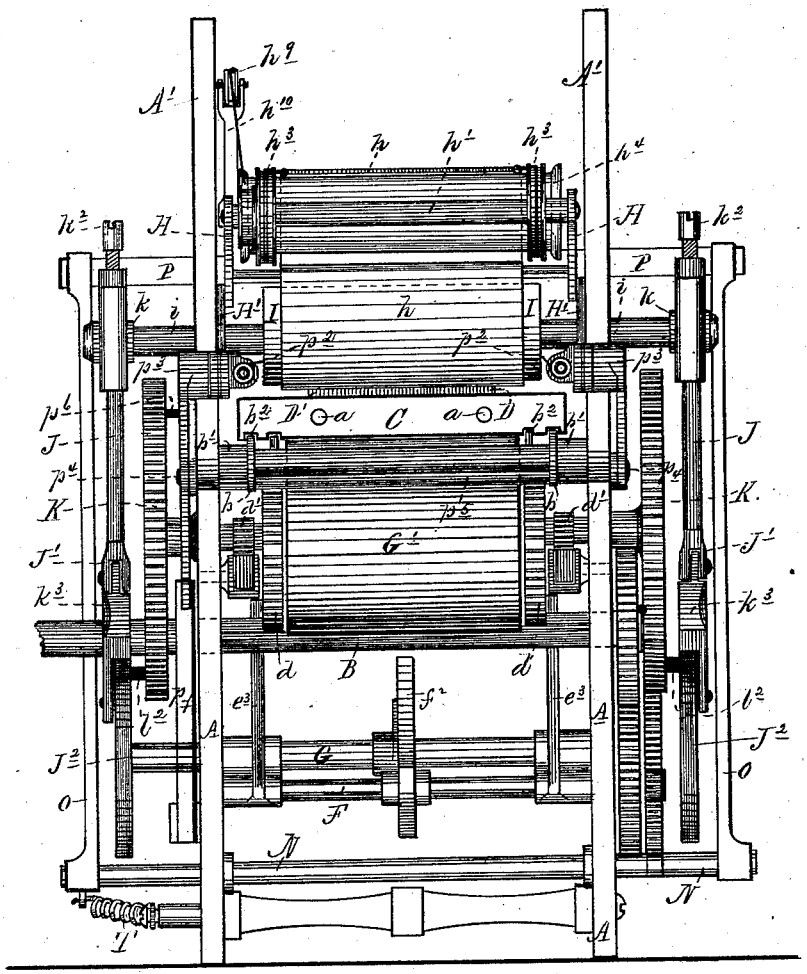
5 Sheets—Sheet 1.

T. C. KENWORTHY & G. W. CLARK.

Plate-Printing Machine.

No. 216,681. **Patented June 17, 1879.**

Fig 1.



Witnessess;
E. G. Wards
S. W. Downs

Inventors;
Thomas C. Kenworthy.
George W. Clark.
By A. L. Munson.
Atty.

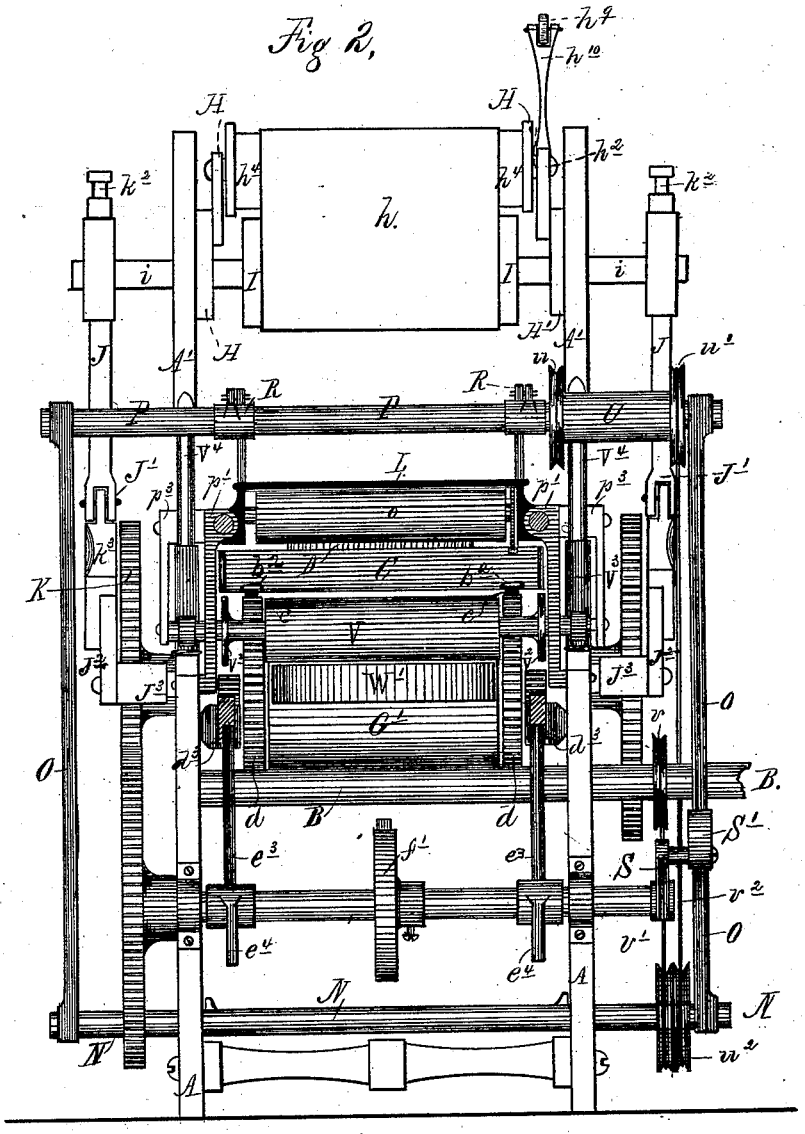
5 Sheets—Sheet 2.

