No. 654,445. Patented July 24, 1900.

T. C. DEXTER.

PAPER FEEDING MACHINE.

(Application filed June 12, 1896.)

(No Model.) 10 Sheets—Sheet 1.

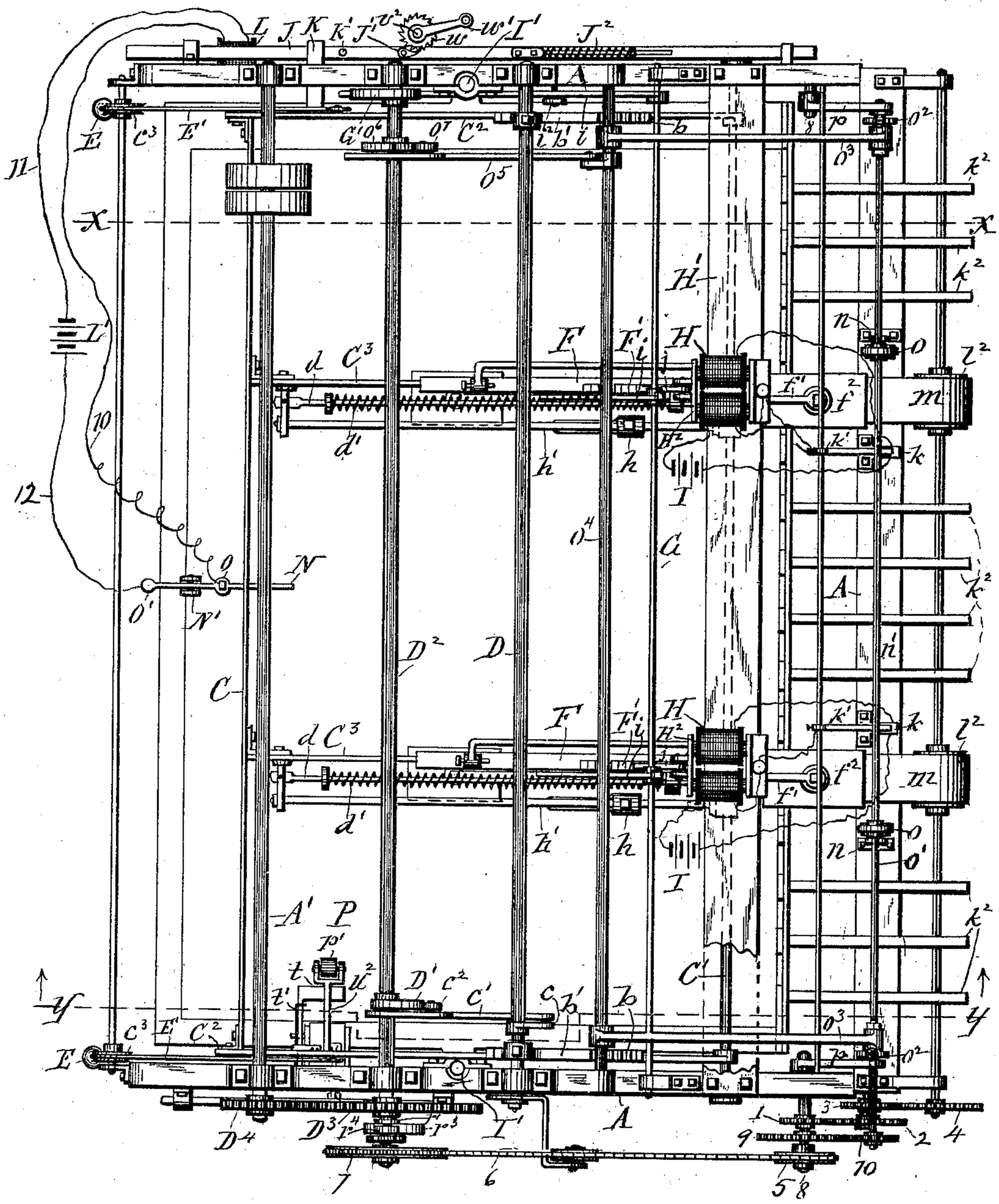

Fig. 1

WITNESSES:
C. L. Bendyson
M. A. Leyden

INVENTOR
Talbot C. Dexter
By E. Lacey
his ATTORNEY

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(No Model.) 10 Sheets—Sheet 2.

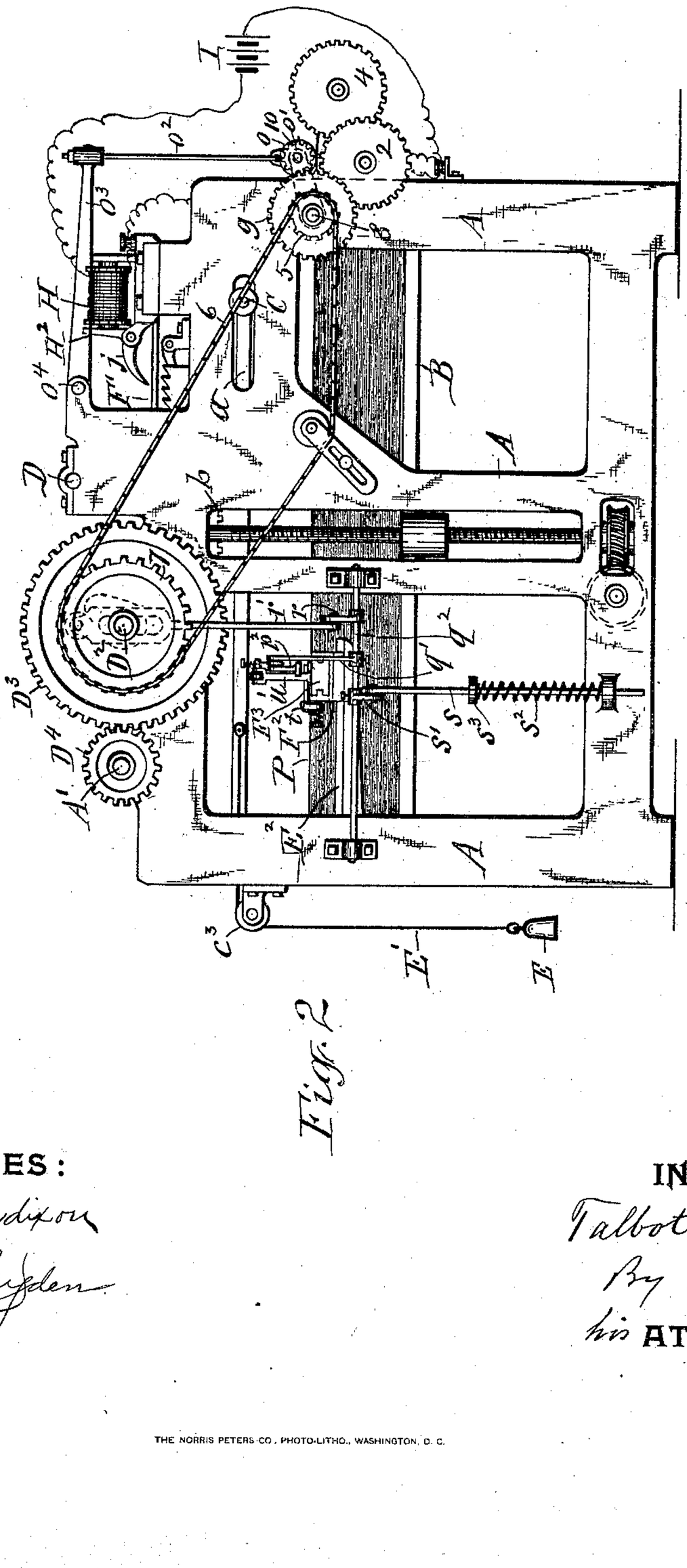

Fig. 2.

WITNESSES:

C. L. Bendixon

M. A. Leyden

INVENTOR

Talbot C. Dexter

By E. Laass

his ATTORNEY

No. 654,445. Patented July 24, 1900.

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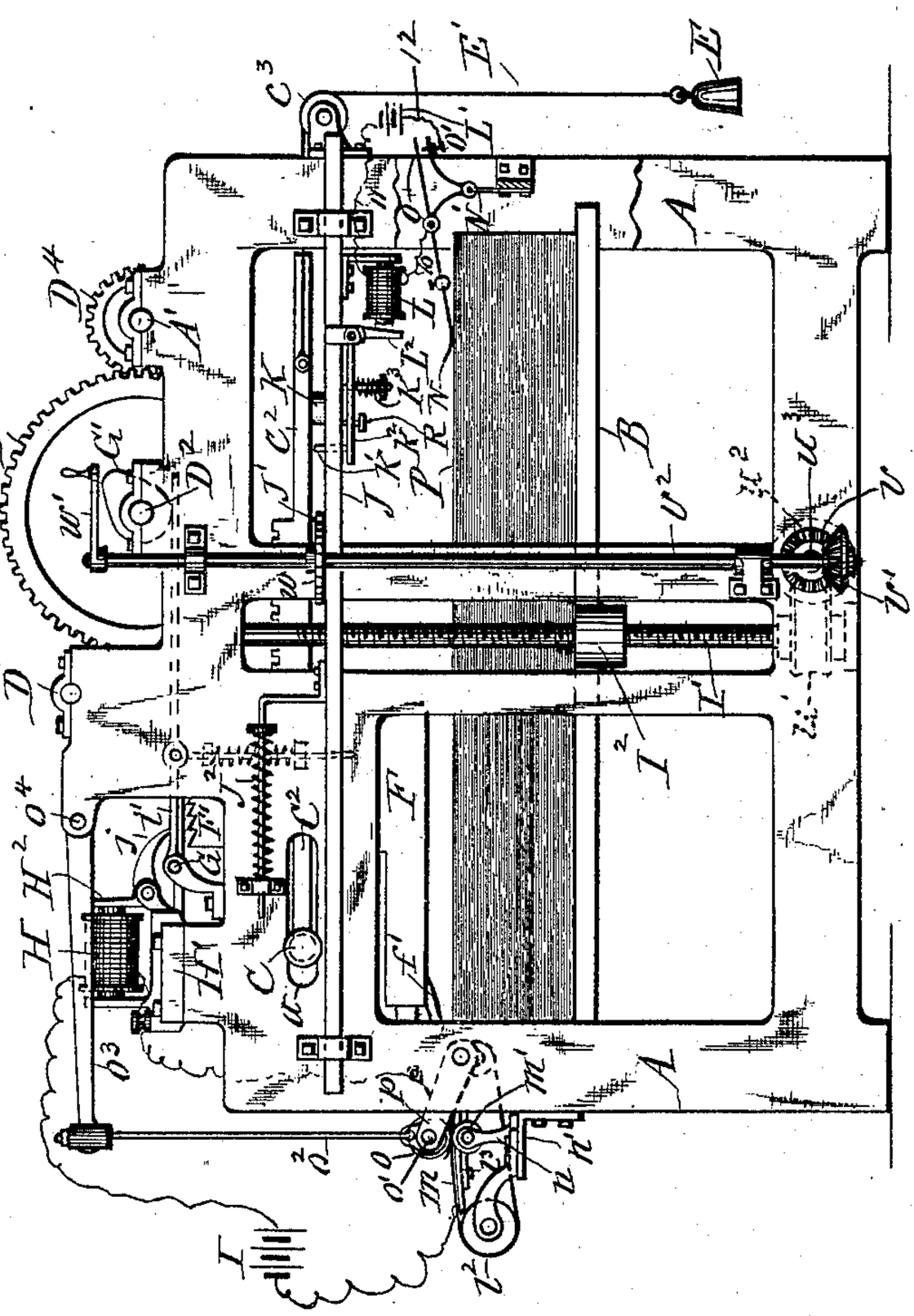
(No Model.) 10 Sheets—Sheet 3.

