(No Model.) 2 Sheets—Sheet 1.

R. SMITH.

PNEUMATIC DEVICE FOR LEADING PAPER THROUGH CALENDER ROLLS.

No. 327,031. Patented Sept. 29, 1885.

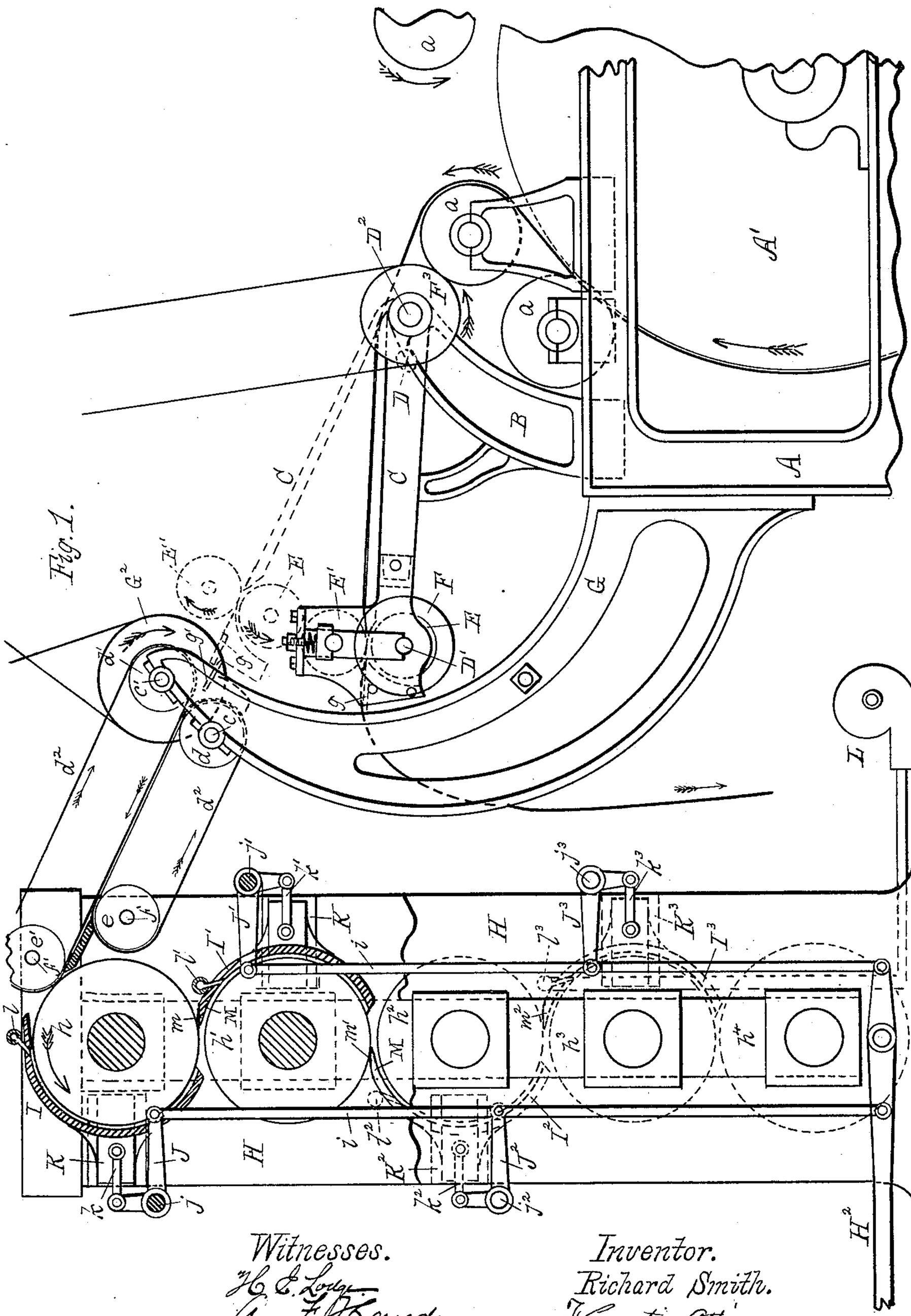

Fig. 1.