T. C. KENWORTHY & G. W. CLARK.

Plate-Printing Machine

No. 216,681. **Patented June 17, 1879.**

Fig 2.



Witnesses:
E. G. Ward.
J. W. Loomis

Inventors;
Thomas C. Kenworthy.
George W. Clark.
By A. L. Minton.
Atty.

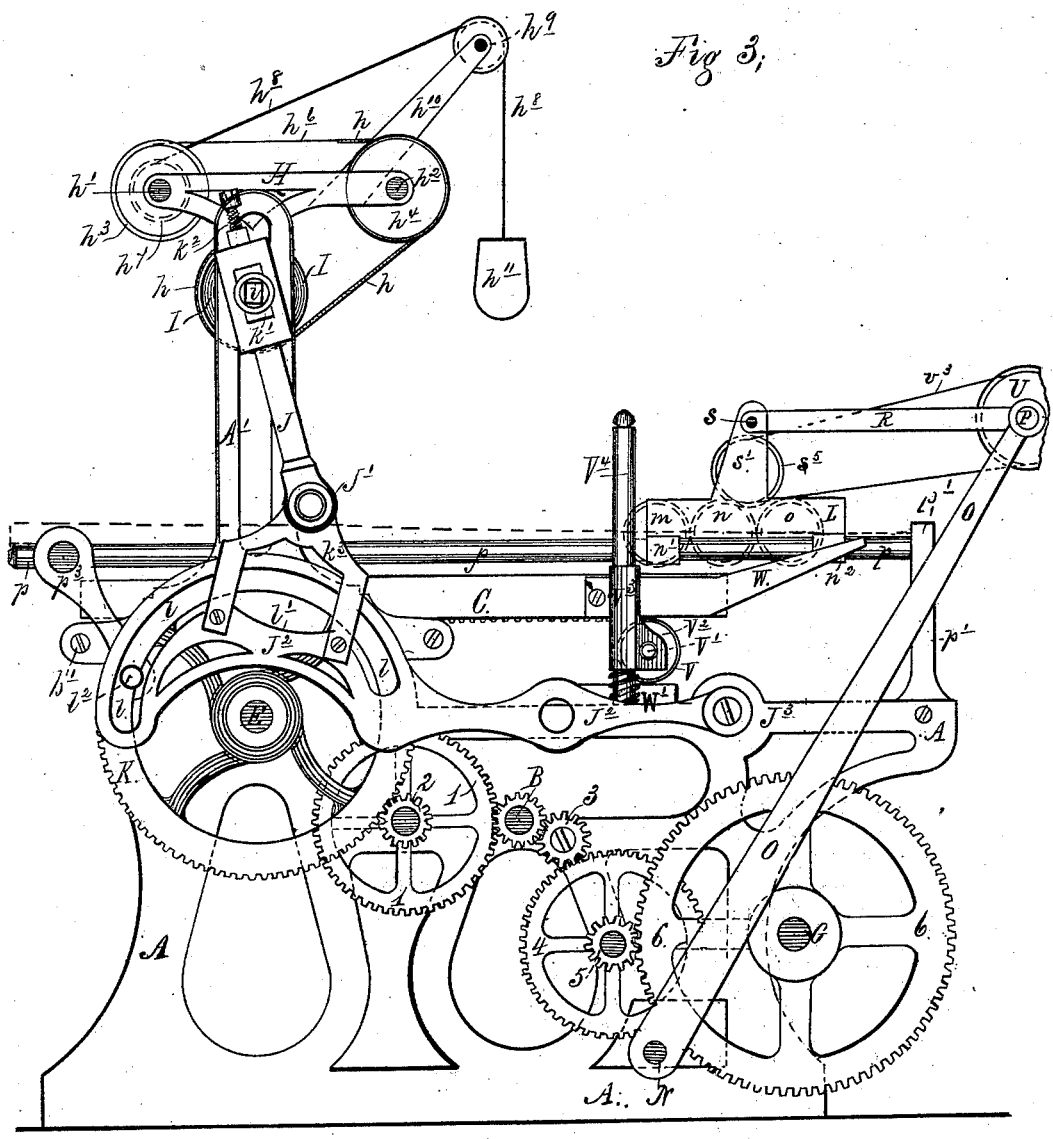
5 Sheets—Sheet 3.