Fig. 3



WITNESSES:

C. L. Bendixon

M. A. Leyden

INVENTOR

Talbot C. Dexter

By E. Laass

his ATTORNEY

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T. C. DEXTER.

PAPER FEEDING MACHINE.

(Application filed June 12, 1896.)

(No Model.) 10 Sheets—Sheet 4.

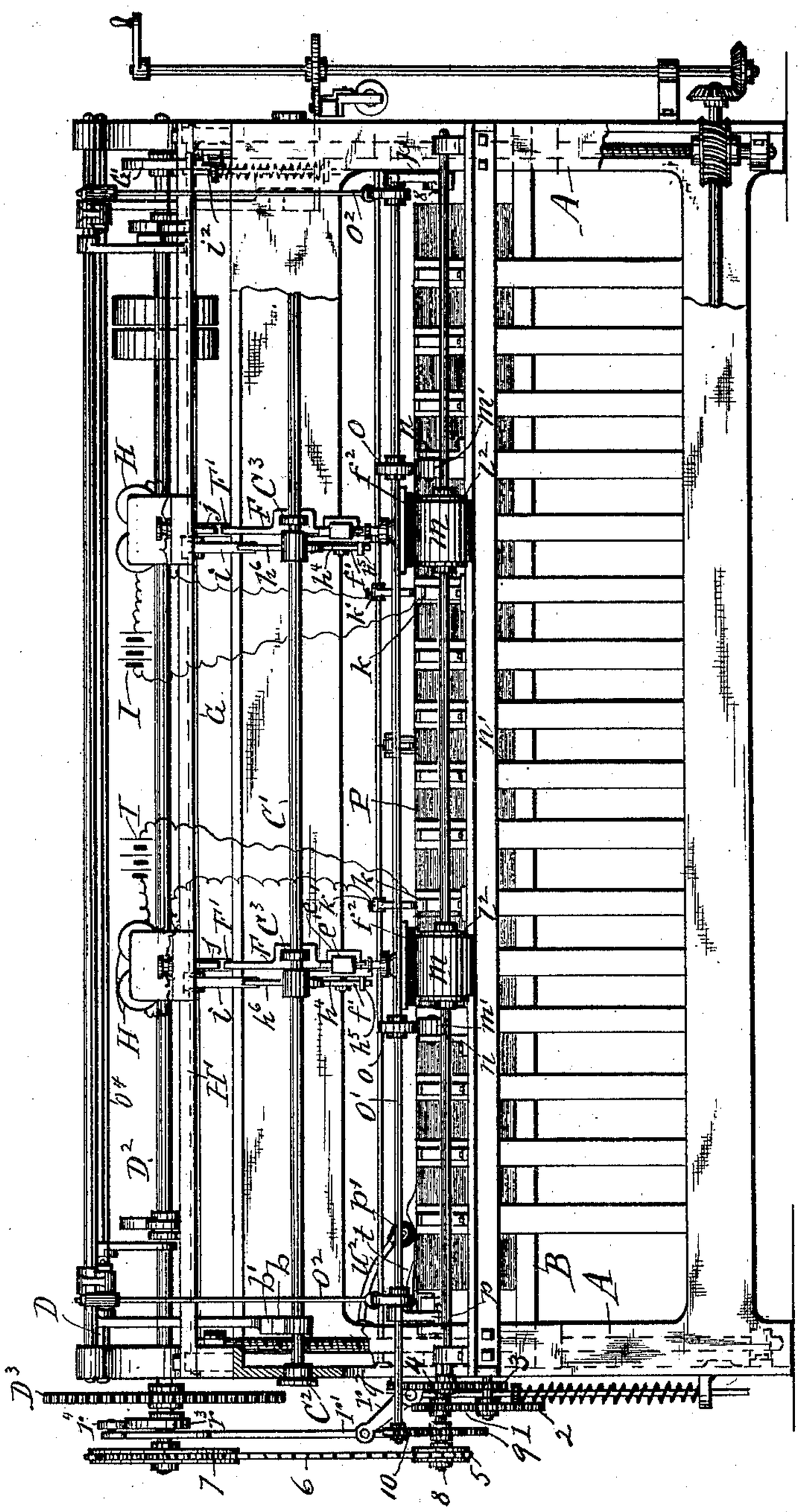


Fig. 4

WITNESSES:

C. L. Burdixon

M. A. Leyden

INVENTOR

Talbot C. Dexter

By E. Laacs

his ATTORNEY

No. 654,445.

Patented July 24, 1900.

T. C. DEXTER.

PAPER FEEDING MACHINE.

(Application filed June 12, 1896.)

(No Model.)

10 Sheets—Sheet 5.

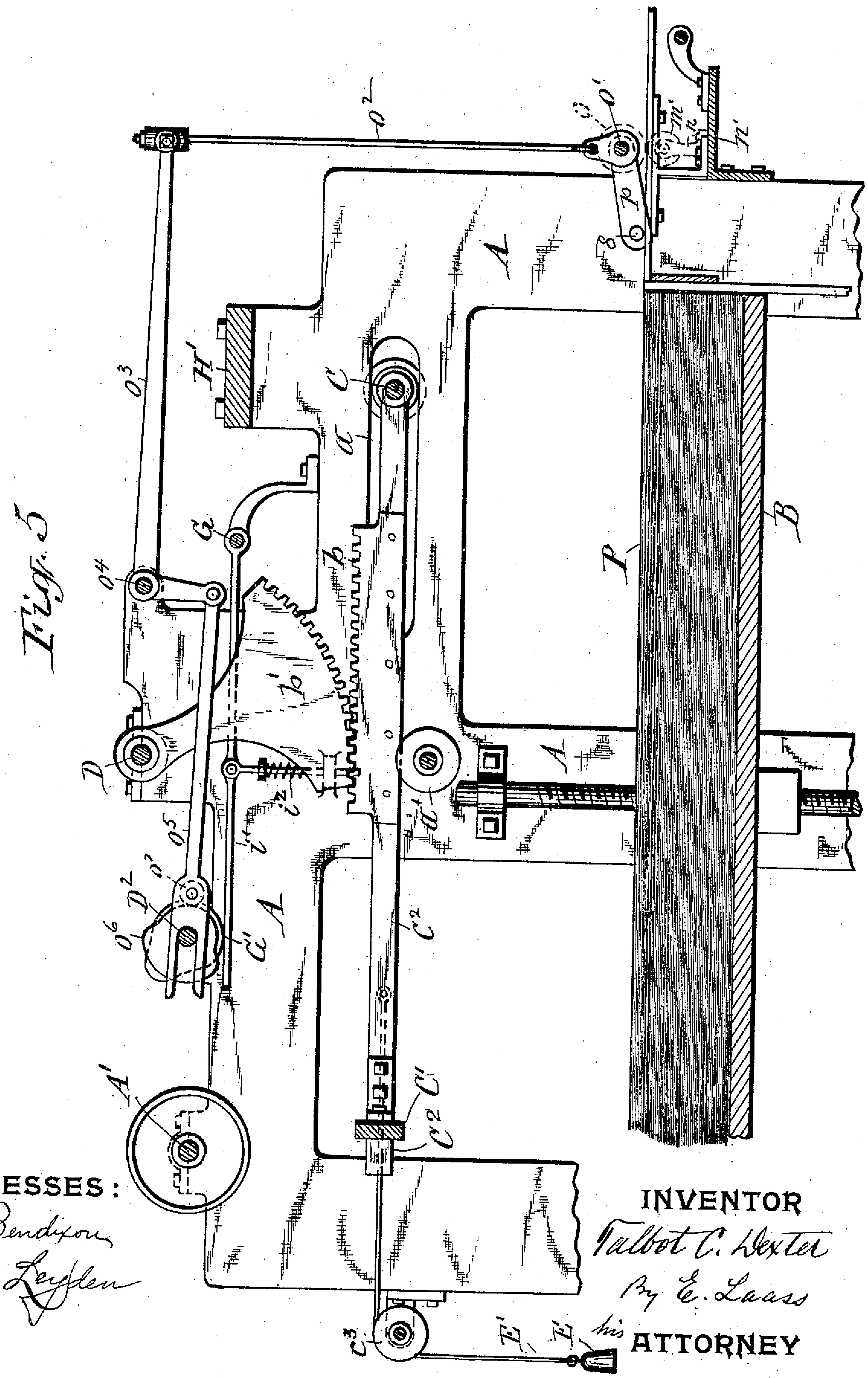


Fig. 5

WITNESSES:

C. L. Bendixon

M. A. Leyden

INVENTOR

Talbot C. Dexter

By E. Laass

his ATTORNEY

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 654,445. Patented July 24, 1900.

T. C. DEXTER.

PAPER FEEDING MACHINE.

(Application filed June 12, 1896.)

(No Model.) 10 Sheets—Sheet 6.