Witnesses.
H. C. Longa
A. F. Boyden.

Inventor.
Richard Smith.
F. Curtis. Atty.

(No Model.) 2 Sheets—Sheet 2.

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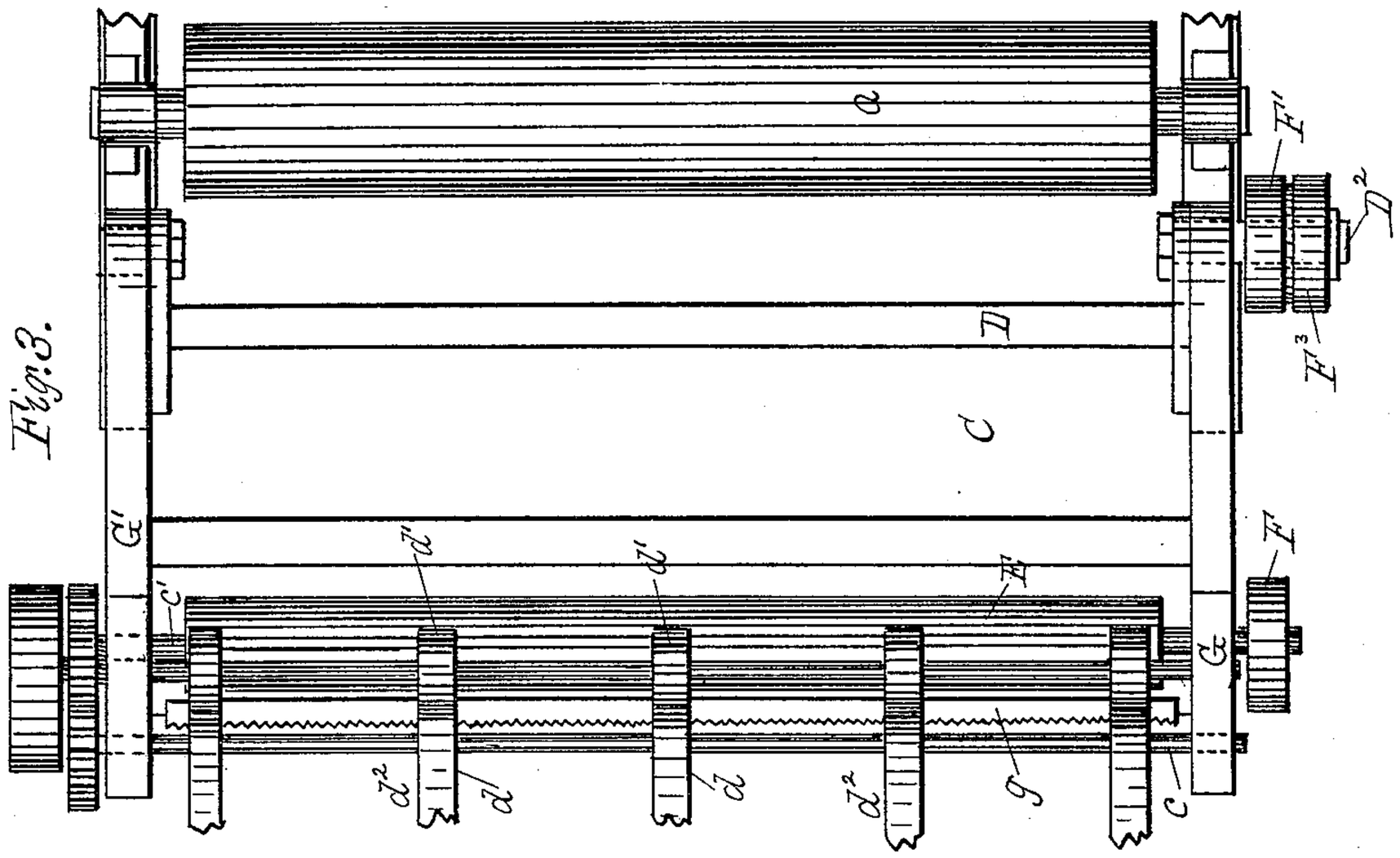


Fig. 3.