T. C. KENWORTHY & G. W. CLARK.

Plate-Printing Machine.

No. 216,681. **Patented June 17, 1879.**

Fig 3.



Witnesses;
E. G. Ward;
S. W. Sloans

Inventors;
Thomas C. Kenworthy.
George W. Clark.
By A. L. Mimlow.
Atty.

5 Sheets—Sheet 4.

T. C. KENWORTHY & G. W. CLARK.

Plate-Printing Machine.

No. 216,681. Patented June 17, 1879.

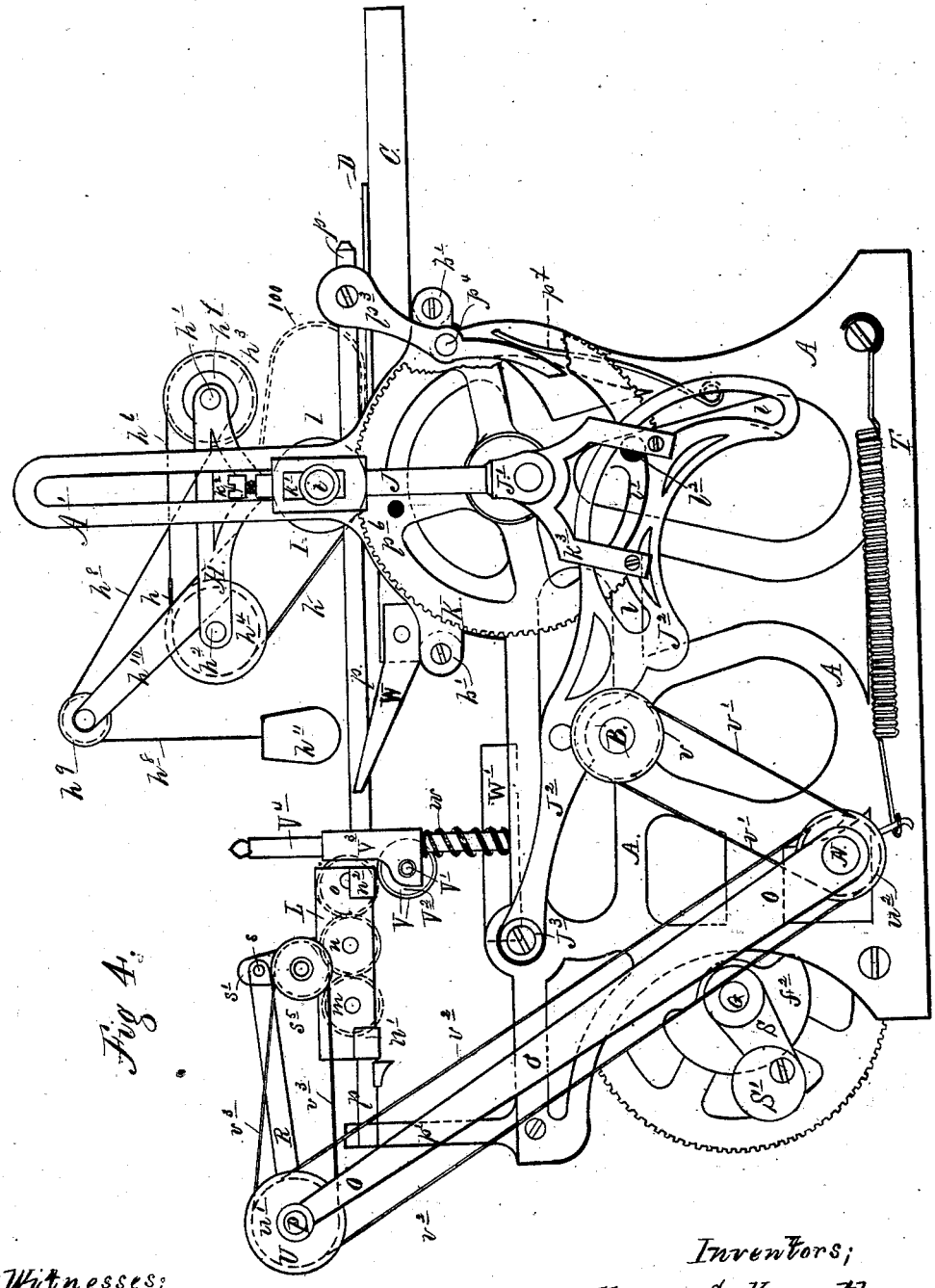


Fig 4.

Witnesses;
E. F. Hard;
S. W. Downs

Inventors;
Thomas C. Kenworthy.
George W. Clark.
By A. L. Munson.
Atty.

5 Sheets—Sheet 5.

T. C. KENWORTHY & G. W. CLARK.

Plate-Printing Machine.

