(No Model.) 3 Sheets—Sheet 1.

C. B. COTTRELL.

MECHANICAL MOVEMENT.

No. 471,786. Patented Mar. 29, 1892.

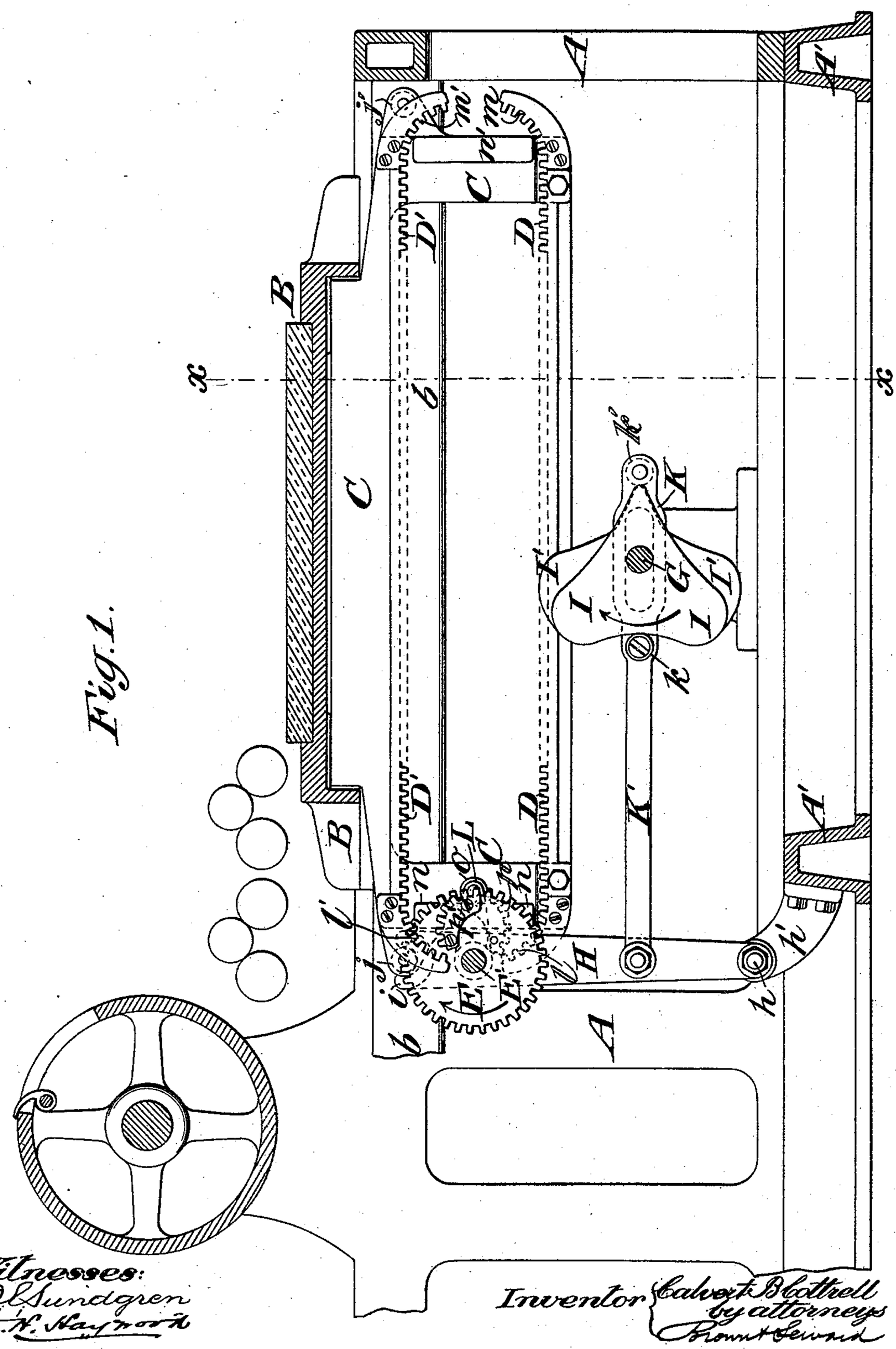

Fig. 1.