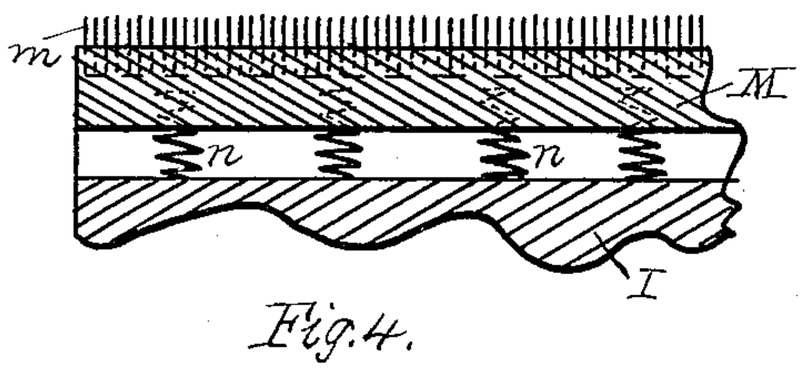


Fig. 4.

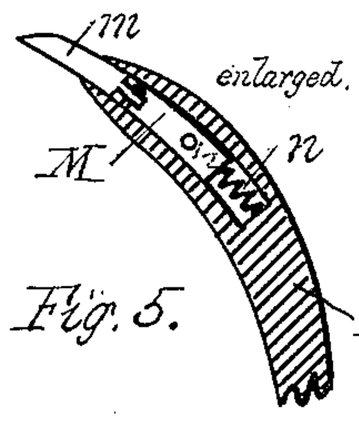


Fig. 5.

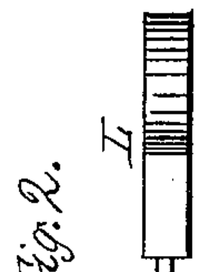
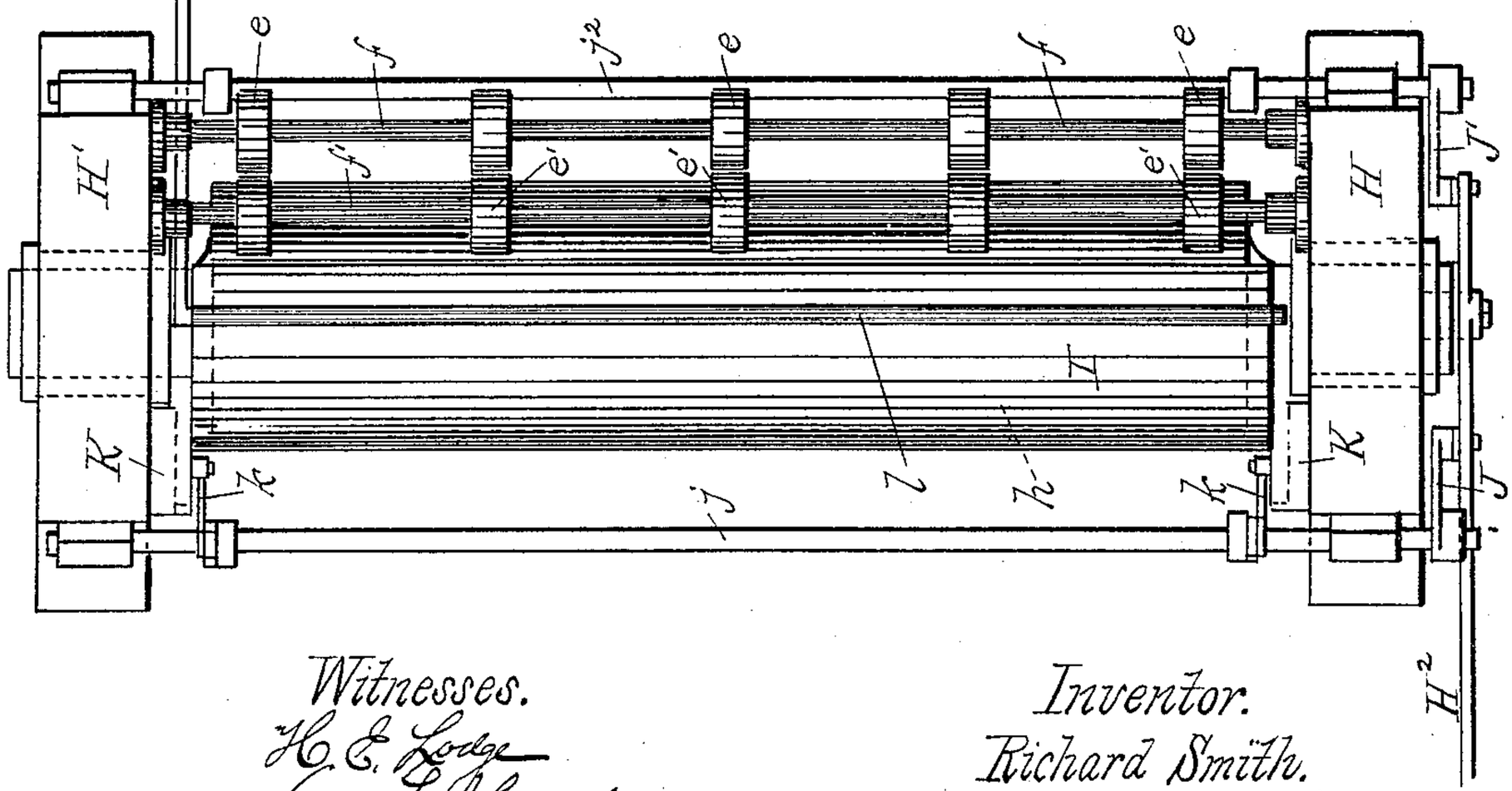