No. 216,681. **Patented June 17, 1879.**

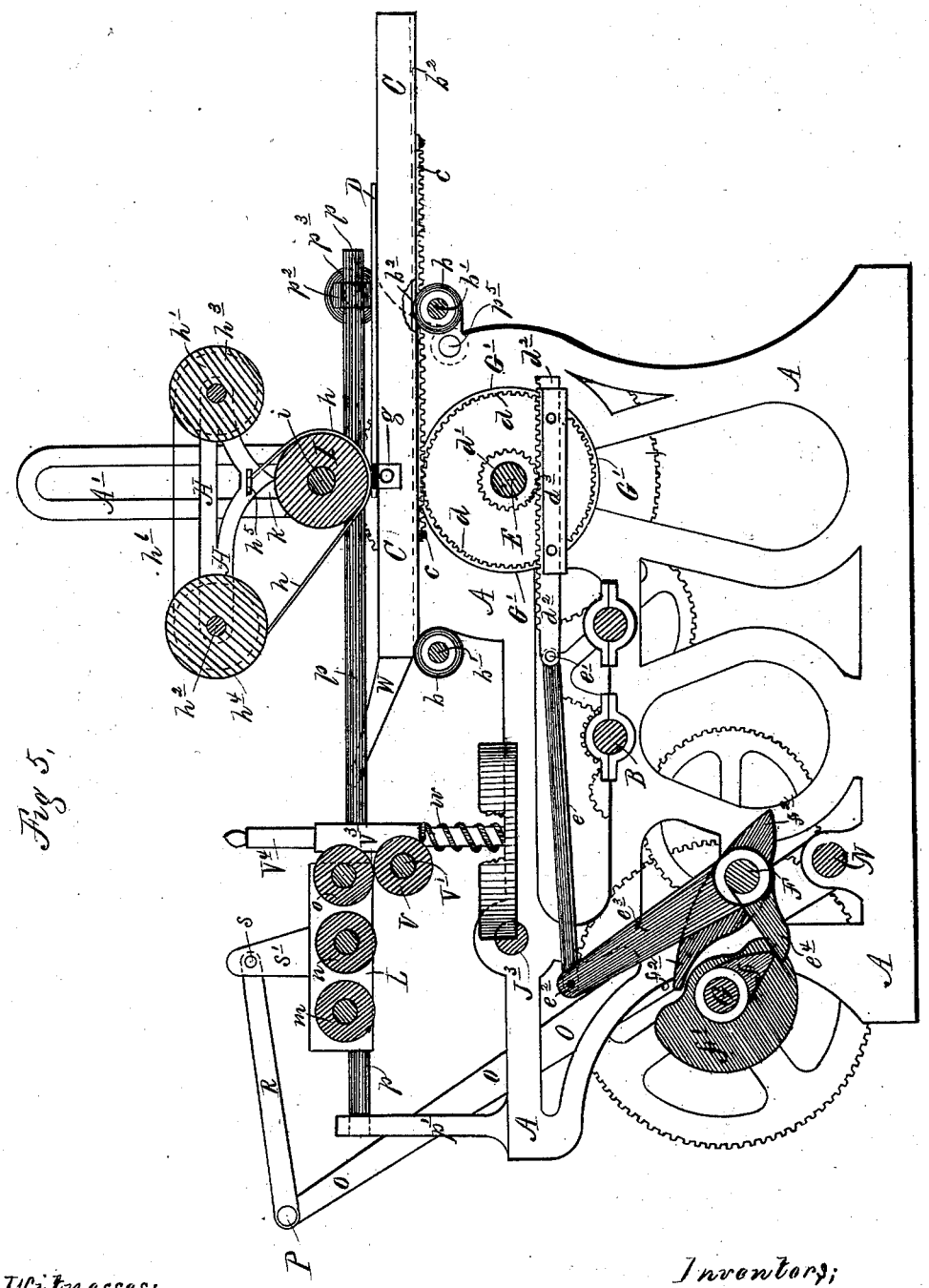


Fig 5.

Witnesses;
E. G. Ward;
J. W. Downs

Inventors;
Thomas C. Kenworthy.
George W. Clark,
By A. D. Mumford
Atty.

UNITED STATES PATENT OFFICE.

THOMAS C. KENWORTHY AND GEORGE W. CLARK, OF NEW YORK, N. Y., ASSIGNORS TO THEMSELVES, JOHN F. BAKER, AND ELIAS DURLACH, OF SAME PLACE.

IMPROVEMENT IN PLATE-PRINTING MACHINES.

Specification forming part of Letters Patent No. **216,681**, dated June 17, 1879; application filed September 3, 1878.

To all whom it may concern:

Be it known that we, THOMAS C. KENWORTHY and GEORGE W. CLARK, both of the city, county, and State of New York, have invented certain new and useful Improvements in Plate-Printing Machines, of which the following is a specification.

This invention relates to that class of printing-machines particularly designed for taking impressions from finely-engraved steel or copper plates.