Fig. 16

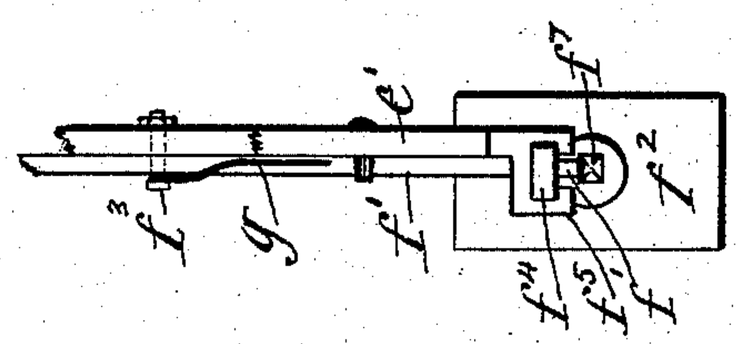


Fig. 6

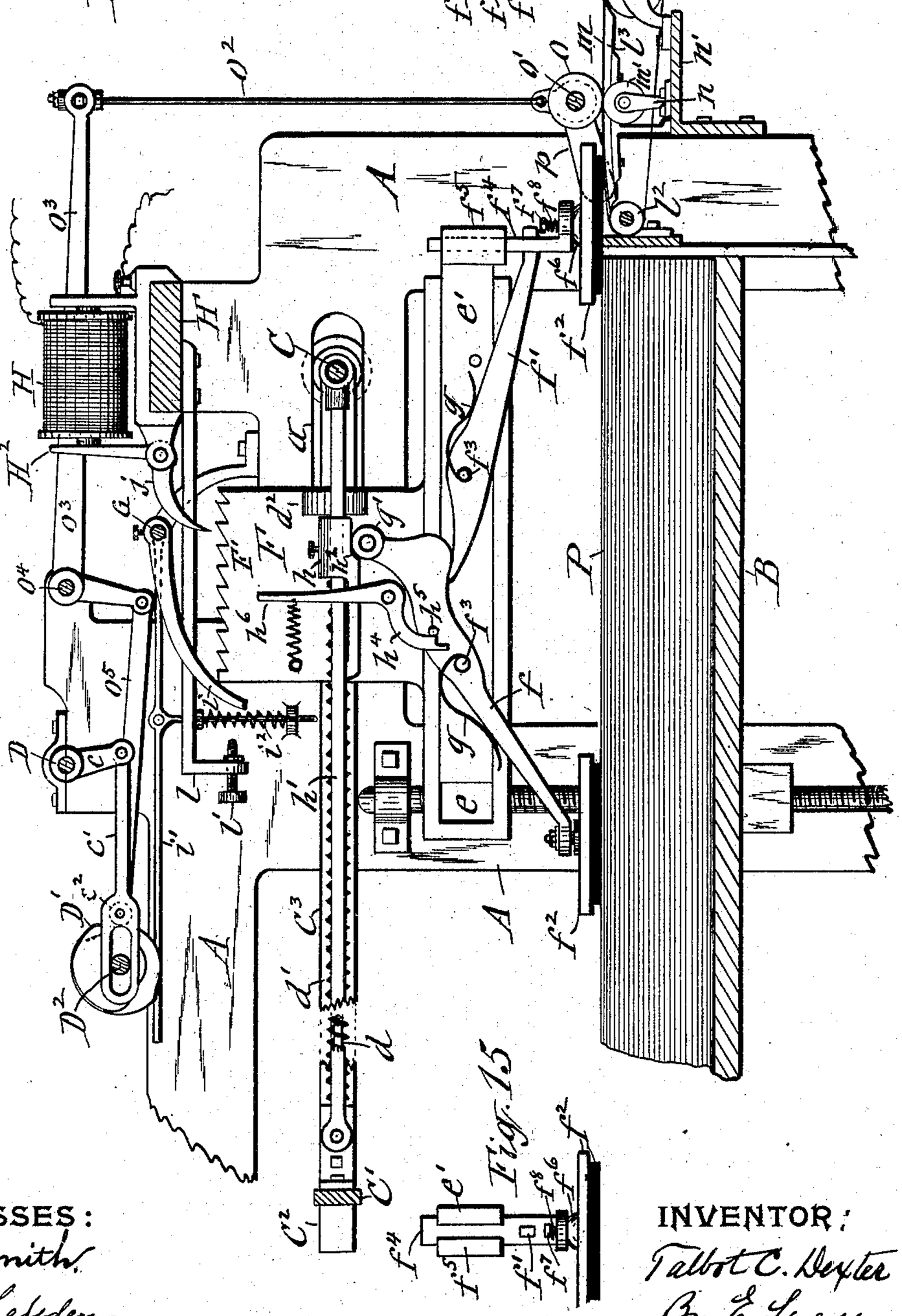


Fig. 15

WITNESSES:
H. B. Smith
M. A. Leydon

INVENTOR:
Talbot C. Dexter
By E. Laass
his ATTORNEY

No. 654,445. Patented July 24, 1900.

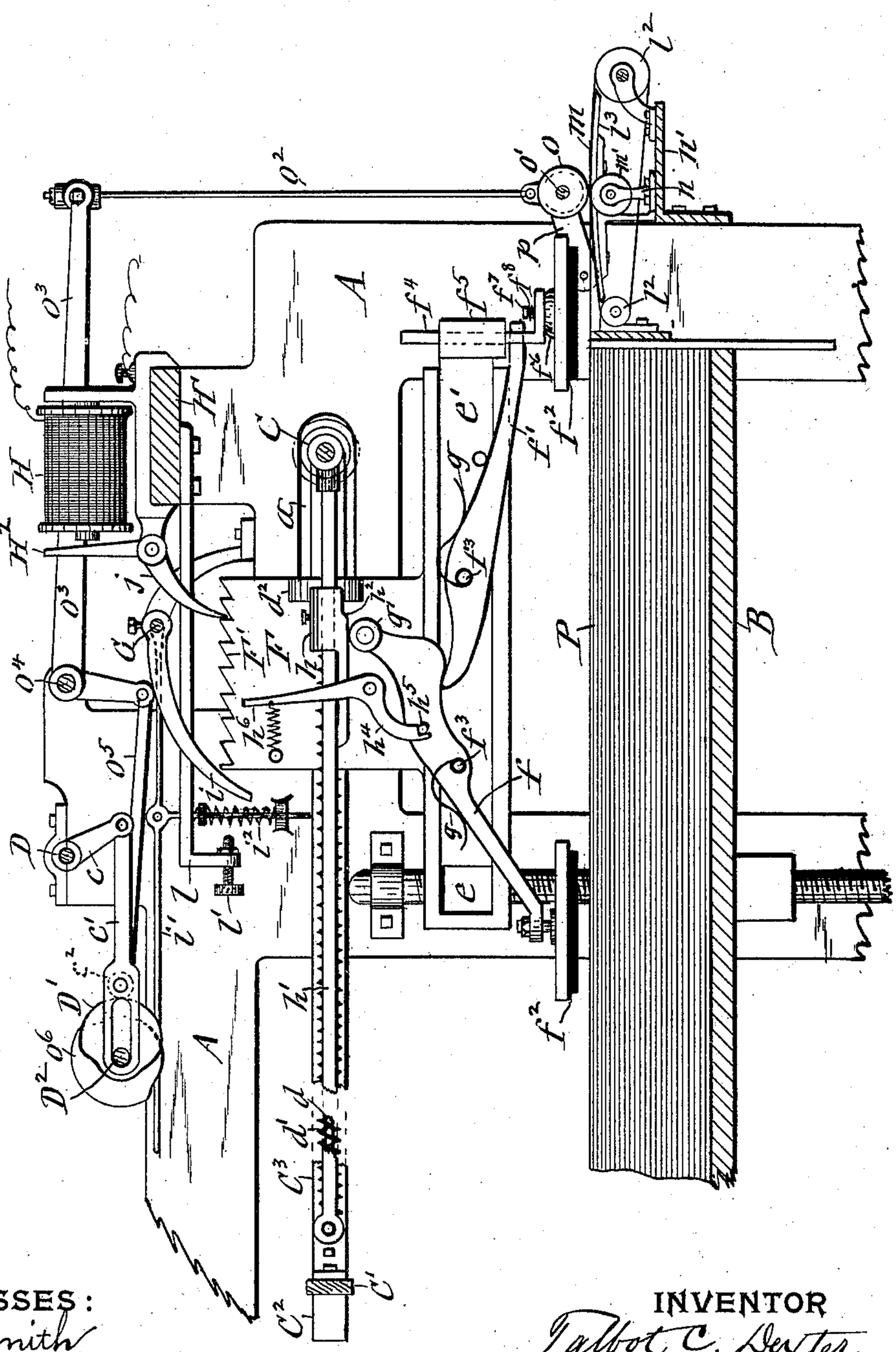
T. C. DEXTER.

PAPER FEEDING MACHINE.

(Application filed June 12, 1896.)

(No Model.) 10 Sheets—Sheet 7.

Fig. 7.



WITNESSES:
H. B. Smith
M. A. Leffler

INVENTOR
Talbot C. Dexter
By E. Laas
his ATTORNEY

No. 654,445. Patented July 24, 1900.

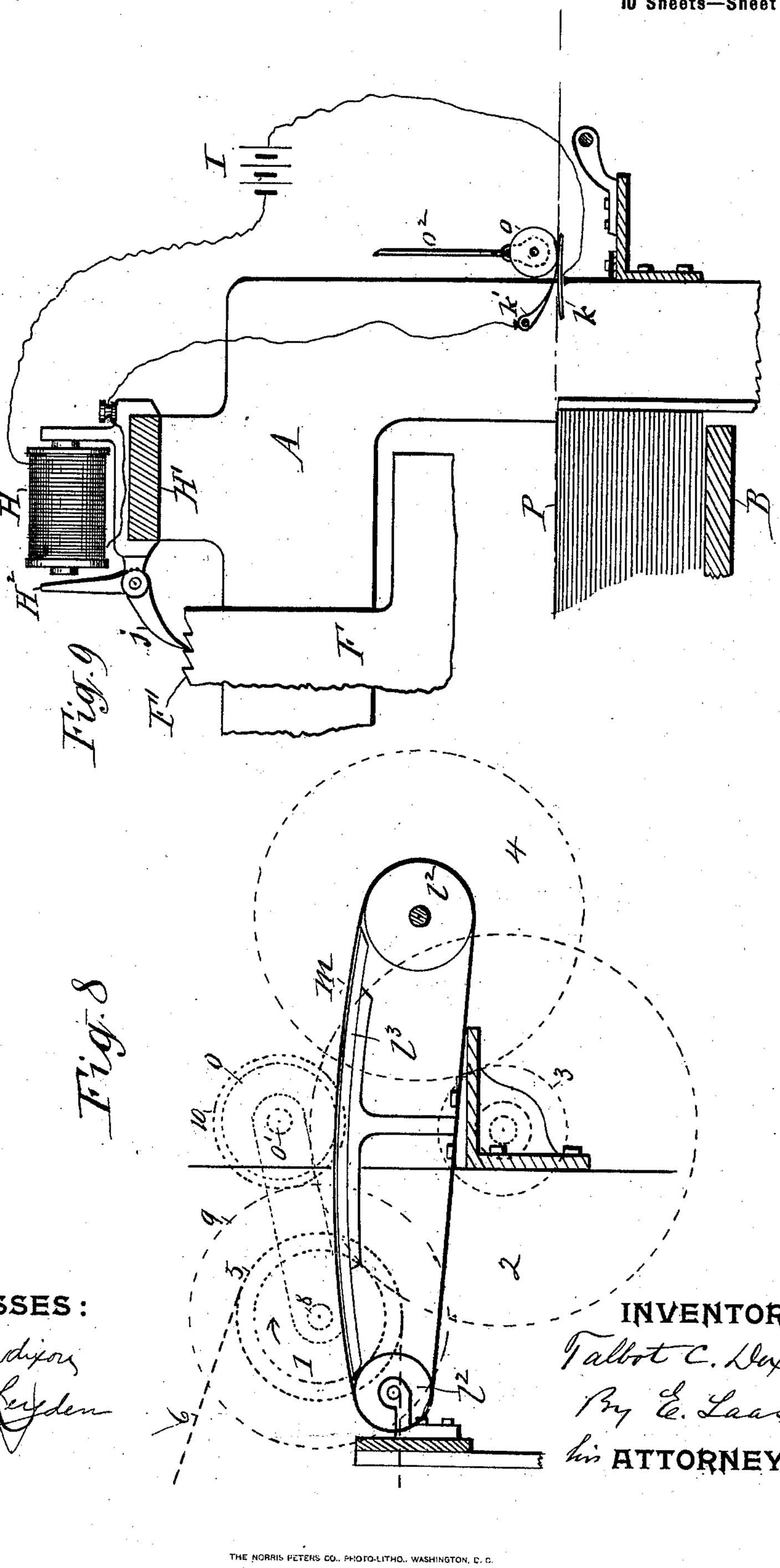
T. C. DEXTER.