Fig. 2.



Witnesses.
H. E. Lodge
A. F. Hayden.

Inventor.
Richard Smith.
F. Curtis. Atty.

UNITED STATES PATENT OFFICE.

RICHARD SMITH, OF SHERBROOKE, QUEBEC, CANADA, ASSIGNOR OF ONE-HALF TO THE FALL MOUNTAIN PAPER COMPANY, CF BELLOWS FALLS, VERMONT.

PNEUMATIC DEVICE FOR LEADING PAPER THROUGH CALENDER-ROLLS.

SPECIFICATION forming part of Letters Patent No. 327,031, dated September 29, 1885.

Application filed December 26, 1884. (No model.)

To all whom it may concern:

Be it known that I, RICHARD SMITH, a citizen of the Dominion of Canada, residing at Sherbrooke, in the county of Sherbrooke and Province of Quebec, have invented certain new and useful Improvements in Pneumatic Devices for Leading Paper Through Calender-Rolls; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to means whereby a continuous rapidly-traveling paper web may be automatically induced to pass between and around the "calender-rolls," so called, and thus in its passage to receive a smooth and finished surface, and is thereby adapted for general commercial purposes.

Hitherto in the process of calendering the paper web, as it passes continuously from the driers of the machine, has been conducted and guided through the stack of calender-rolls by the fingers of the machine-tender, and serious accidents are continually occurring, in which the fingers of the operator get jammed and terribly bruised and the danger multiplied, since the paper web has to be restored every time its continuity is interrupted for any cause whatsoever. Moreover, in the process of "mending up" a large amount of "broken" is produced, because the draft and tension across the paper web is not uniform, and folds or wrinkles are caused, which at once make a crack or break in the paper, and these continue until said tension is properly restored, the paper during this interval being rendered useless for commercial purposes.

To overcome these objections, and to render the waste of the paper less and make the effort of mending-up not so laborious to the operative, and reduce the danger to a minimum, I have constructed the following improvements, which embody the subject of my invention: First, in the employment, in combination with a series of wind cases or shields alternately arranged and disposed over one-half the periphery of each roll, of a current of air, steam, or gas (either pressure or suction) to guide the paper web through the stack; secondly, in the use of spring-actuated "doctors," so called, to prevent the web from winding up around a roll in lieu of advancing down over the surface of the next adjacent lower roll; and, thirdly, in the employment of a pair of swift-running draft-rolls disposed upon the free end of a swinging table or carriage, whereby the slack is taken up and proper tension produced upon the paper web prior to its introduction round and through the rolls forming the calender-stack, all of which arrangements and construction I will proceed to fully and completely describe.