The machine herewith illustrated consists in the adaptation of the several devices now used in the common hand plate-printing presses, usually designated as the "plank," and the impression and back rolls, in combination with certain new mechanical devices, all being arranged in suitable framing, provided with operative mechanism properly geared and adjusted to control the various operations of inking, cleaning, and polishing the plate, and for making the impression therefrom, all such operations being performed in unison, the entire combination of instrumentalities serving to produce a machine of great strength, capable of being rapidly operated by power, and producing fine work in large quantities, all of which combination of parts and the method of applying, controlling, and using them will be hereinafter fully pointed out and described in detail.

In the accompanying drawings, which form an essential and important part of this specification, Figure 1 represents a front elevation of a plate-printing machine in which our invention is fully embodied. Fig. 2 is a rear elevation. Fig. 3 is a right-hand side elevation. Fig. 4 is a left-hand side elevation; and Fig. 5 is a longitudinal view, partly in section, the framing on the left-hand side and all exterior operating parts removed in order to fully show the interior operating parts of the apparatus.

In Figs. 1, 4, and 5 the position of the parts is as they are at the completion of the operation of taking an impression, and in Figs. 2 and 3 the impression-roller and its adjuncts are shown raised in position to permit the inking, cleaning, and polishing operations to take place.

The various reference-letters and figures marked on the several drawings will locate and designate corresponding parts.

The object aimed at in this machine is the arrangement of the elements now successfully employed in hand-presses for plate-printing in such form that power can be applied in operating them. In connection therewith we have introduced new elements, and arranged the action and movement thereof so that all operate in unison, and permit the handling of the work in as free a manner as in the hand-presses, but with the increased production that naturally attends the increased speed of the press.

A represents the framing of the machine, which may be cast in such form as may be approved. B is the main or driving shaft of the apparatus, by means of which motion is communicated to all others parts of the machine. It also carries the balance-wheel and the usual forms of fast and loose pulleys.

C is the plank or bed, which carries the engraved plate D, from which the impression is to be taken, said plate being secured upon the plank in any approved method. This plank C may be either solid or chambered, the latter when it is desired to permit the introduction therein of live steam, so that both plank and plate may be heated. The entry of the jet of steam may be through the openings *a* formed in the front end of the plank, and by means of flexible pipes. This plank C is reciprocated longitudinally, riding upon pulleys *b b*, (see Figs. 1 and 5,) which are mounted loosely and rotate upon cross-shafts b^1 b^1, attached to short arms projecting from the frame A, a grooved way or track, b^2, being cut into the lower face of the plank C, into which the pulleys *b* enter, these tracks serving to guide the plank and to prevent any lateral play during its reciprocations. A guide, *g*, (seen plainly in Fig. 5,) is attached to the inner face of the frame A, and an arm thereof projects over the plank C for the purpose of confining it in its position as well as to assist in steadying it in its move-

ments. The plank C has attached to its lower face on both sides toothed racks *c c*, which mesh into the teeth of gear-wheels *d d*, which are loosely mounted on a sleeve on the shaft E, journaled in bearings or boxes attached to the frame A. Attached to the same sleeve as carries the gears *d d* are attached the small gears, d^1 d^1, (see Fig. 5,) being also secured to and rotating in unison with the gears *d d*. These gears d^1 mesh into the toothed racks d^2 d^2, which are mounted and reciprocated in the guide frames or ways d^3, which are rigidly bolted to the sides of frame A. The racks d^2 have a reciprocating movement imparted to them by means of the connecting-rods *e*, which are pivoted to the rear ends of the racks at *c'* and to the apexes e^2 of the upright levers e^3, whose base is attached to the rocking shaft F. The bases of the levers e^3 are provided with short arms or levers e^4, projecting to the rear at right angles to the perpendicular levers, and such short arms are depressed at stated intervals by the action thereupon of the cams *f*, which are mounted upon the shaft G, such depressions causing the levers e^3 and connecting-rods *e* to act on the racks d^2, drawing them to the rear, and thereby causing the gears d^1 and *d* to revolve, which, acting on the upper racks, *c c*, attached to the base of the plank, cause the plank to move forward. This movement is continued until the cams *f* cease to act upon the lever-arms e^4, when the plank has reached the position as shown in Figs. 4 and 5, when a stand-still occurs, during which time the plank remains motionless. This stand-still continues until the cam f^1, also mounted on the shaft G, strikes the curved lever f^2, also rigidly secured on the rocking shaft F, and forcing the lever f^2 forward, and acting through the same levers e^3, and rod *e*, causes the racks d^2 to move forward, and by the action of the gears and upper racks, *c*, the plank to retire.

A bottom or plank roller, G', is loosely mounted upon the shaft E, its periphery touching the lower face of the plank C, which rides thereupon during its reciprocations. This plank-roller is applied for the same purposes as in the hand plate-printing presses, and serves to obviate the greater amount of friction that otherwise would be met with during the operation of taking the impression if the plank was entirely borne upon the small guide-pulleys *b b*. The introduction of this roller therefore renders the movements of the plank easy without any regard to the amount of pressure that is exerted thereupon by the impact of the impression-roller when printing an impression.

H is a carriage mounted on slides H', which are arranged to rise and fall in the slotted arms A' A', which project upwardly from the main frame A. This carriage H carries the self-acting blanket *h* and its accessories.

