver the printed sheet.

In order to support the printed sheet while it is carried by the delivery-grippers and to prevent its dropping down, I may arrange below the chains D an apron or tapes, K, as shown in Fig. 1, and the apron or tapes may be moved by the passage of the sheet over it, or may have such motion imparted to it that its speed of movement will be the same as that of the sheet when the sheet reaches it in its delivery.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with an impression-cylinder, of an endless carrier provided with delivery-grippers arranged at the front of the cylinder, and having an alternately accelerated and retarded movement, substantially as herein described.

2. The combination, with an impression-cylinder, of an endless carrier provided with two sets of delivery-grippers arranged at equidistant points in the carrier, the said carrier being arranged at the front of the cylinder, and having a movement which is alternately accelerated and retarded, substantially as and for the purpose herein described.

3. The combination, with an impression-cylinder, of an endless carrier provided with delivery-grippers, and arranged at the front of the cylinder, a shaft having a uniform speed of rotation, and mechanism, substantially such as described, for imparting to said carrier from said shaft a movement which is alternately accelerated and retarded, for the purpose herein set forth.

4. The combination, with an impression-cylinder and its grippers, of an endless carrier provided with delivery-grippers arranged at the front of the cylinder, and having a movement which is alternately accelerated and retarded, and receiving motion from the cylinder when it is so retarded, in order that the cylinder-grippers and the delivery-grippers shall be caused to move in proper relation with each other during the transfer of the sheet from the cylinder-grippers to the delivery-grippers, substantially as herein described.

5. The combination, with an impression-cylinder, B, and an endless carrier arranged at the front thereof and provided with delivery-grippers, of shafts D' D^2, wheels D^3 D^4, for supporting and operating said carrier, a pinion, *e*, loose on the shaft D^2, a disk, *e'*, fast on said shaft, and connected with said pinion by a pin-and-slot connection, the shaft H, having a rotation which is alternately accelerated and retarded, and provided with the bevel-wheel e^5, and the toothed sectors *n n'*, whereby mo-

tion is imparted from the cylinder to said shaft D′ when the speed of the carrier is retarded, substantially as and for the purpose herein described.

6. The combination, with an impression-cylinder and an endless carrier arranged at the front thereof and provided with delivery-grippers, of shafts D′ D² and wheels for supporting and moving said carrier, an upright shaft geared with the shaft D², a horizontal shaft geared with the upright shaft, and provided with a pinion, a reciprocating rack-bar having a variable movement, and a swinging frame or hanger, and wheels which are alternately moved to impart from the reciprocating rack-bar a variable rotary motion to said upright shaft, substantially as herein described.

7. The combination, with an impression-cylinder and an endless carrier arranged at the front thereof and provided with delivery-grippers, of the shafts D′ D² and their wheels D³ D⁴, the upright shaft H, geared to the shaft D², the pinion and wheel *f f′*, the shaft *f*², and pinion *f*⁴, the swinging frame J′, with its pinions *j j′* and wheels *k k′*, the rack-bar J, provided with racks *g g′*, and a cam for reciprocating said bar, all substantially as described.

8. The combination, with an impression-cylinder and an endless carrier arranged at the front thereof and provided with delivery-grippers, of the shafts D′ D² and their wheels D³ D⁴, the upright shaft H, geared to the shaft D², the pinion and wheel *f f′*, the shaft *f*², and pinion *f*⁴, the swinging frame J′, with its pinions *j j′* and wheels *k k′*, the rack-bar J, provided with racks *g g′*, the rod I³, and the cams I′ I² and shaft I, all substantially as described.

9. The combination, with the cylinder B, provided with the gripper-recess B′, of the rock-shaft E², the arms E³ E⁴, projecting therefrom, the cam E⁵, the gripper-shaft and grippers E′ E, the arm E⁶, and the rod E⁷ and gripper-closing spring E⁸, all substantially as and for the purpose described.

10. The combination, with the impression-cylinder B, provided with the gripper-recess B′, of the rock-shaft E², the arms E³ E⁴, the cam E⁵, the gripper-shaft and grippers E′ E, a spring for closing the grippers, the arm F, and the cam G, all arranged to operate substantially as described.

11. The combination of an impression-cylinder, an endless carrier arranged in front thereof and provided with delivery-grippers, and having a movement which is alternately accelerated and retarded, cylinder-grippers, and a gripper-shaft supporting said grippers, and having a rocking movement to release the printed sheet, and a bodily movement to withdraw the grippers within the gripper-recess, substantially as herein described.

12. The combination, with the chains D, of the heads or disks *c*, connected with the chains by necks or portions *c′*, the gripper-shaft *c*², journaled in said heads or disks, and provided with the grippers *c*⁴, the gripper-bar *c*³, fixed in said heads or disks and provided with rests *c*⁵, the notched hub *c*⁷ and catch *c*⁹, and the closing-spring *c*⁶, all substantially as described.

CALVERT B. COTTRELL.

Witnesses:
FREDK. HAYNES,
ED L. MORAN.