Witnesses:
C. L. Sundgren
S. F. Haywood

Inventor Calvert B. Cottrell
by attorneys
Brown & Seward

(No Model.) 3 Sheets—Sheet 2.

C. B. COTTRELL.

MECHANICAL MOVEMENT.

No. 471,786. Patented Mar. 29, 1892.

Fig. 3.

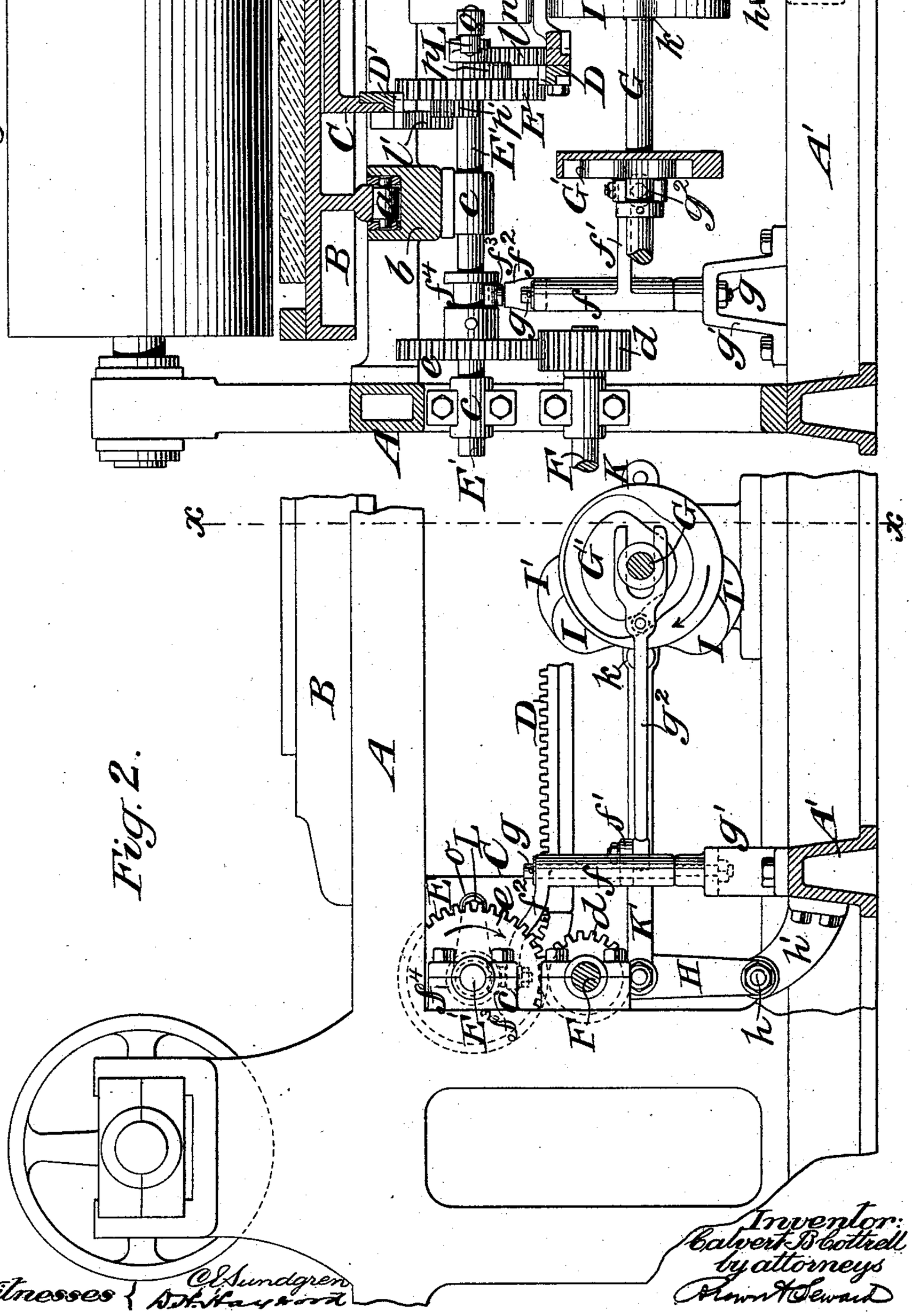

Fig. 2.

