No. 660,030. Patented Oct. 16, 1900.

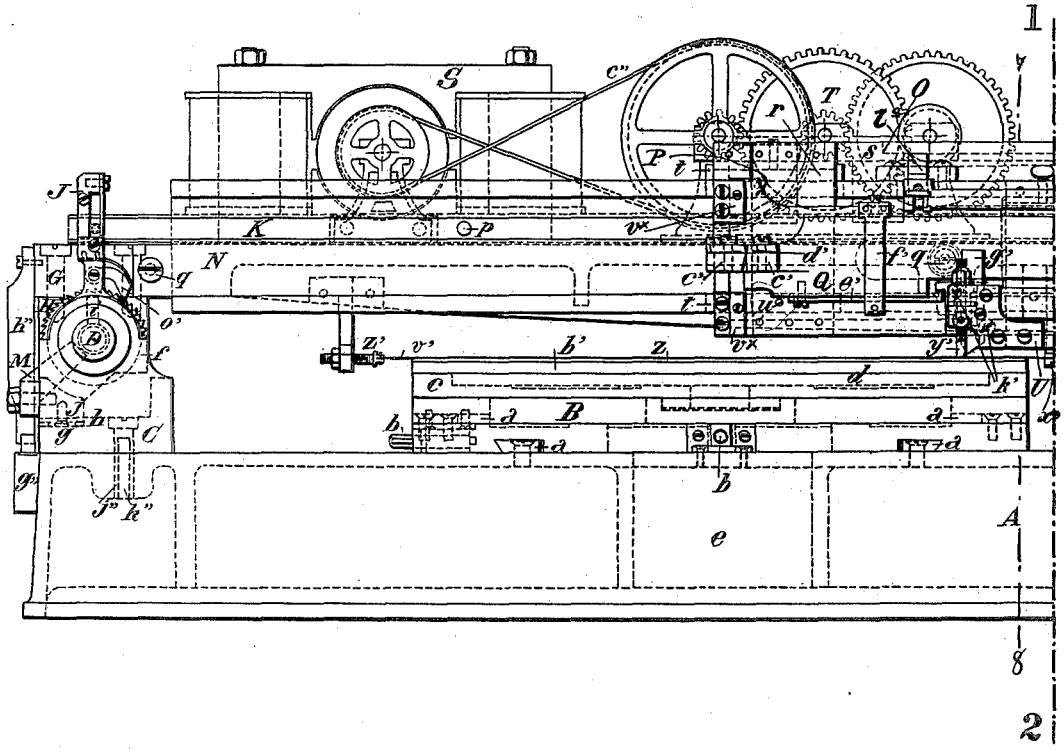
A. SARTIRANA.

ENGRAVING MACHINE.

(Application filed July 27, 1898.)

(No Model.) 7 Sheets—Sheet 1.

FIG-1



Witnesses

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No. 660,030. Patented Oct. 16, 1900.

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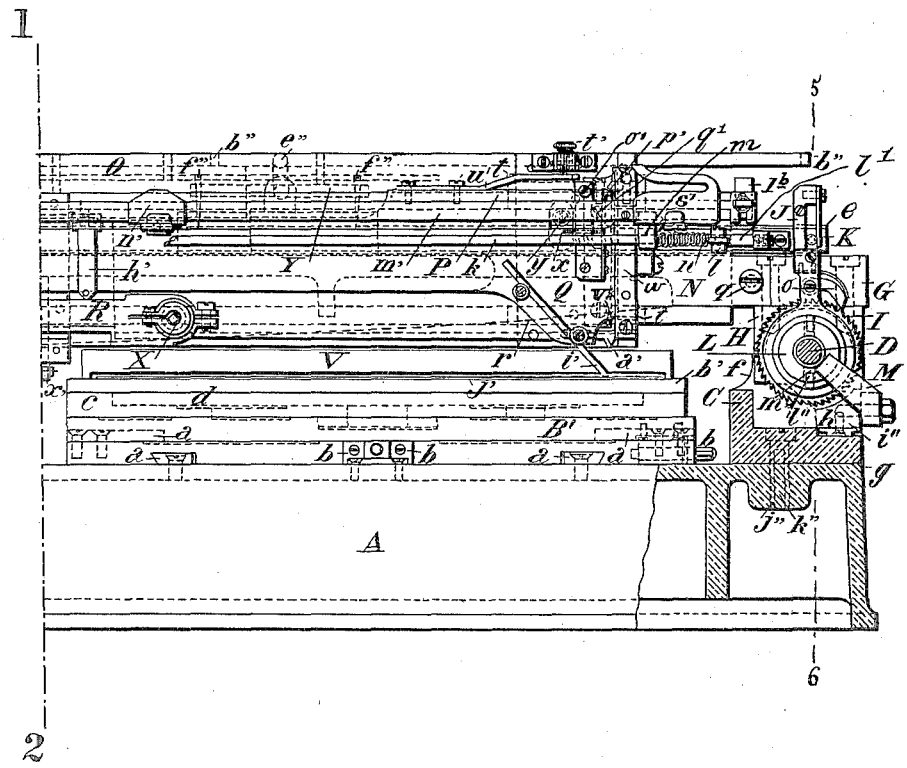
ENGRAVING MACHINE.