PAPER FEEDING MACHINE.

(Application filed June 12, 1896.)

(No Model.)

10 Sheets—Sheet 8.



WITNESSES:

C. L. Bendixon

M. A. Leyden

INVENTOR

Talbot C. Dexter

By E. Laass

his ATTORNEY

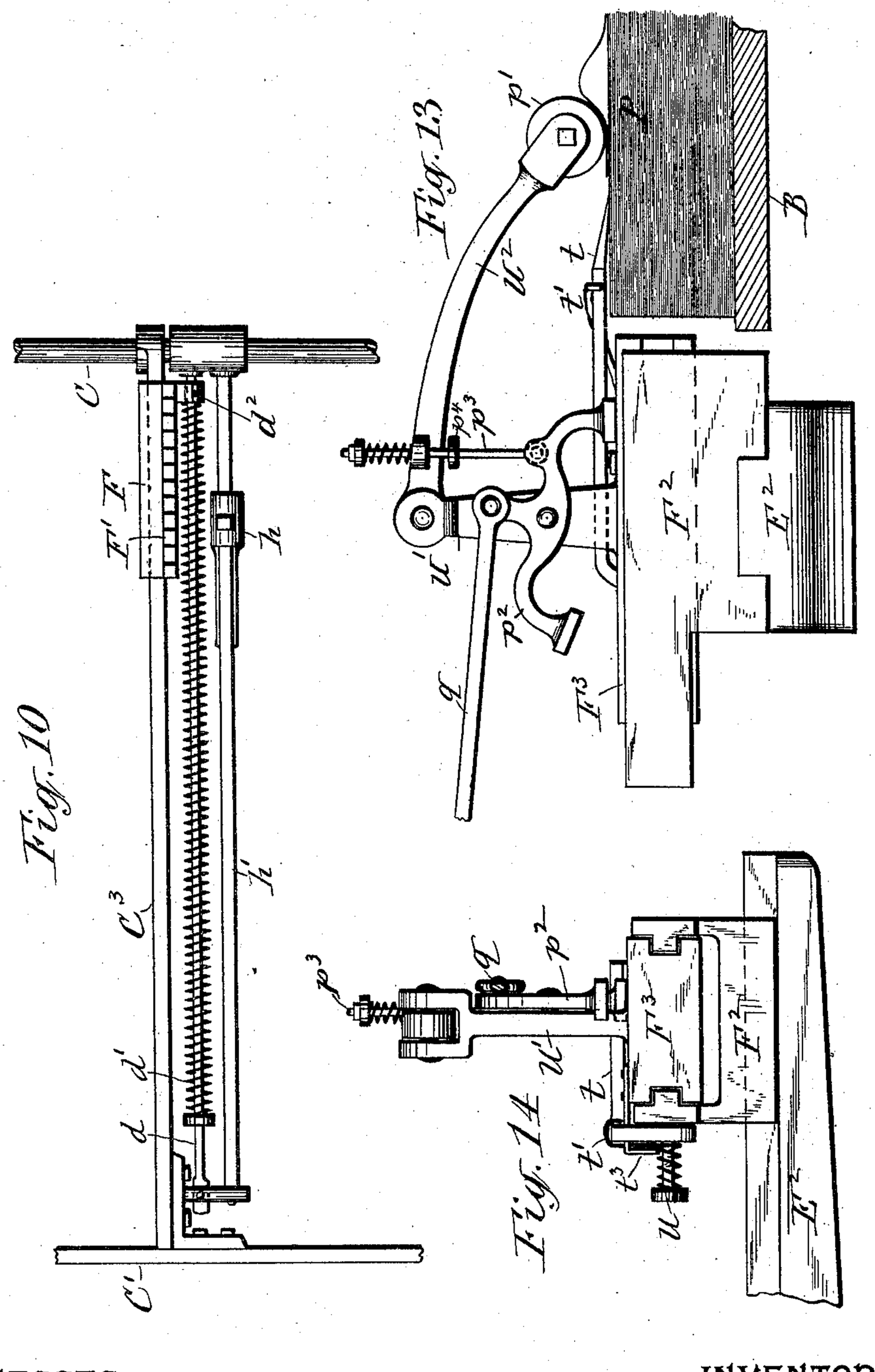
No. 654,445. Patented July 24, 1900.

T. C. DEXTER.

PAPER FEEDING MACHINE.

(Application filed June 12, 1896.)

(No Model.) 10 Sheets—Sheet 9.



WITNESSES:

C. L. Bendixon

M. A. Leyden

INVENTOR

Talbot C. Dexter

By E. Laaes

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T. C. DEXTER.

PAPER FEEDING MACHINE.

(Application filed June 12, 1896.)

(No Model.) 10 Sheets—Sheet 10.