Witnesses { C. Sundgren / D. H. Hayward }

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C. B. COTTRELL.

MECHANICAL MOVEMENT.

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Fig. 6.

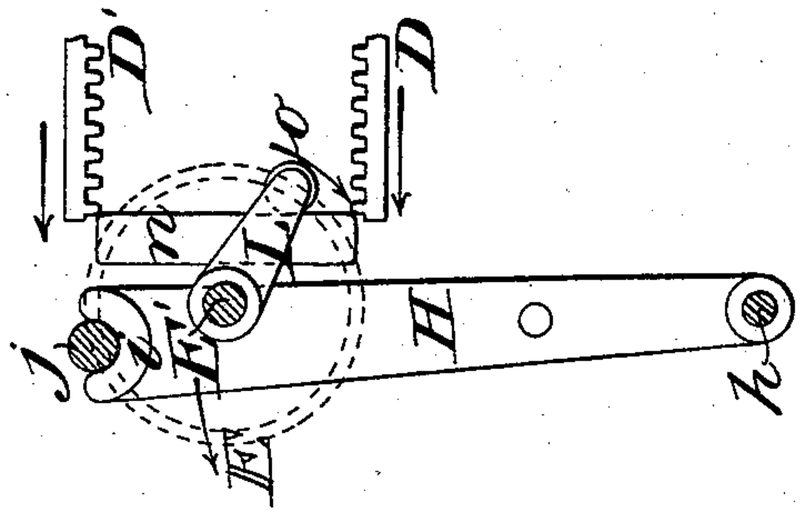


Fig. 10.

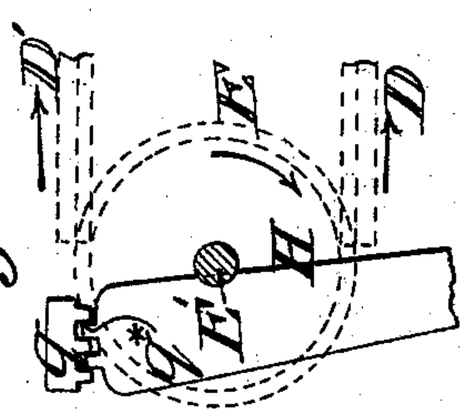


Fig. 5.

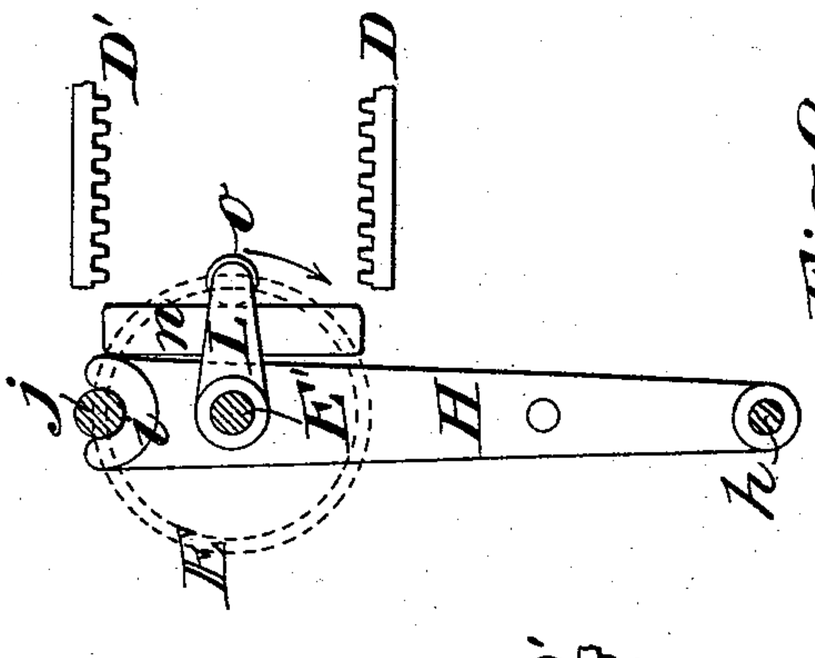


Fig. 9.