(Application filed July 27, 1896.)

(No Model.) 7 Sheets—Sheet 2.

FIG-1 a



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No. 660,030. Patented Oct. 16, 1900.

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ENGRAVING MACHINE.

(Application filed July 27, 1898.)

(No Model.) 7 Sheets—Sheet 3.

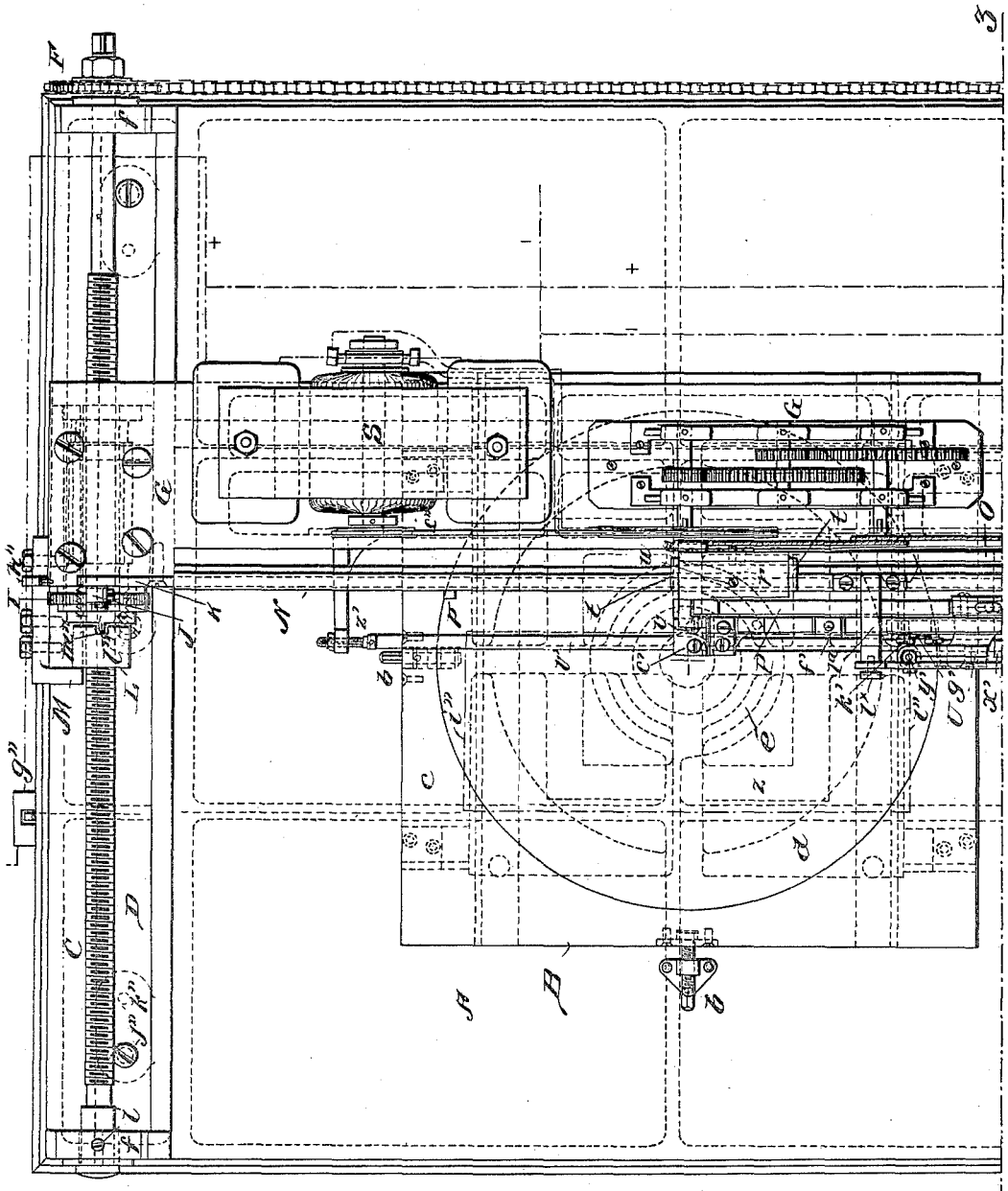

Fig. 2.

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(Application filed July 27, 1896.)

(No Model.) 7 Sheets—Sheet 4.