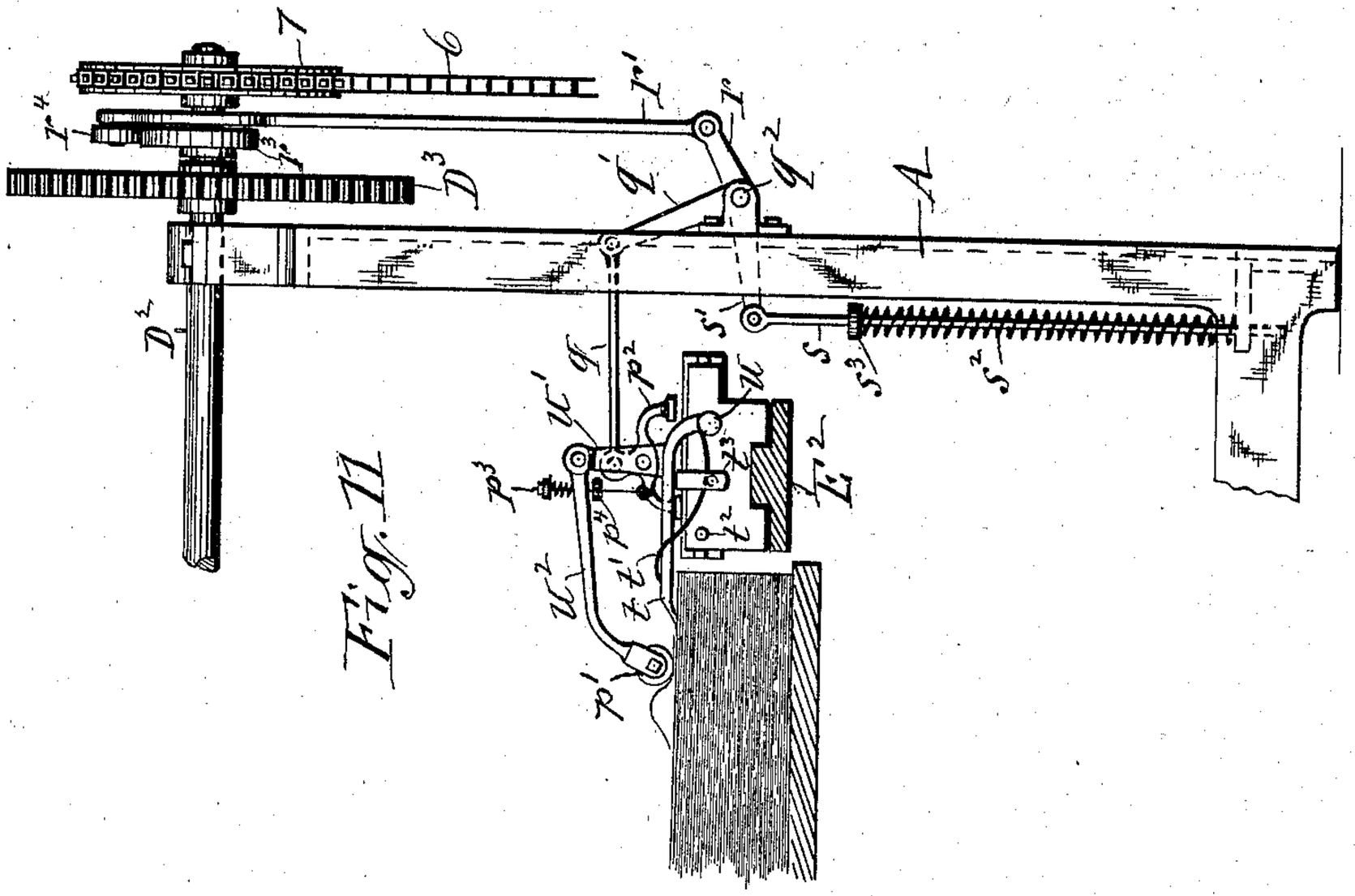

Fig. 11

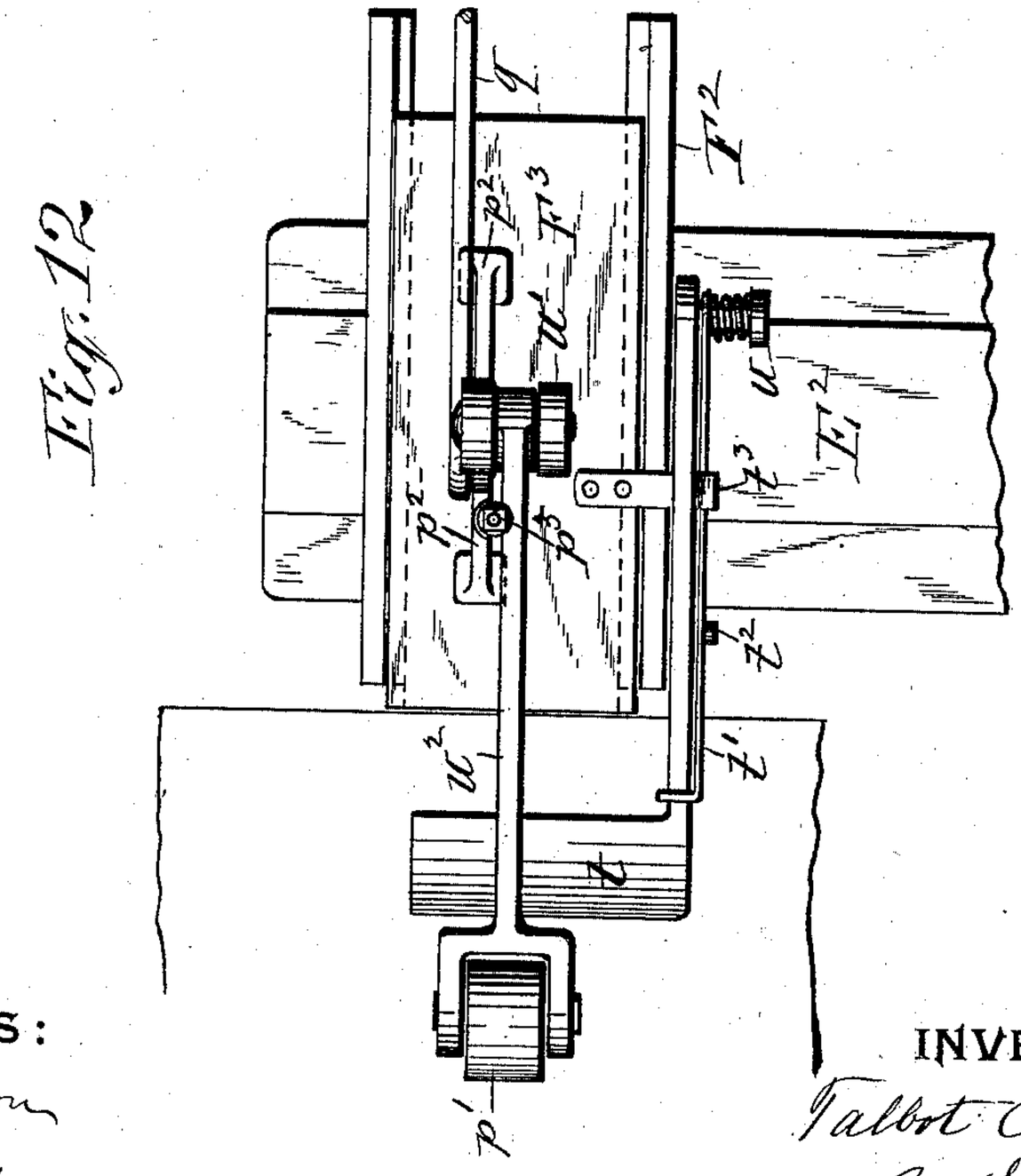

Fig. 12

WITNESSES:

C. L. Bendixon

M. A. Leydon

INVENTOR

Talbot C. Dexter

By E. Laass

his ATTORNEY

UNITED STATES PATENT OFFICE.

TALBOT C. DEXTER, OF PEARL RIVER, NEW YORK.

PAPER-FEEDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 654,445, dated July 24, 1900.

Application filed June 12, 1896. Serial No. 595,373. (No model.)

To all whom it may concern:

Be it known that I, TALBOT C. DEXTER, a citizen of the United States, residing at Pearl River, in the county of Rockland and State of New York, have invented certain new and useful Improvements in Paper-Feeding Machines, of which the following is a specification.

My invention relates to improvements in paper-feeding machines of the buckling type, in which the successive sheets of paper in an adjustably-supported pile are separated and fed from the pile by frictional feeding instruments to a printing-press, folding or ruling machine, or other machine designed to operate upon the paper.

There are two well-recognized classes of frictional paper-feeding machines for separating and successively feeding sheets of paper from a pile, which two classes of machines are distinguishable as "paper-combing" devices or "true frictional feeders." The paper-combing feeding-machines comprise, essentially, a feeding instrument movably supported over a pile of sheets and having a hard smooth engaging surface which is caused to slide or slip over the top sheet of the pile for combing out and partially separating the sheets near the top, giving the pile a shelving appearance at its edge. The true frictional feeding-machines comprise, essentially, a feeding instrument movably supported above a pile of sheets and provided with a soft rubber or other true frictional engaging surface which is adapted to take a positive frictional hold upon the top sheet of the pile and separate and move said top sheet forward singly from the pile. In true frictional feeding-machines the individual sheet moves positively with the frictional feeding instrument the whole length of the stroke while in engagement, whereas in the combing feeding-machines the feeding instrument slips or slides over the sheet and imparts to the sheet (and the adjacent underlying sheets) only a short movement—a fractional part of the stroke of the combing instrument while in engagement. On account of this recognized difference in operation between these two classes of feeding-machines combing devices cannot be employed for the accurate feeding work such as the true frictional feeding devices are capable of accomplishing.

My invention consists in certain novel constructions and combinations of parts of the feeding-machine controlled to a great extent by electrical appliances, all of which improvements coöperate to automatically accomplish the object of the machine, which is to guard more effectually than heretofore against feeding more than one sheet at a time from the machine and to harmonize the actions of all the tributary mechanisms of said machine, so as to enhance the efficiency of its operation.

In order that my invention may be fully understood, I will now describe the same with reference to the accompanying drawings and afterward point out the novelty with more particularity in the annexed claims.

In said drawings, Figure 1 is a plan view of a paper-feeding machine embodying my invention. Figs. 2 and 3 are elevations of opposite sides of said machine. Fig. 4 is a front elevation. Fig. 5 is an enlarged vertical longitudinal section on line X X of Fig. 1. Figs. 6 and 7 are enlarged longitudinal sectional views on line Y Y of Fig. 1, showing the paper-feeding devices in different operative positions. Fig. 8 is a further enlarged detail sectional view illustrating the operation of the sheet-separating devices. Fig. 9 is an enlarged longitudinal section of the electrical devices for automatically controlling the action of the paper-feeding devices. Fig. 10 is a detached detail plan view of that portion of the carriage on which the paper-feeding devices are mounted. Fig. 11 is a detail rear end view, partly in section, of that portion of the machine to which the sheet-buckling devices are applied. Fig. 12 is an enlarged detail plan view of the paper-buckling mechanism. Fig. 13 is a detail elevation of the same mechanism, and Fig. 14 is an outer end view of the same. Fig. 15 is a front view of the front feeding-pad and its connection to its supporting-arm, and Fig. 16 is a plan view of said parts.

Similar characters of reference indicate corresponding parts.

A represents the main supporting-frame of the paper-feeding machine.

B denotes the vertically-movable table, which supports the pile of paper P, from which the sheets are to be fed one at a time. Said table is raised automatically to maintain the top of the pile of paper in the plane of feeding, as hereinafter described.

For feeding the top sheet from the pile it is first buckled and partially separated from the pile by suitable mechanism hereinafter described. The sheet must then be fed forward from the pile without twisting or turning it, in order that it will pass squarely to the printing-press, folder, or other machine and require the least possible registering. Means must also be provided to guard against the delivery of more than one sheet at a time. To accomplish these results, I provide two sets of frictional feeding-off and separating devices, one adjacent to each side of the machine and each set comprising two frictional pads arranged one behind the other. The construction of these devices will now be described.

Horizontally across the machine extends a carriage consisting, mainly, of front and rear cross-bars C and C′ and longitudinal side bars C^2, uniting said cross-bars. Said carriage is moved longitudinally toward and from the delivery end of the machine by mechanisms hereinafter described and is guided by the ends of its front cross-bar sliding in longitudinal slots *a* in the sides of the frame A and by carrying-rollers *a′* under the rear portions of the side rails C^2. To this carriage are connected the true frictional paper-feeding devices, which push the top sheet from the pile of paper, (designated by the reference-letter P in the drawings.) The carriage receives a longitudinal reciprocating motion by means of longitudinal racks *b b*, fastened to the side bars C^2, with which mesh segmental gears or quadrants *b′*, attached to a rock-shaft D, which is actuated by a crank *c*, attached to said shaft and connected to a pitman *c′*, which has pivoted to its free end a roller c^2, held in contact with and receiving reciprocating motion from a cam D′, attached to a shaft D^2, receiving rotary motion from the driving-shaft A′ by gears D^3 D^4, as more clearly shown in Fig. 2 of the drawings. The roller c^2 is maintained in contact with said cam by the weight E, which is connected to the carriage by a strap or chain E′, running on an intermediate sheave c^3, journaled upon a bracket attached to the rear end of the frame A, said weight serving to draw the carriage rearward and causing the crank *c* to push the pitman *c′* toward the cam D′. Between the side bars C^2 of the carriage are longitudinal bars C^3, attached to the front and rear cross-bars C and C′ of the carriage, and to these intermediate longitudinal bars are connected my improved true frictional paper-feeding devices, which are designed to coöperate with other devices for separating the top sheet from the underlying sheet. Upon each of said intermediate longitudinal bars is mounted a longitudinally-movable bracket F, provided with a ratchet F′, which is parallel with the bar and has the abrupt faces of its teeth toward the front or delivery end of the macnine. A rod *d*, parallel with the bar C^2, is firmly secured to the carriage and is surrounded by a spiral spring *d′*, which presses with one of its ends against an ear d^2 on the side of the bracket F, and thereby forces said bracket toward the delivery end of the machine. The spring is of sufficient length and sufficient tension to hold the bracket normally at its extreme forward position on the carriage.

The base of the bracket F is provided with a horizontal longitudinal groove *e*, in which is secured a longitudinally-adjustable bar *e′*, to which are connected the feeding devices proper. These feeding devices consist of two arms *f* and *f′*, pivoted intermediate their lengths, as shown at f^3, to the aforesaid bar and each carrying on its free end a pad f^2, of soft rubber or other suitable material, presenting the requisite true frictional surface on the under side, which surface is flat and extended laterally as well as longitudinally to obtain an effective hold on the paper to be fed from the machine. The pad which is adjacent to the delivery end of the machine I prefer to connect to the arm *f′*, by means of a vertical limb f^4, sliding in a vertical guide f^5 on the end of the bar *e′*. The foot of said limb is connected to a convex boss f^6 on top of the plate, which has the pad affixed to its under side. To permit this pad to vibrate in its aforesaid connection, I attach the top plate to the foot of the limb f^4 by means of a bolt f^7, which passes freely through said foot and is fastened to the boss f^6. A spiral spring f^8, interposed between the top of the foot of the limb and head of the bolt, serves to hold the boss against the under side of said foot. The limb f^4 is connected to the front end of the arm *f′*, which is inserted in an eye in the limb, as shown more clearly in Fig. 15 of the drawings. The pads are sustained normally in horizontal position and are afforded a slight rocking motion to allow them to conform to any unevenness in the surface of the top of the pile of paper. The arms *f f′* extend with their free ends in opposite directions from each other, and inasmuch as they move in arcs toward the top of the pile of paper the pads are carried in a slight degree toward each other in their approach to the pile of paper, and therefore tend to buckle and loosen the top sheet from the underlying sheet when said pads are brought to bear on said top sheet. This facilitates the feeding of the paper from the machine, which is subsequently effected by the joint forward movement of the two pads.