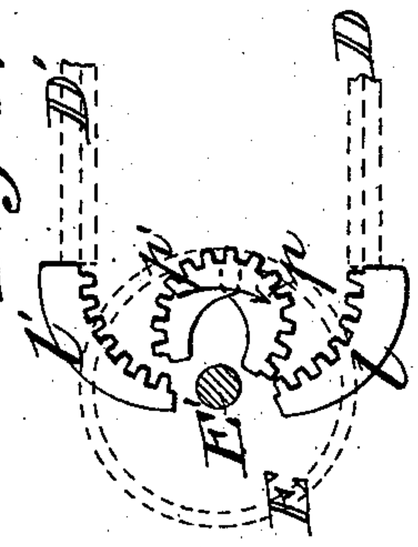


Fig. 4.

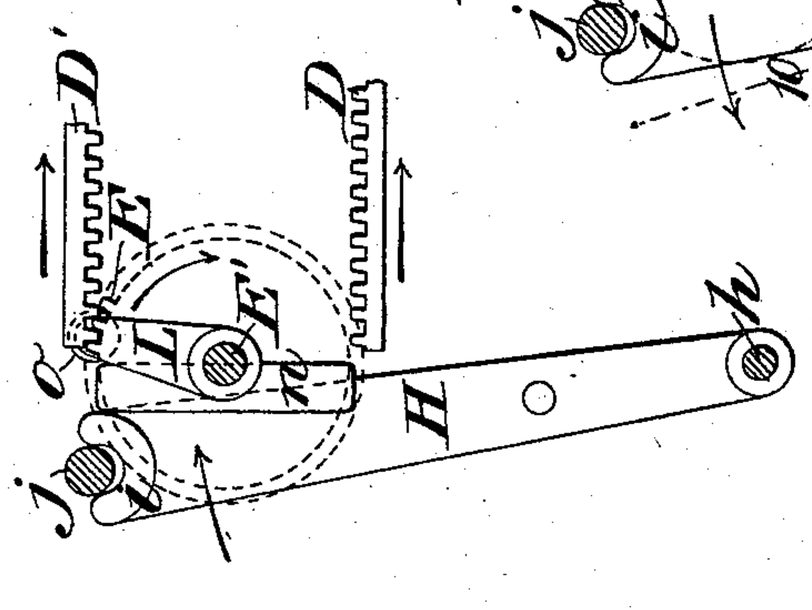


Fig. 7.

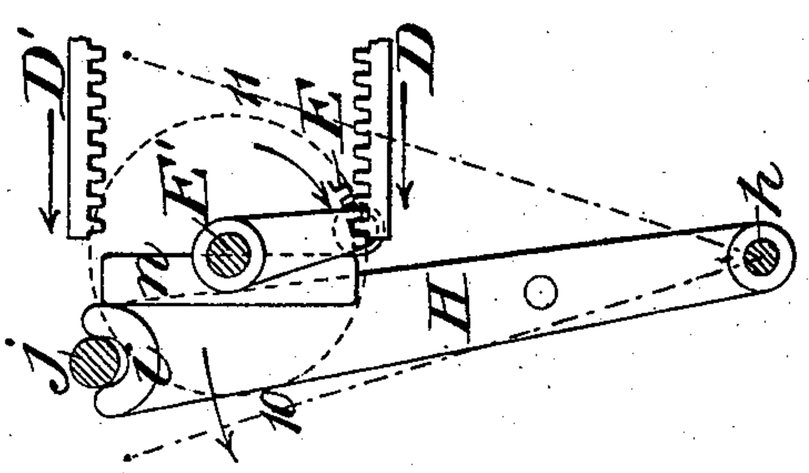
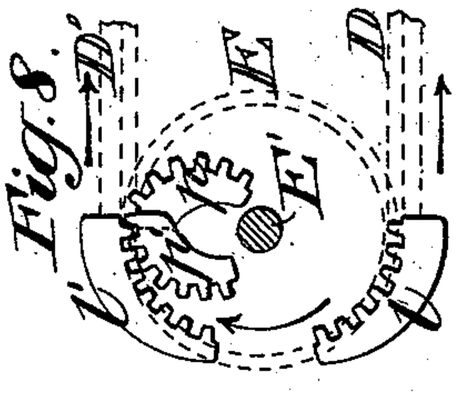