In the drawings accompanying this specification, I have shown in Figure 1 a side elevation of my invention arranged as a whole and fitted upon the calender-roll stack and drier-frame, the two upper rolls being in section. Figs. 2 and 3 represent a plan of the apparatus; and Fig. 4 a longitudinal and Fig. 5 a transverse section, both enlarged, of one of the "doctors," so called.

In these drawings I have shown a portion of the drier-frame of a paper-machine at A, with one of the driers at A′, and with the paper rolls *a a* mounted thereon. Suitably disposed in the standards B B′, bolted to the sides of the drier-frame, is the swinging table C, the pivot of which is the shaft D, extending across the machine, while a corresponding shaft, D′, is similarly disposed upon the free or swinging end of said table in proper bearings. This latter shaft supports and carries a draft-roller, E, which co-operates with a like roll, E′, spring-actuated, in order to produce friction between the two rolls, and consequent requisite tension upon the paper web. This tension is to be increased or diminished according to the thickness of the web in process of manufacture. The top surface of this table is of wood, properly smoothed and bolted to the side frames, to stiffen the table and at the same time give it the requisite lightness.

In order to actuate the draft-rolls E E′, I

have attached to the ends of the shafts D′ D² driving-pulleys F F′, suitably bolted, of which the latter, F′, is the driver, while motive power is furnished by a second belt and pulley, F³, connected thereto.

Between the calender-stack and the end of the drier-frame I have mounted two curved arms or housings, G G′, which support parallel shafts *c c′*, carrying a series of rolls, *d d d′ d′*, respectively, while running over these latter is a series of endless belts or tapes, *d² d²*, similar to those used in printing-presses, which extend around a second series of rolls, *e e′*, of the same diameter as *c c′*, the rolls *e e′* being mounted upon their shafts *f f′*, and are driven by the driving-pulley G², and at the same speed as the first series.

When the swinging table C is moved upward, it is evident that some quick and ready means must be adopted by which to sever the continuously-traveling paper web just prior to its alignment with the adjacent faces of the endless belts *d² d²* before entering between them. To accomplish this object I have secured a saw-toothed plate or cutter, *g*, upon the extreme outer or swinging end of the table C, and a fixed or immovable corresponding one at *g′* between the housings F F′. The teeth of these plates interlock, and at the instant the plate *g* has passed by the fixed cutter *g′* the paper is severed without being stopped, and is free to continue its rapid passage, supported between the endless belts *d² d²*, which carry it to the stack of calender-rolls.

When the paper web is traveling continuously and without interruption, the table remains in its normal or raised position, as shown by the dotted lines in Fig. 1, and is locked to the standards F F′ by any well-known mechanical device, as a spring catch or bolt, while the tension or pull of the rolls E E′ may be removed entirely by means of a lever or other equivalent which will nullify the tension of the springs until the web again breaks, when their employment will be necessary.

The side standards or housings supporting the calender-rolls are shown at H H′, while the rolls are represented at *h h′ h² h³ h⁴*, suitably mounted and journaled in the usual adjustable boxes. Since I propose to use a blast of air or its equivalent (either suction or pressure) in order to guide the paper web automatically through and around the rolls, it becomes necessary to partially cover and protect a portion of the surface of the calendering-rolls in order to produce the desired effect, by confining the current of air, and thus oblige it to assume a certain direction, and carry with it the advance end of the paper web to be led between the rolls. I have therefore shown, as partially closing the exterior peripheries of said rolls, a series of alternately oppositely-disposed wind-cases, I I′ I², &c., which are plates bent preferably concentric with the curvature of the rolls and extending their entire length. Furthermore, I have rendered said cases adjustable with respect to the peripheries of the rolls—that is, they are made to advance toward or withdraw from said rolls, according as a blast of air is required to conduct the paper web when mending up. In order to accomplish this readily and operate the entire series at one movement, I have pivoted at the base of the front standard, H, a hand-lever, H², to which are attached two parallel upright connecting-rods, *i i′*, which operate similar oppositely-disposed bell-crank levers J J′ J², &c., pivoted upon supporting-rods *j j′ j² j³*, &c., while short arms or links *k k′ k²* are fastened to the wind-cases, the ends of which are secured and move within suitable guides, K K′, &c., attached to the standard H. Parts similar to all these are duplicated upon the rear standard, H′, in order to move both ends of said wind-cases the same amount and at the same instant, and thus maintain them equally distant at all times from the surface of the rolls.