For operating the aforesaid arms so as to carry the pads in and out of contact with the top of the pile of paper respectively during the forward and rearward movements of said pads the free ends of the arms receive a downward pressure by suitable springs *g g*, and

when at their extreme forward position they are caused to rise simultaneously from the pile by the depression of the inner end of the arm *f*, bearing on top of the inner end of the companion arm *f'*. To effect this lifting of the pads from the paper, the inner end of the arm *f* has pivoted to it a roller *g'*, over which is a tripper which by contact with said roller depresses the inner end of the arm *f*, and thereby causes the free ends of the two arms to rise from the pile of paper. This tripper, as shown in the drawings, comprises a sleeve *h*, clamped adjustably on a rod *h'*, which is parallel with the bar C^3 and secured to the carriage. Said sleeve is formed with a forwardly-facing shoulder h^2, which in the operation of the machine is caused to strike the roller *g'* and mount the same, as hereinafter more fully described, to thereby depress the inner ends of the two arms *f f'*.

In order to retain the frictional feed-pads f^2 f^2 lifted during their rearward movement, I pivot to the side of the ratchet F' a latch h^4, which is formed at one end with a hook which automatically engages a lug h^5 on the arm *f* when said arm is tripped by the contact of the roller *g'* with the shoulder h^2, as aforesaid. To disengage the hook of the latch from the feed-arm *f* and allow said arm to drop when the carriage has arrived at its rearmost position, a finger *i* is fixed to a shaft G, journaled in suitable bearings on the sides of the main frame A, which shaft receives a properly-timed rocking motion by a lever *i'*, extending from said shaft and held in contact with a rotary cam G' by means of a spring-actuated rod i^2. The rocking of the shaft G causes the finger *i* to strike an arm h^6, projecting from the latch h^4, which latch is thereby thrown out of engagement with the lug h^5 on the arm *f* and allows the pad-carrying end of said arm and companion arm *f'* to be depressed by the springs *g*, so as to bring the pads f^2 to bear on top of the pile of paper during the succeeding forward movement of the carriage. Said springs *g* are attached at one end to the pivot-pins of the arms *f* and *f'* and bear with their free ends on the pad-carrying portions of said arms. In order to insure the lifting of said pads from the paper when the carriage has arrived at its extreme forward position, as hereinbefore stated, I employ an electromagnet H, mounted on a bar H', which extends across the machine and is supported on the sides of the main frame A. The armature H^2 of said magnet is pivoted to the supporting-bracket of the magnet and is formed with a dog *j*, adapted to engage the ratchet F' when said armature is released from the magnet. In connection with said magnet I employ a circuit maker and breaker actuated by the paper in transit from the machine, which may consist, as shown in the drawings, particularly in Fig. 9, of a metallic plate *k*, arranged directly under the plane of the travel of the paper and in proximity to the delivery end of the feeding-machine and constituting one of the terminals of the electric circuit derived from the battery I, and a metallic finger *k'*, supported above the plate *k* and constituting the other terminal, which finger *k'* is pivotally connected to and insulated from a rod extending across the front of the machine and secured to the sides of the frame A. Said finger rests normally upon the plate *k*, and thus the circuit is normally closed to energize the magnet H and cause it to attract its armature, and thereby hold the dog *j* out of contact with the ratchet F'. When, however, a sheet of paper is pushed forward from the pile by the feed-pads f^2, said sheet becomes interposed between the two terminals *k* and *k'* and breaks the circuit. The armature H^2 becoming thereby released from the magnet causes the dog *j* to drop into engagement with the ratchet F' and prevents said ratchet from being carried farther forward by the carriage on which it is yieldingly mounted, as hereinbefore described. The said carriage continuing to move a short distance forward causes the shoulder h^2 of the sleeve *h* to mount the roller *g'* on the inner end of the arm *f*, and thereby tilt said arm, together with the companion arm *f'*, so as to lift the pads f^2 from the paper. The sheet in transit holds the circuit broken a sufficient length of time to allow the carriage to start back from its extreme forward position, and during its retrograde movement the latch h^4 retains the arms in their elevated position, as hereinbefore described.

To the cross-bar H' is attached a rearwardly-extending bar *l*, which terminates with a downward deflection provided with a screw-threaded eye through which passes a set-screw *l'*, disposed in line with the ratchet F'. This set-screw is adjustable to project with its front end a greater or less distance forward and come in contact with the rear end of the ratchet F' and arrest the movement thereof when the carriage approaches its rearmost position. Said arresting of the movement of the ratchet causes the roller *g'* to be carried forward from the shoulder h^2 of the sleeve *h* sufficiently to allow the arms *f f'* to drop when the finger *i* trips the latch h^4, so as to release the arm *f*, as already herein described.

The set-screw *l'* is employed more as a safeguard to insure the aforesaid forward movement of the ratchet F' in case the spring *d'* should prove to be too weak to force the ratchet in said direction when the carriage is in its extreme rear position and the spring expanded.

By the employment of the two flat feeding-pads f^2 f^2, arranged one in front of the other and coöperating to synchronously drop onto and rise from the paper and bearing with a uniform pressure upon the same during the forward movement of said pads, the top sheet of the pile of paper is more positively pushed forward and fed from the machine than can be accomplished by a single-paper-pushing

device bearing on the top sheet only at one point. This is due chiefly to the facts that a single-paper-pushing device requires greater downward pressure to obtain the requisite hold on the sheet, and this increased pressure indents the paper at the point of contact of the pushing device, and said indentation causes the top sheet to take more or less hold on the underlying sheet, and thereby moves the latter sheet with the top sheet. Said indentation of the top sheet is effectually obviated by the two flat pads f^2 f^2, arranged and operating in the manner hereinbefore stated.

To further guard against the delivery of more than one sheet at a time from the feeding-machine, I employ a sheet-separator at the delivery end of said machine. This sheet-separator consists, essentially, of a bed m, directly under the plane of feeding and in position to allow the front pad f^2, with the paper adhering thereto, to travel over said bed a sufficient distance to subject the under side of the paper in transit to a certain degree of friction inferior to that exerted upon the top of the paper by the pad f^2. The result is that in case two or more sheets are carried simultaneously onto said bed by the pad f^2 the frictional hold of the bed m on the under side of the lower sheet or sheets checks the movement of the latter, while the top sheet is pushed forward by the pad. The bed m may be either stationary or slightly movable longitudinally in the direction of the feeding or movable considerably slower than longitudinal movement of the pads f^2 and is made, to some degree, arching. When arranged as last described I form the said bed of an endless belt of rubber or other suitable material running on rollers l^2 l^2 and supported intermediate by an arching plate l^3 directly under the upper run of the belt, as shown in Fig. 8 of the drawings. Various mechanisms may be employed to impart the aforesaid slow motion to the belt which constitutes the bed m. In the annexed drawings said mechanism is represented of the form of a train of gears 1 2 3 4. The gear 4 is attached to the shaft of the foremost rollers l^2, and the gear 1 is secured to the side of a sprocket-wheel 5, mounted on a short shaft 8, journaled in the side of the frame A, which sprocket-wheel is connected by a driving-chain 6 with a sprocket-wheel 7 on the shaft D^2. Between the beds m m are sheet-supporting rollers m', pivoted to brackets n, attached to a cross-bar n' on the front of the frame A. The tops of said rollers are even with the plane of the bed.

Over the rollers m' m' are drop-rollers o o, secured to a shaft o', which extends across the machine and is supported at its ends by rods o^2, which are suspended from the front ends of levers o^3, fastened at their rear ends to a rock-shaft o^4, which latter is actuated by a crank attached to said shaft and having on its free end a rearwardly-extending pitman o^5, the rear end of which is bifurcated and straddles the rotary shaft D^2, to which is fastened a cam o^6. A roller o^7, pivoted to the pitman o^5, is held in contact with the cam o^6 by the weight of the suspended shaft o' and rollers o, connected to said shaft, said weight drawing down the arms o^3 and causing the pitman o^5 to be pushed toward the cam o^6. The cam o^6 and its aforesaid connections with the shaft o' cause the said shaft to be alternately raised and lowered, and in order to guide the shaft o' in its vertical movement and allow the same to receive positive rotary motion said shaft is connected at its ends to arms p p, which are of even lengths and are pivoted to the sides of the frame at points axially in line with the short shaft 8, on which the sprocket-wheel 5 and pinion 1 are mounted, said shaft, in fact, forming the pivotal support of one of the arms p, and thus the vertically-moving shaft o' is caused to travel in an arc concentric to the shaft 8. A gear-wheel 9, attached to the short shaft 8, meshes with a smaller pinion 10, attached to the shaft o', which latter is thus rotated at a greater speed than shaft 8.

The drop-rollers o are provided with soft-rubber faces on their peripheries, while the subjacent rollers m' have hard and smooth peripheral faces. The latter rollers merely serve to support the paper brought onto the top of them by the paper feeding and separating pads f^2 and thence propelled from the feeding-machine by the geared rubber-faced upper rollers o o.

Referring to Figs. 1 and 4 it will be observed that I provide two sets of feeding-off and separating devices and controlling devices arranged transversely of the machine and that each pair of feeding and separating fingers f f' is arranged directly behind or in line with one of the electric controlling devices, each of said devices comprising electric terminals k k'. This arrangement is of great importance, as it effectively squares and registers the front edge of the sheet in the following manner: When the sheet moves forward under the action of the two sets of feeding and separating fingers, both supported from the same feeder-carriage, the forward edge of the sheet will in many cases start forward at a slight angle to the forward edge of the pile, on account of the unavoidable unevenness of the pile of sheets, and this will bring one part of the forward edge of the sheet into registered position before the other, causing one of the electric controlling devices to be actuated before the other. As soon as the first electric controlling device is actuated the feeding and separating fingers in rear of and controlled by said device will be disengaged from the sheet, while the other set of feeding and separating fingers will continue in operation until the point of the forward edge of the sheet directly in front of said other set of devices reaches registered position and actuates the second electric controlling device, which will throw said other set of feeding

and separating fingers out of operation. The two sets of feeding and separating fingers being independently controlled it will be clear that the sheet will be accurately squared and registered. If the sheet starts forward squarely, it will of course be understood that the two sets of feeding and separating devices will be thrown out of operation at the same time.

In connection with the described paper-feeding devices I prefer to employ suitable means for automatically loosening the top sheet from the next underlying sheet preparatory to being pushed forward from the pile by the aforesaid feeding devices. Said loosening of the sheet is effected by buckling the rear portion thereof with mechanisms of various forms. Such buckling mechanisms, in combination with feeding off and separating mechanisms and the peculiar construction of said mechanisms disclosed, constitute parts of my present invention. I will now describe this part of my machine.