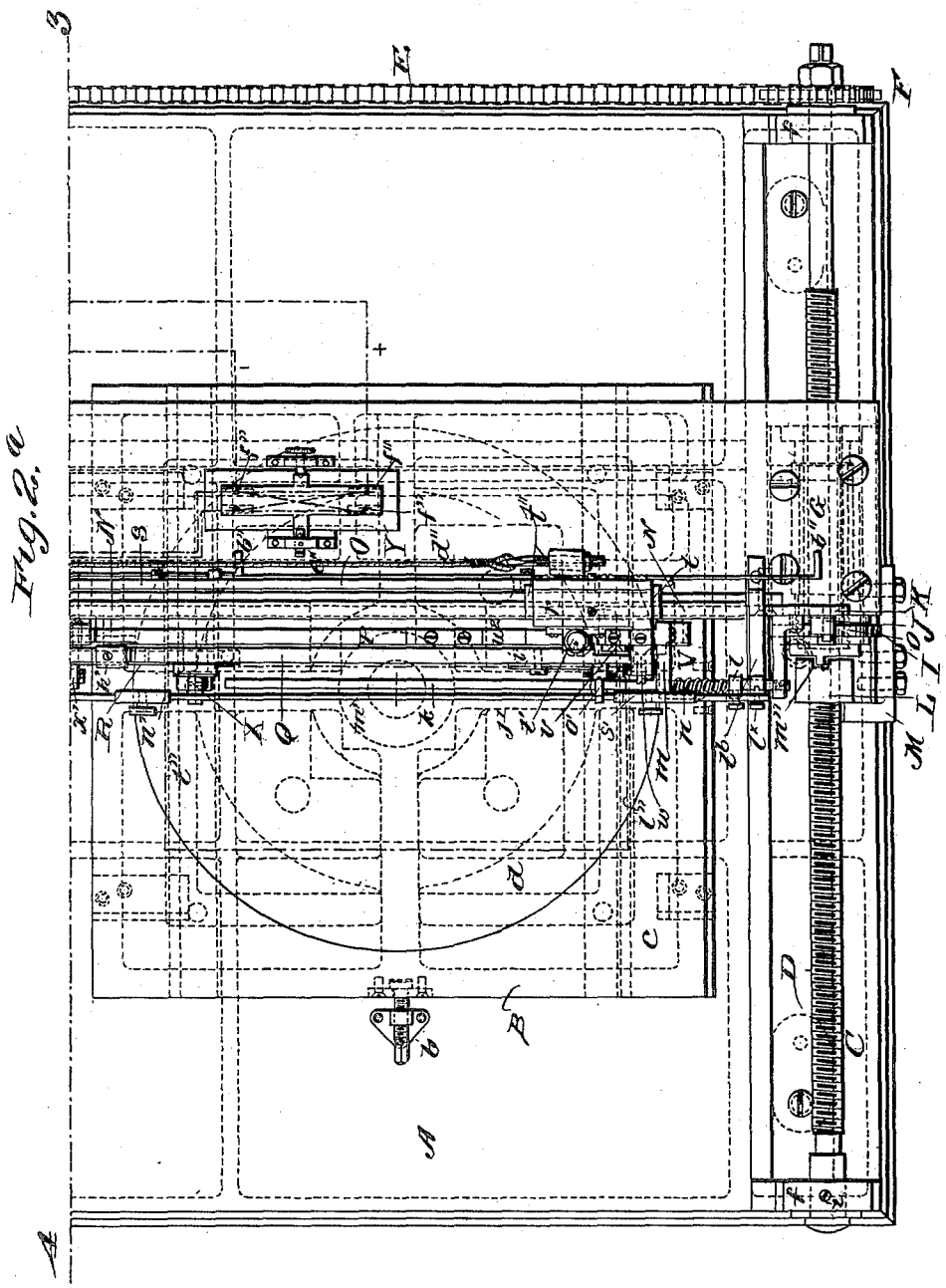

Fig. 2.

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ENGRAVING MACHINE.

(Application filed July 27, 1896.)

(No Model.) 7 Sheets—Sheet 5.