In revolving bodies centripetal force always exerts a somewhat important function upon an object located upon its surface; hence, and more especially in paper-making machines, the paper web has a great tendency to adhere to the surface of the calender-rolls, and pass continuously around one roll in lieu of advancing on and around the next adjacent roll. This fact is especially noticeable in the manufacture of light-weight paper, and I have found it necessary to employ, in connection with the wind-cases above alluded to, a device called a "doctor." In this especial instance I have terminated the upper extremity of the wind-cases, which enter between two rolls in the shape of a straight steel bar or doctor, M, which is beveled to coincide, or approximately so, with the line of a tangent to the roll at the point where said doctor touches said roll, and I find that the most effective position is a point a short distance to one side of the place of contact between the two rolls where the exterior surface of the top roll first begins to assume an upward path of movement in its rotation; hence, when the paper after a break is to be mended up, the operator raises the lever and advances the wind-cases toward the rolls and in close proximity thereto, while their respective doctors are brought in close contact with the upwardly-moving surface of each roll, and thus any tendency which the paper web may have as it emerges from one side between two rolls to the other to pass up and wind around the top roll of the pair, is instantly checked by the doctor, which, as the curve of the latter coincides with the interior curve of the wind-case, it guides the paper along in its proper course down around the lower roll of said pair. The same action ensues as the paper web emerges from between the next two rolls and meets the next doctor, and so on down between the rolls composing the stack.

Mounted upon the wind-cases, with which they are suitably connected, I have disposed a series of pipes, *l l′ l²*, &c. The latter com-

municate with a blower, L, either exhaust or pressure, and from which the air is obtained as means for guiding and passing the paper web through the rolls. In the present instance I assume a pressure-current is applied and continuously passing in the direction of the path of movement of the paper web, and I have consequently perforated the pipes $l\ l'\ l^2$, &c., at any acute angle with the peripheries of the rolls, so as to more readily pass along and maintain the air-current in the same direction with the rotation of the roll.

The doctors M may be made simply as a prolongation of the wind-cases; but, since they remain in contact with the rolls every time the paper web is mended, it necessarily follows that rapid wear will ensue, and the hand-lever H^2 must accordingly be further actuated to bring said doctors into proper position. This, however, after much use, would bring the wind-cases too closely to the rolls; hence I propose, as shown in Figs. 3 and 4, spring-actuated doctors in which either a series of steel fingers, *m m*, &c., may be attached to a plate M, or a continuous steel plate or bar may be inserted within a recess formed in the wind-cases and actuated by springs *n n*, &c. By this device I can easily maintain the doctors in proper contact with the peripheries of the rolls, to compensate for the wear of the former, and thus actuate the lever H^2 always a fixed amount, just sufficient to bring the wind-cases in proper relation to the surface of the rolls.