Fig. 8.



Witnesses:
C. L. Sundgren
D. F. Hayward

Inventor:
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UNITED STATES PATENT OFFICE.

CALVERT B. COTTRELL, OF WESTERLY, RHODE ISLAND.

MECHANICAL MOVEMENT.

SPECIFICATION forming part of Letters Patent No. 471,786, dated March 29, 1892.

Application filed January 22, 1892. Serial No. 418,873. (No model.)

To all whom it may concern:

Be it known that I, CALVERT B. COTTRELL, of Westerly, in the county of Washington and State of Rhode Island, have invented a new and useful Improvement in Mechanical Movements, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to mechanical movements through which rotary motion is converted into reciprocating rectilinear motion by a rotary pinion and two racks with which the said pinion is brought alternately into and out of gear.

The improvement consists in the combination, with such racks and pinion, of devices (hereinafter described and claimed) whereby the pinion is brought out of gear with either of the said racks and into gear with either one and whereby the racks and the reciprocating parts to which they are affixed are started very slowly and have their movement gradually accelerated at the commencement of their stroke in either direction and gradually retarded toward the end of each stroke.

The invention is applicable to various machines, but with particular advantage for the purpose of driving the reciprocating bed of a printing-machine, which purpose I have chosen for illustration in the accompanying drawings, in which—

Figure 1 represents a longitudinal elevation, partly in section, of the principal parts of the printing-machine which are necessary for the illustration of the improvement. Fig. 2 represents a side elevation of parts of the machine which are in front of the plane of the section, Fig. 1. Fig. 3 is a transverse vertical sectional view taken in the line $x\,x$ of Figs. 1 and 2 and viewed from the left of those figures. Figs. 4, 5, 6, 7, 8, and 9 are diagrams which will be hereinafter explained. Fig. 10 is a detailed view exhibiting a modification which will be hereinafter explained.

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

A is the stationary framing of the machine.

B is the reciprocating bed, arranged to run in the usual way on roller-shoes a on longitudinal bearers b, provided on the framing.

C is a rack-frame rigidly secured to the under side of the bed B for the purpose of carrying the two straight racks D D′, which are arranged with their teeth facing each other, at such distance apart that either one may gear with a rotary pinion E, which is carried by a horizontal shaft E′, which is arranged transversely to the bed in stationary bearings c and which is furnished with a spur-gear e, through which it derives constant rotary motion from a pinion d on the main shaft F of the machine.

The two racks D D′, though parallel with, are not opposite to each other, but, as will be understood by reference to Fig. 3, are set off laterally from each other, so that either one may be in gear with the pinion E, while the other is out of gear therefrom. The said shaft E′ is movable lengthwise in its bearings c for the purpose of bringing the gear E into line with either of the racks and out of line with the other. This lengthwise movement of the shaft is produced from a cam G′ on a shaft G, arranged transversely of the machine in stationary bearings. This shaft may be the shaft commonly known as the "cam-shaft" in reciprocating-bed cylinder printing-machines, and may have motion, one revolution for each stroke of the bed back and forth, given to it in the usual way. Motion is transmitted from the cam G′ to produce the longitudinal movement of the shaft E′ through an elbow-lever $f\ f'\ f^2$, which works on an upright fulcrum-pin g, erected in a fixed standard g', one of the arms of the said lever being connected with the yoke-rod g^2 of the cam G′ and the other arm f^2 of the said lever carrying a shoe f^3, which engages with a grooved collar f^4 on the shaft E′, the said collar in the example represented being a part of the hub of the gear e.