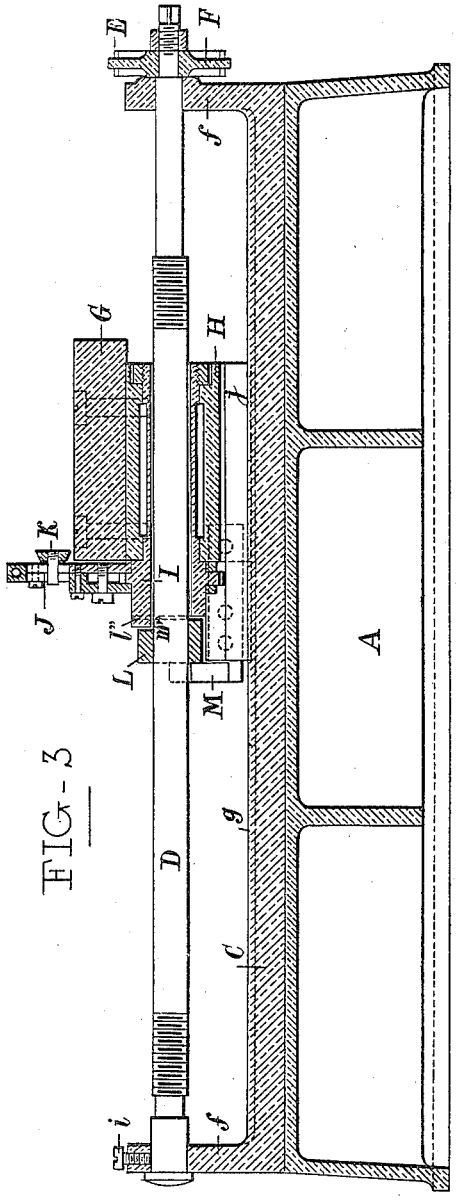

FIG. 3

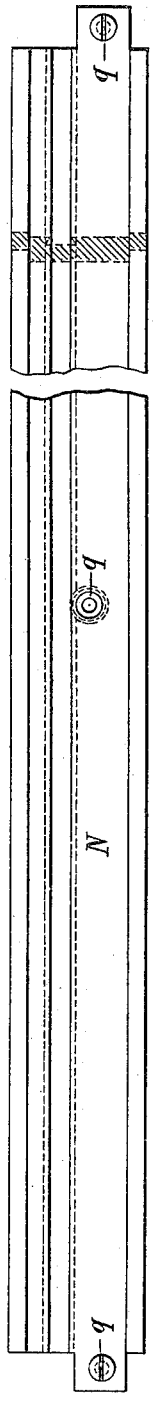

FIG. 5

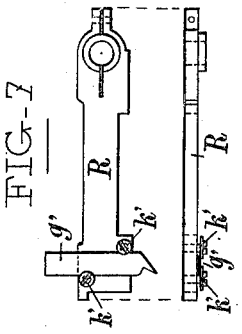

FIG. 7

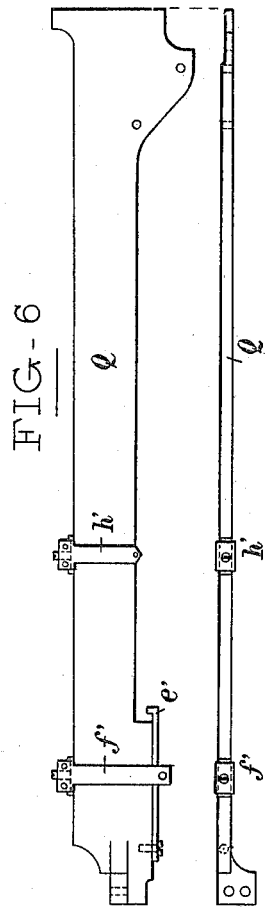

FIG. 6

Witnesses