The operation of this apparatus embodying my invention is as follows, with the various rolls and pulleys moving in the direction of the arrows, as indicated: The paper web has been interrupted and broken for some cause, and it must be restored; hence the operator drops the table C into a horizontal position and lifts the lever H^2 to bring the doctors to bear against the rolls $h\ h'\ h^2$, &c., and the wind-cases I I I^2 near to the surfaces of said rolls. The paper is then passed around the rolls *a a* and drier A′, thence over the table C between the quick-running rolls E E′, which exert sufficient tension upon the web commensurate with its strength, hence adjustable but not enough to break it. Immediately upon the proper restoration of the tension and removal of the slack consequent upon the mending up, the operator swings the table upward, the paper web meantime continuously passing along until the movable cutter *g* has engaged with and passed the fixed cutter *g′* upon the arms G G′. The paper web is then instantly severed, and the draft-rolls carry and feed it directly to the tapes $d^2\ d^2\ d^2$, whence it is conveyed to the entrance of the wind-case I in a line directly at right angles to the calendering-rolls—an important feature, since it obviates the loss of paper incidental to the ordinary method, where the paper web is introduced at an angle with the axis of rotation of the rolls. Upon the arrival of the advance end of the paper web in front of the wind-case the pressure from the air-current through the pipe *l* forces it quickly around the roll *h*, while the interior surface of said case maintains and guides it in a proper direction between the rolls *h* and *h′*. Immediately said web emerges from between the rolls, although in close contact and with a tendency to pass up and wind around the upper one, it at once encounters the doctor, which removes it therefrom and compels it to follow the curve of the wind-case I′, when the pressure from the air-current emerging from the pipe *l′* still further advances it, and so on through the rolls of the stack, when it may either be passed onward and led through in a similar manner by means of a second series of tapes $d^2\ d^2$, to a second stack, or be led to the reels, upon which it is temporarily stored.

I find a great advantage accrues by the operation of conducting paper through calender-rolls in the manner before premised—that is, the current of air in passing over the surface of the paper exercises a very decided influence in cooling the heated continuous paper web as it passes from the driers. Hitherto it has been customary to grind and finish the calender-rolls cold; hence after being mounted in proper position, and the heated web has passed through them for any length of time, the rolls become hot and expand, and the result is that the faces of the rolls do not coincide, since they were ground to fit when in cool position; and I further find that a special cold blast of air applied across the web prior to its entrance between the rolls of the stack and independent of the current inducing the progress of said web through the stack, accomplishes the cooling of the individual rolls to remain cold; hence there is no expansion, and the surfaces coincide exactly with the greatest degree of efficiency.

I claim—

1. A series of revolving rolls, over and between which passes a continuously-traveling paper web, in combination with mechanism which applies a current of air or its equivalent to said web in the direction of the path of travel of the latter, substantially as set forth.

2. In a paper-machine, the combination, with the driers and calenders, of a pair of quick-running draft-rolls, so arranged that the normal tension shall be restored to the continuous traveling paper web prior to its introduction between said calenders, substantially as and for purposes herein described.

3. In a paper-machine, the combination, with the quick-running draft-rolls, the swinging table, and the cutter or knife attached thereto, of the fixed cutter, whereby the continuously-traveling paper web may be severed without cessation of its movement, and thence conducted to the calendering-rolls, substantially as described.

4. The combination, with the driers and calender-rolls, of the swinging table, the quick-running draft-rolls, and the endless belts or tapes, by means of which the continuous trav-

eling paper web is conducted to the calenders in paths of movement at right angles to their axis of rotation, substantially for purposes set forth.

5. The combination, with a series of revolving rolls, of a series of alternately oppositely-disposed adjustable curved plates partially inclosing the peripheries of said rolls, all arranged and operating substantially as described.

6. The combination, with a revolving roll, of a shield or cover, bent concentric therewith and partially inclosing and adjustable with respect to its periphery, substantially as stated.

7. The combination, with a pair of rolls provided with and partially inclosed by bent shields, of a spring-actuated bar resting upon and in contact with the surface of the upper roll, substantially as and for purposes set forth.

8. The combination, with a roll, *h*, and wind-shield I, mounted in suitable guides, of the levers H^2 J and the connecting-rod *k*, by which adjustment of the shield is effected with respect to the periphery of the roll, substantially as stated.

9. The combination, with the revolving rolls *h h'*, &c., wind-cases I I', &c., of a guide or doctor, M, provided with the spring-actuated teeth *m m*, &c., substantially for the purposes set forth.

In testimony whereof I affix my signature in presence of two witnesses.

RICHARD SMITH.

Witnesses:
H. E. LODGE,
A. F. HAYDEN.