The pinion E does not, while in gear with either of the straight racks D D′, produce the whole length of the stroke of the bed in either direction; but the slow and gradually-accelerated commencement of the stroke and the gradually-retarded and slow stoppage of the movement at the end of the stroke of the rack-frame C and bed in either direction are produced in part by a crank-pin o on a crank L, carried by the pinion-shaft E′, acting against one or other of two cross-heads $n\ n'$ on the rack-frame C near the ends thereof, and in part by the action of the forked upper end of

a lever H, which engages by turns with one and the other of two pins *j j'*, which project laterally from the rack-frame C, one near each end thereof. The said forked lever is fulcrumed at its lower end on a stationary pin *h* in a bracket *h'*, secured to the bed-plate A' of the machine. The pins *j j'* are furnished with anti-friction rollers to facilitate their reception into the fork *i* of the lever. The movements of the said forked lever are produced by cams I I' on the shaft G, hereinbefore mentioned. The said cams I I' may be considered as practically a single cam with two leaves, one of which acts upon one and the other upon the other of two rollers *k k'*, which are attached to a yoke K, which is connected by a rod K' with the said lever H, one leaf I producing the movement of the lever in one direction and the other leaf I' its movement in the other direction. It is while the racks D D' have been carried beyond the pinion by the forked lever H that the longitudinal movement of the shaft E', hereinabove described, to bring the pinion E out of line with one and into line with the other of the racks takes place.

In some cases the forked lever H and the crank-pin *o* may be all that is necessary to produce and control the slow starting and gradual acceleration and the gradual stoppage of the bed; but I prefer generally to employ, in addition to the said lever and crank-pin, for the purpose of more perfectly controlling the said starting and stopping, two short eccentric toothed sectors *p p'*, attached to the pinion E, one on each side thereof, and arranged to engage with short curved racks *l l'* and *m m'*, of which *l* and *m* form extensions of the straight rack D, and *l'* and *m'* form extensions of the straight rack D'. Said curved racks are not, however, in line with the said straight racks D D', but are offset from them, as shown in Fig. 3, because of the curved sectors *p p'* being set off on opposite sides of the pinion E. In the figure last mentioned the shaft G is represented as in the act of moving lengthwise to change the relation between the pinion and the two straight racks D D', and it will be understood, by reference to said figure, that when the pinion E would be in line with the lower straight rack D the sector *p* would be in line with the lower curved racks *l m*, and when the said pinion would be in line with the upper straight rack the sector *p'* would be in line with the upper curved racks *l' m'*.

Having described the construction and separate operations of the several parts of my improvement, I will now describe by the aid of the diagrams Figs. 4, 5, 6, and 7 the combined operations of the straight racks D D' with the pinion E, of the crank-pin *o* with the cross-heads *n n'*, and of the forked lever with the pins *j j'* on the rack-frame, leaving for subsequent explanation the eccentric sectors *p p'* and the curved rack-extensions *l m l' m'*.