I is the impression-roller, which is affixed to a shaft, *i*, which is journaled in bearings in the slides H', the shaft *i* projecting outside of and beyond the frame-arms A', for the purposes as will presently be fully described.

The carriage H is provided with two revolving shafts, h^1 h^2, located above the impression-roller, (see Figs. 3, 4, and 5,) the shaft h^1 carrying two grooved pulleys, h^3, and the shaft h^2 carrying a drum-roller, h^4.

A rod, h^5, (see Fig. 5,) is located directly above the impression-roller I, to which one end of the blanket *h* is permanently secured. The blanket *h* is then carried down in front of the impression-roller I, carried under it, between it and the plank C, then upward on an incline to the rear, beneath, around, and over the drum h^4, and terminating a short distance in front of such drum. Cords h^6, of a suitable nature and strength, are then attached to this end of the blanket, and are carried to the grooved pulleys h^3, passing around them several times and secured thereto.

A smaller grooved pulley, h^7, is attached to either one of the pulleys h^3, a cord, h^8, being secured thereto, and, after being given several turns thereabout, is passed to and over a pulley, h^9, mounted on an arm, h^{10}, projecting upwardly from the carriage H, the end of the cord being provided with a weight, h^{11}, which serves by the medium of the cords and pulleys, arranged as stated, to always keep the blanket taut and to take up all the slack that occurs while taking an impression.

The vertical reciprocating movements of the impression-roller I and the carriage H, carrying the blanket, are obtained as follows: To the projecting ends of the shaft *i*, outside of the frame-arms A', are pivoted or attached connecting-rods J J. The shaft *i* is journaled in bearings in the adjusting-slides *k k*, mounted in a slot, k^1, in the top of the connecting-rods J J, and such slides are governed by means of the set-screws k^2. The base or lower ends, J^1, of such connecting-rods are slotted and pivoted on a stud or arm, k^3, attached to the face of the cam-levers J^2, the rear ends of such cam-levers being pivoted on a stud, J^3, which projects from the sides of the framing A. These cam-levers J^2 are shown plainly in Figs. 3 and 4, the forward or cam portions of each being enlarged and provided with cam-slots *l*, which extend for one-half of the circle on the line of which they are formed, a portion of such cam-slots being enlarged, as shown at l^1, by cutting away on the line of a reversed circle of the same circumference as that of slots *l*, the center of both slot and its enlarged portion being that of the center of the path described by the pin l^2 in its revolutions.

The movements of this cam-lever are received from and controlled by means of a traveling pin, l^2, which is projected from the side of the gear-wheel K, attached on both ends of the rotating shaft E, such pin centering and moving in the slot *l* l^1. The operation of this cam-lever and the attendant results upon the carriage H, blanket *h*, and the impression-roller I is as follows, the position of the apparatus being as

shown in Fig. 4: A rotary movement being imparted to the shaft E, the gear-wheel K revolves to the rear, causing the pin l^2 in the slot l to rise against the upper curved surface of the slot, which action forces the cam-lever upward in unison with the rise of the pin. This continues until the pin loses its gripe on the lever, when it follows loosely in the slot until it reaches the position shown in Fig. 3. At the time the pin l^2 loses its hold on the cam-lever, the curved slot l therein corresponds with the curved path followed by the pin, so that a stand-still occurs during one-half the revolution of the shaft E and gear K until the pin has traversed the whole length of the slot l, and as the pin touches the base thereof the cam-lever begins to fall, the upper surface of the slot resting upon the pin until the pin reaches the cut-away portion l^1 of the slot, and as this part of the slot then conforms with the circle or path in which the pin is moving, the pin holds its gripe upon the lower face only of the slot l^1. This provides a stand-still until the pin again enters the main slot l, striking the upper face thereof, and again causing the cam-lever to rise, as at first stated. This movement of the cam-lever J results, commencing at the termination of the act of taking an impression, in lifting the shaft i, carrying the impression-roller, the carriage H, the blanket h, and all attachments connected therewith to the position as shown in Figs. 2 and 3, in holding them at rest during the time of one-half the revolution of the shaft E and gear K, while the pin l^2 is traveling the full length of the cam-slot l, during which period of rest the inking, cleaning, and polishing of the plate are accomplished. The paper upon which the impression is to be made is also inserted in place at the retiring of the inking and cleaning apparatus. The impression-roller I is then dropped and the apparatus is ready to make the desired impression.

It will be noticed that when the impression-roller is down upon the plate D (see Fig. 4) the pin l^2 is binding upon the lower face of the slot l^1 in the cam-lever, the adjustment, by means of the set-screws k^2 and slides k^1, being such that the impression-roller is held rigidly in its place during the taking of the impression, and until the pin l^2 loses its hold in the slot and the cam-lever commences to rise, this taking place the instant the process of taking the impression is completed.