To the frame A, near one side thereof, is attached a bracket E^2, on which is mounted a guide F^2, disposed at right angles to the line of feeding. In this guide is a sliding bracket F^3, from the top of which rises a post U′, to the upper end of which is pivoted the paper-buckling finger U^2, which extends part way toward the center of the machine a sufficient distance to allow the free end of said finger to bear on top of the pile of paper, as illustrated in Figs. 11 to 14 of the drawings. Said end of the finger has affixed to it a suitable friction-pad p', usually composed of soft rubber. To the side of the post is pivoted a three-armed lever p^2, two arms of which extend in opposite directions from the pivot and in lines parallel with the fingers U^2 and are shaped so as to cause them to bear alternately on the top of the sliding bracket F^3 when oscillatory motion is imparted to said lever. One arm of this lever is under the buckling-finger U^2 and has connected to it an upwardly-extending rod p^3, which passes through an eye in said finger and has connected to it a collar p^4, by which it lifts the finger when said lever-arm is lifted by the oscillation of the lever. This oscillatory motion is imparted to the lever by means of a rod q, connected at one end to the third arm of the lever and connected at the opposite end to the free end of a rock-arm q', fastened to a horizontal shaft q^2, which is mounted in bearings on the side of the frame A and receives a rocking motion by means of a crank r, attached to said shaft and having connected to its free end a pitman r', extending upward therefrom and bifurcated at its upper end to straddle the shaft D^2, so as to be guided thereby in its vertical movements. To the shaft D^2 is fastened a cam r^3, against which is made to bear a roller r^4, pivoted to said pitman. Said roller is held in contact with the cam by means of a rod s, attached at one end to an arm s', attached to the shaft q^2, and sliding with its opposite end in an eye attached to the frame A. A spiral spring s^2, surrounding said rod and bearing at one end on top of the aforesaid eye and at the opposite end on a collar s^3, attached to the rod, forces the latter upward. To the guide F^2 is pivoted a plate t, which is parallel with the buckling-finger U^2 and extends toward the free end thereof and terminates with a thin edge beveled from the top down and disposed in a line parallel with the line of feeding. This plate receives a downward pressure by means of a spring t', attached at one end to the guide F^2 and bearing with its free end upon the top of the said plate. A stop or lug t^2, projecting from the guide F^2, limits the downward movement of the plate t, so as to maintain the plate attached to the guide when the buckling device is detached from the machine or the table B is lowered to receive a fresh supply of paper. Another lug t^3 is attached to the slide F^3 and extends under the spring t', so as to lift the same during the forward or inward movement of the slide F^3, and thus release the paper from the pressure imparted to the plate t by said spring. A set-screw U is connected to the guide F^2 and bears with its inner end on the slide F^3 to subject the latter to a certain degree of friction for the purpose presently described. Said set-screw is adjustable to vary the degree of friction as may be desired. Said paper-buckling devices operate as follows: The reciprocating rod q first tilts the three-armed lever p^2, so as to cause it to lift the buckling-finger U^2 by means of the rod p^2, which effect is due to the hereinbefore-described friction imparted to the slide and causes the movement of the aforesaid rod to be transmitted to the lever. The further movement of the rock-arm in the same direction then draws the slide F^3 back, and in this movement the lug t^3 allows the spring t' to press the holding-down plate t down upon the top of the pile of paper. The succeeding reverse movement of the rod q tilts the three-armed lever p^2, so as to allow the buckling-finger U^2 to move into engagement with and press onto the top sheet of the pile of paper and then pushes the slide F^3 forward, while the said finger is made to bear with some force on the top sheet by means of a spring x on the protruding upper end of the rod p^3. During this latter movement the lug t^3 lifts the spring t', so as to relieve the plate t from the pressure of the spring t' and allow the buckling-finger U^2 to draw the underlying portion of the top sheet from under the plate t, and in this operation the paper becomes buckled directly in front of the finger U^2 and is thus loosened from the next underlying sheet. In the next movement of the rock-arm q' the buckling-finger U^2 is lifted from the paper and the released portion of the paper springs back and slips upon the top of the holding-down plate t, which serves to maintain the top sheet in its

said loosened condition while the feeding devices draw the said sheet forward to the delivery end of the machine.

My invention also pertains to the means for automatically raising the paper-supporting table B, so as to maintain the top of the pile of paper in a proper plane for feeding the successive top sheets therefrom. This part of my invention is clearly shown in Fig. 3 of the drawings, in which I′ represents one of the two table-lifting screws, which are journaled upright on the sides of the frame A and work in nuts I^2, attached to the table B. Each of said screws has affixed to its lower end a worm-gear u', which engages a corresponding gear u^2 on a horizontal shaft u^3, extending across the base of the machine and journaled in suitable bearings on the sides of the main frame A. To one end of the shaft u^3 is attached a miter-gear v, which meshes with a corresponding gear v', attached to a vertical shaft v^2, supported in bearings on the frame A and having affixed to it a ratchet-wheel w and also provided with a hand-crank w', which latter is required for turning the shaft in a direction to impart the requisite movement to the two screws I′ to lower the table B when required. The purpose of the ratchet-wheel w is to automatically raise said table, and to effect this I employ a reciprocating bar J, disposed at right angles to the shaft v^2 and having connected to it a pawl J′, engaging said ratchet-wheel. The bar J is pushed in one direction by means of a spring J^2 and is moved in the opposite direction by the longitudinal movement of the carriage C′ C^2 C^3, which has an arm K projecting from it and extending across the bar J back of a lug or pin K′, which is supported on said bar movably to and from the path of the arm K by means of a bell-crank K^2, pivoted to the under side of the bar and having secured to one of its arms the lug or pin K′, which passes up through an aperture in the bar. A spring K^3 supports said arm of the bell-crank to cause the lug or pin to normally project above the bar and come in contact with the arm K during the forward movement of the carriage, whereby the bar is pushed forward and the pawl J′ is caused to impart a partial rotation to the ratchet-wheel w, which motion is transmitted to the screws I′, which raise the table B. In order to automatically control this action, I employ an electromagnet L in a circuit derived from a battery L′, and to the second arm of the bell-crank K^2, I attach the armature L^2. Said magnet is arranged in such position in relation to the bell-crank that the attraction of the armature tilts the bell-crank, so as to withdraw the lug or pin K′ from the path of the carriage-arm K, and thus prevent the bar J from being moved with the carriage and from disturbing the table-lifting screws I′.

For controlling the action of the magnet L I employ a circuit controller or maker and breaker, actuated by the variations in the heights of the pile of paper on the table B. Said circuit-controller consists of a wire or suitable light metallic rod N, pivoted intermediate its length to a bracket N′, attached to a cross-bar on the rear end of the frame A. One end of said wire or rod rests constantly on top of the pile of paper, and the opposite end of the wire or rod constitutes one of the electric terminals O, directly under which is the other terminal O′. Wires 10 and 11 connect the magnet L, respectively, with the terminal O and battery L′, and another wire 12 leads from the battery to the terminal O′. The operation of said circuit-controller is as follows: So long as the top of the pile of paper is within the plane of feeding the rod N is sustained in a position to close the circuit, and thus the armature L^2 is attracted and the bell-crank K^2 is caused to withdraw the lug or pin K′ from the path of the carriage-arm K, so as to leave the table-lifting screws I′ at rest; but as soon as a sufficient number of sheets have been fed from the pile to bring the top thereof beneath the plane of feeding, the inner end of the lever N has descended sufficient to throw the opposite end or terminal out of contact with the terminal O′. This breaking of the circuit causes the magnet to release the armature K^2 and allows the spring K^3 to draw up the long arm of the bell-crank K^2, which thereby pushes the lug or pin K′ into the path of the carriage-arm K and causes the same to push the bar J forward, in which movement the pawl J′ turns the ratchet-wheel w and causes the shaft v^2 to transmit a partial rotation to the screws I′, which elevate the table B until the top of the pile of paper is again brought within the plane of feeding, when the aforesaid operation is repeated. A set-screw R is adjustably connected to the bell-crank K^2, so as to come in contact with the under side of the bar J and limit the movement of the bell-crank to prevent the armature from going too far from the magnet.

By the expression used in the specification and claims "feeding devices having a normally-active frictional engagement with the sheets on their forward stroke" I mean to cover such feeding instruments which take a positive frictional hold upon the surface of the top sheet of the pile on their forward stroke to cause the single sheet to move positively forward with the feeding instruments the whole distance of their stroke while in engagement, as distinguished from combing devices which do not have a positive frictional hold upon the sheets, but slip or slide over the surface of the top sheet and move a number of sheets. I am aware that it has been proposed to control the operation of such combing devices by automatic mechanism regulated by the position of the sheets being fed from the machine, and I do not claim such a mechanism. I do, however, claim to be the first to provide means operated by the sheets of paper for automatically controlling the operation of true frictional feeding instruments which positively engage

and move the sheets singly, and I claim this structure broadly.

I claim the specific structure of the automatically-controlled feeding-off devices in addition to the broad feature of automatically-controlled true frictional feeders under the control of mechanism operated by passing sheets; but I would have it understood that the structure of said feeding-off mechanism is subject to the claims in an application filed by me July 13, 1894, Serial No. 517,396, for improvements in paper-feeding machines, in which application I have claimed the combination of means for moving the top sheet of a pile, mechanism for operating the sheet-moving means, a tripper suspended in the path of the top sheet and adapted to be operated thereby, a rack carried by the sheet-moving means, and a device controlled by the tripper adapted to engage the rack and arrest the operation of the sheet-moving means. In said application Serial No. 517,396 I have also claimed the combination, with means for advancing the top sheet, of a pile, including a sheet-shifting instrument, suitable driving mechanism for the advancing means, a yielding connection between said sheet-advancing means and the driving mechanism, and a tripper controlled by the advanced sheet adapted to arrest the operation of the advancing instrument.

In Patent No. 605,089, granted to me June 7, 1898, for improvements in paper-feeding machines I have claimed, broadly, a novel form of automatically-controlled feeding devices which are rendered inoperative or inactive independently of their normal stroke and elevation from the surface of the paper, whether or not they are constructed to move out of and into contact with the paper at the ends of their stroke, the preferred form of such devices comprising a feed-finger carrying a rotatable friction-feed roll held against rotation by an automatic device for feeding and automatically allowed to rotate freely over the surface of the sheet when the sheet comes into registered position. My present case is more comprehensive than said Patent No. 605,089 in this particular and is distinguishable from said case in that my present claims cover any and all forms of true frictional feeding instruments when combined and automatically controlled as specified in the several combinations recited.