I will refer first to Fig. 4, which represents the position of the parts at the time when during the movement of the rack-frame and bed to the left the upper straight rack D' has been moved as far as the pinion by its action on the upper rack D' will move them, the said rack D' having just passed out of gear with the pinion E, and the forked lever H having been brought by its cam I I' into action on the pin *j* of the rack-frame to complete or control the completion of the stroke of the rack to the right with a gradually-retarded velocity. The said lever in thus operating to complete the stroke moves to the upright position shown in Fig. 5, which corresponds with Fig. 1. During the first part of this action of the lever the crank-pin *o* is inoperative; but as the retarded movement of the rack-frame and bed continues the cross-head *n* overtakes the crank-pin, which then assists in checking the momentum of the rack-frame and bed until, when the lever arrives in the upright condition, the crank L is horizontal and the crank-pin *o* serves as a positive stop to the rack-frame and bed, as shown in Fig. 5. The crank-pin then by its continued rotation acts upon the cross-head *n* to start the rack-frame and bed slowly to the left and move them in that direction with a gradually-accelerated velocity, as may be understood by reference to Fig. 6, the lever H in the meantime receiving from its cam a corresponding movement by which the movement of the rack-frame and bed is controlled to the extent of holding the cross-head in contact with the crank-pin *o* until the rack-frame and bed have the full speed given to them by the action of the pinion E on the straight racks. During the operation of the crank-pin and forked lever, just described, while the straight racks are both out of reach of the pinion E, the longitudinal movement of the shaft E' takes place to bring the said pinion in line with the lower rack D, which when the rack-frame and bed have attained the full speed comes, as shown in Fig. 7, into gear with the pinion, which then continues the movement of the rack-frame and bed to the left until the right-hand end of the lower rack D runs out of gear with the pinion, and the stroke of the bed to the left is continued and completed by the action of the forked lever on the pin *j'* under the control of the cross-head *n'* and the crank-pin *o* in the same way as hereinbefore described with reference to the action of the lever and crank-pin on the pin *j* and cross-head *n* for completing the stroke to the right. The slow and gradually-accelerated movement of the rack and bed to the right is then commenced by the action of the crank-pin *o* on the cross-head *n'* under the control of the forked lever H and pin *j'* in the same way as described with reference to the action and control by the said crank-pin and lever on the cross-head *n* and pin *j* at the commencement of the stroke to the left until the right-hand end of the upper rack D' comes into gear with the pinion, which then con-

tinues the movement of the rack-frame and bed to the right.

In the operation just described with reference to Figs. 4, 5, 6, and 7 the movements of the forked lever produced by its cam I I′ is to and fro on the left hand of the upright position shown in Fig. 5, the extreme position to the left being indicated in Fig. 7 by the line 10, which represents the center line of the said lever. The said lever in completing the movement to the left moves at the same speed with the rack-frame until its fork descends far enough to let the pin *j* pass out of it, and it remains in this position until the proper point in the return of the rack-frame by the pinion, when said lever returns, following up the said pin *j* until it engages with it. At and near the left-hand end of the stroke of the rack-frame and bed the corresponding movement of the lever to and fro is on the right of the upright position, as indicated by the center line 11, which shows the extreme position of the lever to the right.

The operation of the eccentric toothed sectors *p p′* and the curved rack-extensions *l l′* for more effectually controlling the gradual retardation and stoppage and the slow starting and gradual acceleration of the rack-frame and bed is illustrated in the diagrams Figs. 8 and 9, the position of the parts in Fig. 8 corresponding with that of the relative parts in Fig. 4, and the position of the parts in Fig. 9 corresponding with that of the relative parts in Fig. 5.

The sector *p′* comes into operation, as shown in Fig. 8, on the upper rack-extension *l′* just as the upper straight rack D′ in moving to the right runs out of gear from the pinion E, and the continued rotation of said sector beyond this position in gear with the said rack-extension controls the retarded completion of the stroke of the rack-frame and bed to the right. Just as this continued rotation of the said sector takes it out of gear with the said rack-extension *l′* the longitudinal movement of the pinion-shaft E′ takes place to bring the pinion E in line with the rack D and the sector *p* in line with the rack-extension *l*, and the said sector *p* by its continued rotation strikes into gear with the said rack-extension, and as the rotation of the said sector proceeds in gear with the said rack-extension, the rack-frame having been started to the left by the crank-pin and forked lever, the said sector and rack-extension control the gradually-accelerated movement of the rack-frame until as the rack D comes into gear with the pinion E the said sectors pass by each other and leave the rack-frame to the operations of the pinion. A similar operation of the sector *p′* with reference to the rack-extension *m′* and of the sector *p* with reference to the rack-extension *m* takes place at the end of the stroke of the rack-frame and bed to the left and commencement of their stroke to the right, the shaft E′ being moved longitudinally between the operations of the two sectors to bring the pinion again into line with the rack D′ and the sector *p′* into line with the rack-extension *m′*.