The action of the self-acting blanket h is as follows: As the impression-roller impinges upon the plate, pressing the blanket between the plate and the roller, the plank begins its forward movement, drawing the blanket from the drum h^4, and carrying it forward until it takes the position as shown by dotted lines in Fig. 4. During this movement the cords h^8 give way, unwinding from the grooved pulleys h^3, rotating them, and causing the small grooved pulley h^7 to wind upon itself a portion of the cord h^8, which passes over the pulley h^9, and carries the weight h^{11}. This, of course, lifts the weight in proportion to the amount of cord taken up. At the completion of the impression, as the impression-roller rises from the plate, the blanket h is released, and, by the action of the weight, cords, and pulleys described, is instantly returned to its normal position.

By this arrangement of blanket and impression-roller plenty of space and time are secured in which to perform the operations of inking, cleaning, and polishing the plate, and for the proper introduction of the sheet of paper upon the plate and plank.

Instead of using the weight h^{11} as the means for controlling the reverse movements of the blanket, a spring may be attached to the cord h^8, and secured to some suitable point in the machine.

The operations of inking the engraved copper or steel plate, the removal of the surplusage of ink from the unengraved portions thereof, and the polishing of the plate prior to taking the impression therefrom are accomplished substantially as follows: L is the carriage, in which are mounted and operated the inking-roll m, cleaning and polishing rolls n and o, and such other auxiliary means as may seem best to employ for the perfect execution of this part of the work. This carriage reciprocates the entire length of the machine over the plank and plate, passing in between the impression-roller and blanket, and the plank, its rolls, &c., performing their work in the advance movement. In the retrograde movement the carriage is raised up, so that its rolls move above the plate. This carriage reciprocates upon two supporting rods or ways, p, being secured thereupon by means of slides n^1 n^2, which are attached to or project as a part of the carriage.

The supporting-rods p at their rear ends are secured in a rocking stud pivoted to the standards p^1, which project upwardly from the frame A. At the forward ends these rods are also secured in rocking studs p^2, which are pivoted to the top of the oscillating lever p^3, whose fulcrum p^4 is a shaft, p^5, arranged in the framing A. The lower arm of this lever is acted upon by a traveling pin, p^6, which projects from the inner face of the gear K, such pin at the proper time pressing this lower arm of the lever p forward, causing the upper arm to rise a short distance. This action takes place at the time the carriage L reaches the forward extreme of its motion, the supporting rods taking the position as shown in dotted lines in Fig. 3. This enables the carriage to be retired above the plate until it reaches its normal position, when the pin p^6 ceases to act on the lever p^3, which is then, by means of the spring p^7, returned to its original position, the rods p falling in unison therewith.

The lever p^3 is duplicated on the opposite side of the machine, or the lower arm dispensed with and the upper arm operated by

means of the rocking shaft, upon which both levers are mounted.

The reciprocating movements are imparted to the carriage L as follows: To a rocking shaft, N, arranged in the base of the frame A are attached upright arms O, such arms, at their apex, supporting a shaft, P. Two short connecting-rods, R, are loosely attached to this shaft, and at their forward ends are connected to a stud or pin, *s*, attached to the arms s^1, which project up from the carriage L. On one end of the rotating shaft G, which is projected laterally beyond the arm O, is attached the arm S, which carries at its extreme an adjustable eccentric cam, S′. This cam, in its revolutions with the arm S, acts upon the rear of the arm O, forcing it forward, and thereby, through the connecting means described, causes the carriage L to move forward. As soon as the cam S′ ceases to act upon the arms O such arms are quickly returned to their first position by means of the spring T, which is attached to a pin projecting from the base of the arm O, the other end of such spring being secured to a pin at the front part of the machine.

The inking, cleaning, and polishing rollers *m*, *n*, and *o* are all geared together, (see Fig. 4,) also to a gear attached to the arm s^1 of the carriage L, which has secured to its side a grooved pulley, s^5.

Upon the shaft P, between the arms R and O, is mounted a sleeve, U, carrying at each end a grooved pulley, u u^1, and upon the rocking shaft N, between the frame A and the arm O, is loosely mounted a double-grooved pulley, u^2.

On the main shaft B (see Figs. 2 and 4) is rigidly secured a grooved pulley, *v*. A belt or cord, v^1, conveys power from pulley *v* to pulley u^2, a belt or cord, v^2, from pulley u^2 to pulley u^1, and a cord, v^3, from pulley u^1 to pulley s^5.

As the main shaft B is in continuous motion, it is plainly evident that such motion is imparted to the inking and cleaning rolls and continues at all times, no matter what position they may be in.

V is the ink take-up and transfer roll, which is mounted on a shaft, V^1, journaled in bearings in slides V^3, arranged upon upright posts V^4, attached to the frame A. This roll is operated by means of an inclined cam-piece, W, attached to the sides of the plank at the rear. These cams, in their movements, ride over the pulleys V^2 on each end of the shaft V^1, carrying the roll, and as the cam-pieces advance (during the rear movement of the plank) the roll is forced down until it comes in contact with the ink-table W′, (see Figs. 2 and 4,) the movement of the cams on the pulleys causing the ink-roll to rotate and to take up ink from the table W′, the position at this juncture being as shown in Fig. 3. As the plank moves forward the roll is caused to rise by means of the springs *w*, which are applied about the posts V^4 and imprisoned between the frame A and the base of the slides V^3. The rise of the roll is continued until it touches the rotating ink-roller *m* in the carriage L, (see Figs. 4 and 5,) and delivers the ink thereto.