In another application filed by me December 28, 1896, serially numbered 617,263, for improvements in paper-feeding machines I have claimed the combination of the separator-beds at the delivery end of the machine, separator-pads operating solely as a separator above said beds, and auxiliary independently-controlled feeding instruments operating upon the pile of sheets to the rear of the separator-pads and alternately therewith, whereby the sheets are fed from the pile to the separator-beds and afterward engaged by the separator-pads to separate them from any chance underlying sheets and feed them from the machine. My present application is distinguishable from said application Serial No. 617,263 in that the separator-pad and auxiliary feeding instrument are operated synchronously or simultaneously to be brought into contact with the sheet and moved forward under the control of a single-operating mechanism.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In a paper-feeding machine, the combination of a support for a pile of sheets, suitable sheet-buckling mechanism for effecting a preliminary separation of the sheets, suitable sheet-advancing means for feeding the successive sheets from the pile, and a sheet-separator at the delivery end of the machine comprising a lower separator-bed and an upper feeding and separating member adapted to separate the top sheet from any chance underlying sheet, substantially as and for the purpose set forth.

2. A paper-feeding machine, comprising suitable sheet-buckling devices operating upon the pile to effect a preliminary separation of the top sheets, a sheet-separating bed at the delivery end of the machine, a feeding-pad operating upon the front portion of the sheet of paper over the aforesaid bed to separate the top sheet from any chance underlying sheet, and an auxiliary pad to the rear of said front pad and moving in unison therewith to promote the travel of the top sheet, substantially as set forth.

3. In a paper-feeding machine, the combination of a support for a pile of sheets, a sheet-buckling mechanism for effecting a preliminary separation of the sheets, two sets of sheet-advancing devices arranged transversely of the machine, means controlled by the sheet for throwing said sheet-advancing devices out of operation independently, and a separator at the delivery end of the machine comprising a sheet-separating bed and a separating and feeding pad, substantially as and for the purpose set forth.

4. In a machine for feeding sheets of paper from a pile, the combination of a support for a pile of sheets, suitable sheet-buckling mechanism for effecting a preliminary separation of the sheets, a separator at the delivery end of the machine comprising a sheet-separating bed and a separating-pad operating over the bed, and a resiliently-supported sheet-advancing instrument adapted to feed the sheets from the pile to the separator-bed, substantially as and for the purposes set forth.

5. A paper-feeding machine comprising suitable sheet-buckling devices for effecting a preliminary separation of the sheets, a sheet-separating bed at the delivery end of the machine, a feeding-carriage supporting a main feeding and separating pad in operative relation with said separating-bed, and an

auxiliary frictional feeding instrument yieldingly supported upon the feeding-carriage to the rear of said main pad, means for moving the main pad and auxiliary instrument into operative relation with the pile simultaneously, and means for operating the feeder-carriage, substantially as set forth.

6. In a paper-feeding machine, the combination of sheet-buckling mechanism operating upon the rear portion of the pile of paper to be fed, sheet-retarding beds at the delivery end of the machine, feeding-pads operated upon the top of the front portion of the aforesaid pile and over the retarding-beds to carry the top sheet onto the same, auxiliary feeding-pads operating upon the pile of paper at the rear of the aforesaid front pad to promote the travel of the sheet, and sheet-delivery mechanisms removing said advanced sheet from the retarding-bed, as set forth.

7. A paper-feeding machine comprising friction-pads disposed one back of the other with a space between them and movable in unison longitudinally and vertically to and from the plane of feeding, and a longitudinally-movable bed at the delivery end of the machine receiving the front pad over it and mechanism actuating said bed to move it slower than the forward motion of the pad to thereby separate the sheets in transit, as set forth.

8. In a paper-feeding machine, the combination of sheet-buckling devices over the rear end of the pile of paper, a plurality of sets of feeding-pads moving synchronously longitudinally and to and from the plane of feeding, the pads of each set being arranged one to the rear of another, sheet-separating beds at the delivery end of the machine receiving over them the sheet and the front pads of the aforesaid sets, and sheet-propellers receiving the advanced sheet and removing the same from the machine, as set forth.

9. In combination with a friction-pad advancing the top sheet from the pile, an endless belt disposed longitudinally at the delivery end of the machine and in position to receive the aforesaid pad over it, and a longitudinally-arched plate under the upper run of said belt to support the same correspondingly arched, as set forth and shown.

10. In combination with a friction-pad advancing the top sheet from the pile, an endless belt disposed longitudinally at the delivery end of the machine and in position to receive the aforesaid pad over it, a longitudinally-arched plate supporting the upper run of the belt correspondingly arched, and mechanism imparting to said belt a longitudinal movement slower than that of the pad, as set forth.

11. In a paper-feeding machine, the combination of a longitudinally-reciprocating carriage, a bracket mounted movable longitudinally on said carriage, a spring forcing said bracket forward, spring-pressed paper-feeding arms pivoted to said bracket and extending in opposite directions therefrom and in a line parallel with the line of feeding, friction-pads attached to the free ends of said arms, a longitudinal ratchet on the aforesaid bracket, a dog movable to and from engagement with said ratchet, a sheet-actuated device controlling the dog, and a tripper on the carriage thrown into operation by the arrest of the movement of the carriage and adapted to lift the paper-feeding arms out of engagement with the sheet, substantially as set forth.

12. In a paper-feeding machine, the combination of a longitudinally-reciprocating carriage, a bracket mounted movable longitudinally on said carriage, a spring forcing said bracket forward, spring-pressed paper-feeding arms pivoted to said bracket and extending in opposite directions therefrom and in a line parallel with the line of feeding, friction-pads attached to the free ends of said arms, a longitudinal ratchet on the aforesaid bracket, a dog movable to and from engagement with said ratchet, a sheet-actuated device controlling the dog, a tripper on the carriage lifting the aforesaid paper-feeding arms during the movement of the carriage after the engagement of the dog, a latch retaining said arms in elevated position during the rearward movement of the carriage, and means for disengaging the latch, substantially as set forth.

13. In a paper-feeding machine, the combination of a longitudinally-reciprocating carriage, a bracket mounted movable longitudinally on said carriage, a spring forcing said bracket forward, spring-pressed paper-feeding arms pivoted to said bracket and extending in opposite directions therefrom and in a line parallel with the line of feeding, friction-pads attached to the free ends of said arms, a longitudinal ratchet on the aforesaid bracket, a dog movable to and from engagement with said ratchet, an electromagnet holding said dog out of engagement, a circuit-controller at the delivery end of the machine and actuated to break the circuit by the sheet in transit from the machine and thereby causing the aforesaid dog to engage the ratchet, a tripper on the carriage lifting the aforesaid paper-feeding arms during the movement of the carriage after the engagement of the aforesaid dog, a latch retaining said arms in their elevated position during the rearward movement of the carriage, and a rocking finger timed to throw the latch out of engagement at the rearmost position of the carriage, as set forth.

14. In a paper-feeding machine, the combination with a sheet-separating bed at the delivery end of the machine, a carriage reciprocating toward and from said bed, a bracket mounted on said carriage, a bar connected to said carriage and adjustable longitudinally thereon, paper-feeding arms pivoted to said bar and provided at their free ends with friction-pads and traveling with the foremost of said pads over the separating-bed, and mechanisms moving the said arms toward and from the plane of feeding, respectively, at the ex-

treme rear and front positions of the carriage, as set forth.

15. In combination with the paper-feeding pads advancing the top sheet from the pile, and a sheet-separating bed at the delivery end of the machine receiving the front pad over it, paper-supporting rollers at said end of the machine, drop-rollers over said supporting-rollers, a shaft carrying said drop-rollers, a gear-wheel journaled to the side of the machine, arms carrying said shaft at opposite sides of the machine and pivoted to swing in arcs concentric to the axis of the aforesaid gear-wheel, a pinion attached to the end of the roller-carrying shaft and meshing with said gear-wheel, and mechanism intermittently lifting the drop-rollers, as set forth.

16. In combination with the paper-feeding devices, a sheet-buckler consisting of a guide secured to the main frame of the machine and disposed in a line at right angles to the line of feeding, a slide riding on said guide, a paper-buckling finger pivoted to said slide, a lever pivoted to the slide and having two arms bearing alternately on the slide in the inward and outward movement of the latter, a buckling-finger lifter actuated during the outward movement of the slide and dropping said finger during the inward movement of the slide, a vertically-movable plate pivoted to the guide and having its free end immediately back of the buckling-finger to receive upon it the recoiling buckled portion of the sheet, a spring depressing said plate, and a lug on the slide releasing said plate from the pressure of the spring during the forward movement of said slide, as set forth.

17. In combination with the guide disposed at right angles to the line of feeding, a slide riding on said guide, a paper-buckling finger pivoted to the slide, a three-armed lever pivoted to the slide and having two of its arms extending, respectively, forward and rearward from the pivot and in lines parallel with the buckling-finger, said arms having a limited vertical play between their free ends and top of the slide, a rod attached to the forward arm to lift the buckling-finger with the lifting of said arm, a plate pivoted to the guide and having its free end over the paper back of the buckling-finger, a spring depressing said plate, a lug on the slide releasing the plate from the pressure of the spring during the forward movement of the slide, a pitman connected to the third arm of the aforesaid lever, and mechanism imparting reciprocating motion to said pitman, as set forth.

18. In combination with the slide and paper-buckling devices connected thereto, a rock-shaft having a plurality of arms projecting from it, a spring-actuated rod connected to one of said arms and turning the same in one direction, a pitman connected to another of said arms for turning the same in the opposite direction, a rotary cam, a roller on the pitman bearing on said cam, and a pitman connected to another of the aforesaid arms for transmitting motion to the slide, as set forth and shown.

19. In combination with the vertically-movable table, and screws and nuts for raising said table, gears on said screws, a shaft extending across the machine and having fastened to it gears meshing with the gears of the screws, a miter-gear on one end of said transverse shaft, a vertical shaft on the side of the main frame, a miter-gear on said shaft meshing with the corresponding gear on the transverse shaft, a ratchet-wheel attached to the vertical shaft, a longitudinally-movable bar at right angles to the vertical shaft, a pawl on said bar engaging the ratchet-wheel, a spring moving said bar in one direction, a longitudinally-reciprocating carriage, an arm on said carriage extending across the bar, a bell-crank pivoted to the bar, a pin on one arm of said bell-crank sliding vertically in the bar and to and from the path of the carriage-arm, a spring supporting said bell-crank arm, an armature attached to the other arm of said bell-crank, an electromagnet facing said armature, and a circuit maker and breaker actuated by the variations in the height of the pile of paper, as set forth.

20. In a paper-feeding machine, the feeding devices proper, consisting of arms disposed in a line parallel with the line of feeding and moved back and forth on said line and falling and rising to and from the top of the pile of paper, and in said vertical movements slightly approaching and receding from each other, as set forth.

21. In combination with the sheet-buckling devices operating upon the rear portion of the pile of paper, a secondary sheet-buckling mechanism, consisting of feeding-pads rising and falling from and to the top of the pile of paper, and in said vertical movements, slightly approaching and receding from each other, and sheet-separating mechanisms at the delivery end of the machine, as set forth.

In testimony whereof I have hereunto signed my name this 28th day of May, 1896.

TALBOT C. DEXTER. [L. S.]

Witnesses:
TOWNSEND JONES,
V. E. MARSH.