It is obvious that instead of the lever H being made with a fork *i* to engage with pins *j j′* on the rack-frame the lever may be made with a short toothed rack *q** to engage with short racks *q* on the frame, as shown in Fig. 10.

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

1. The combination, in a mechanical movement, with a reciprocating rack-frame and two racks thereon and a rotary pinion for gearing with said racks, of a lever for engaging with said rack-frame at opposite ends thereof by turns and a cam for actuating said lever to control the stopping and starting of the reciprocating movements of said frame, substantially as herein set forth.

2. The combination, in a mechanical movement, with a reciprocating rack-frame and two racks thereon and a rotary pinion for gearing with said racks, of a crank-pin attached to said pinion, cross-heads on the said rack-frame, against which the crank-pin operates to start the rack-frame in either direction and as a stop, a lever for engaging with the rack-frame at opposite ends thereof by turns, and a cam for actuating said lever to maintain the proper relation between the crank-pin and cross-heads, substantially as herein set forth.

3. The combination, in a mechanical movement, with a reciprocating rack-frame and two straight racks thereon, a rotary pinion for gearing with said racks, and a longitudinally-movable shaft for said pinion, of eccentric toothed sectors carried by said shaft and curved rack-extensions at opposite ends of said straight racks for gearing with said eccentric sectors, substantially as and for the purpose herein set forth.

4. The combination, in a mechanical movement, with a reciprocating rack-frame and two straight racks thereon in different lines and curved rack-extensions at the ends of said racks, of a longitudinally-movable shaft and a pinion thereon for gearing with said straight racks, a lever for engaging with said rack-frame at opposite ends thereof by turns, a cam for actuating said lever to control the gradual starting and stopping of the rack-frame, and eccentric sectors carried by said shaft for engaging with the curved rack-extensions to control the acceleration of the rack-frame after starting and its retardation before stopping, substantially as herein set forth.

5. The combination, in a mechanical movement, with a reciprocating rack-frame having a cross-head at each end and having two straight racks arranged in different lines and curved rack-extensions at the ends of said racks, of a longitudinally-movable shaft, a pinion on said shaft for engaging with said racks, a crank-pin carried by said shaft to

produce the starting of the rack-frame in either direction and its positive stoppage, and eccentric toothed sectors carried by said shaft to engage with said curved rack-extensions to control the acceleration of the rack-frame after starting and its retardation before stoppage, substantially as herein set forth.

6. The combination, in a mechanical movement, with a reciprocating rack-frame having a cross-head at each end and having two straight racks arranged in different lines and curved rack-extensions at the ends of said racks, of a rotary pinion for gearing with said straight racks, a longitudinally-movable shaft for said pinion, a crank-pin carried by said shaft for operating on said cross-heads, a lever for engaging with the rack-frame at each end in turn, a cam for actuating said lever to maintain a proper relation between the said crank-pin and cross-heads, and curved toothed sectors carried by said shaft to engage with the said curved rack-extensions for controlling the operations of the said crank-pin and said lever, all substantially as herein set forth.

7. The combination, substantially as and for the purposes specified, of the reciprocating rack-frame C, having two straight racks D D′ and two cross-heads *n n′*, the longitudinally-movable shaft E′, carrying a pinion E and a crank-pin *o* for operating, respectively, upon said racks and cross-heads, the lever H for engaging with said rack-frame at opposite ends alternately, the cam-shaft G, the cam I I′ on said cam-shaft for operating said lever, and the cam G′ on said shaft, and mechanism, substantially as herein described, between said cam G′ and the longitudinally-moving shaft for producing the longitudinal movement of said shaft.

CALVERT B. COTTRELL.

Witnesses:
A. R. STILLMAN,
B. FRANK LAKE.