The ink-table may be of any of the approved forms now in use, and the ink may be supplied from fountains or otherwise applied. These being of common construction are not shown in detail in the drawings or described.

The operation of the apparatus as described is substantially as follows, the position of the parts being that as shown in Figs. 1 and 3: Motion, being imparted to the main driving-shaft B, is, by means of gears 1 and 2, transmitted to the gears K, which drive shaft E and operate the cam-lever J^2, and, by means of gears 3, 4, and 5, to gear 6, which drives the shaft G. The carriage L is moved forward over the plank, coating the engraved plate with ink, as described, the cleaning and polishing rolls following, combined with the other auxiliaries connected therewith. Then clean the plate of surplus ink and polish its surface.

Having advanced to the front of the plank and completed its office, the carriage is raised by the rods upon which it travels, lifting the various rolls, &c., from contact with the plate, and is quickly retired to its original position. The impression-roller and self-acting blanket are now lowered to contact with the plate prior to taking the impression, and during the time they are falling, and as soon as the inking and cleaning apparatus uncovers the plate, the necessary sheet of paper is fed into position and laid upon the plate by means of any of the well-known devices now employed for such purposes in printing-presses, which device may be operated by connection with any of the moving parts of the machine.

As soon as the impression-roller touches the plate, binding the cord of the sheet of paper between the blanket and the plate, the plank advances and the impression is taken in precisely the same manner as in the common hand plate-presses. The pressure exerted being sustained by the back roller, which rotates on the shaft in unison with the movement of the plank, the impression-roller also rotating by reason of its contact with the plate until the movement of the plank ceases, the self-acting blanket is drawn through and between the plate and impression-roller, as was previously described.

The impression being completed the impression-roller rises, releasing the blanket, which instantly resumes its normal position. The plank then retires, during which movements the paper sheet that has been printed is removed or stripped from the plate in any approved manner, and for this purpose we purpose using any of the well-known devices now employed to perform similar duties in printing-presses. The plank having reached its first position, the operations as described are again repeated.

It is plainly evident that as the sheet of paper is drawn through between the plate and plank and the impression-roller the impression taken is gradually accomplished—that is, as the plank advances the impression is taken at the point of impact between the periphery of the impression-roller and the face of the plate. This is precisely the same process as in the manipulation of the hand-press, and has all of that method of printing.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination of the impression-roller I, rods J, cam-lever J^2, slides k^1, carriage H, blanket h, drum h^4, grooved pulleys h^3, cords h^6, pulley h^7, cord h^8, and weight h^{11}, all arranged, applied, and operating substantially as and for the purposes as herein shown and set forth.

2. The combination of the plank C, pulleys b b, racks c c, gears d d^1, rack d^2, connecting-rods e, levers e^3 and e^4, cams f, lever f^2, and cam f^1, all applied and operating as and for the purposes as herein shown and set forth.

3. The combination of the carriage L, carrying the inking devices, ways or rods p, rocking levers p^3, traveling pin p^6, and spring p^7, all arranged, applied, and operating as and for the purposes as herein shown and set forth.

4. The combination of the inclined cams W, attached to the rear end of the plank C, pulleys or wheels V^2, ink-roll V, slides V^3, posts V^4, and springs w, all arranged, applied, and operating as and for the purposes as herein shown and set forth.

5. In a plate-printing machine, the combination, substantially as described, of the following instrumentalities, viz: a plank or bed carrying the plate and having a longitudinal reciprocating movement, a vertically-reciprocating carriage carrying the impression-roller and a blanket passing between the impression-roller and plank or bed, an apparatus for applying ink to the plate, which apparatus reciprocates between the plank and impression-roller, and mechanism, substantially as described, for operating such devices in unison.

6. The combination of the vertical reciprocating carriage H, in which are mounted the impression-roller I and the blanket h, with its stretching mechanism, and the reciprocating plank C, all arranged, applied, and operating as and for the purposes substantially as herein shown and set forth.

7. The combination of the reciprocating carriage H, impression-roller I, drum h^4, pulleys h^3, cords h^6 h^8, pulley h^9, weight h^{11}, and blanket h, all arranged, applied, and operating as and for the purposes as herein shown and set forth.

8. The combination, with a vertically-reciprocating carriage in which are mounted an impression-roller and a blanket and its stretching-drum, of a reciprocating plank moving beneath said carriage, roller, and blanket, and mechanism for operating the same in unison, all substantially as and for the purposes as herein shown and set forth.

In testimony whereof we have hereunto set our hands this 2d day of August, 1878.

THOMAS C. KENWORTHY.
GEORGE W. CLARK.

Witnesses:
A. L. MUNSON,
J. S. OSBORNE.