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(Application filed July 27, 1896.)

(No Model.) 7 Sheets—Sheet 6.

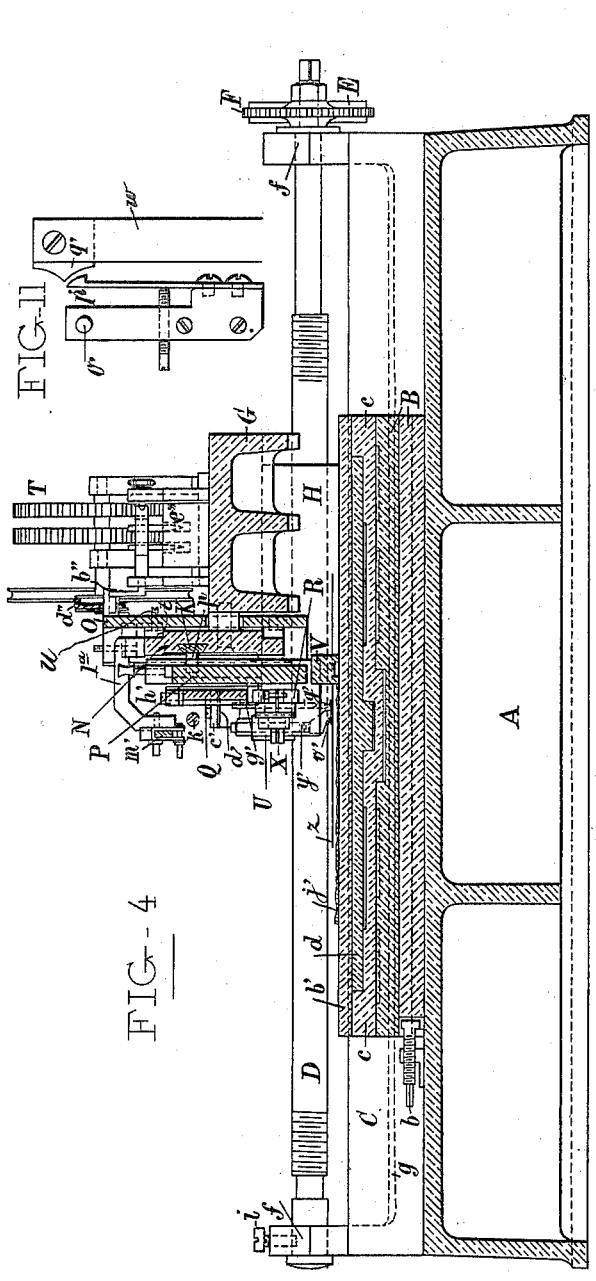

FIG-4

FIG-11

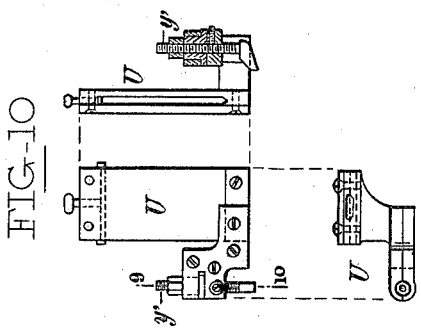

FIG-10

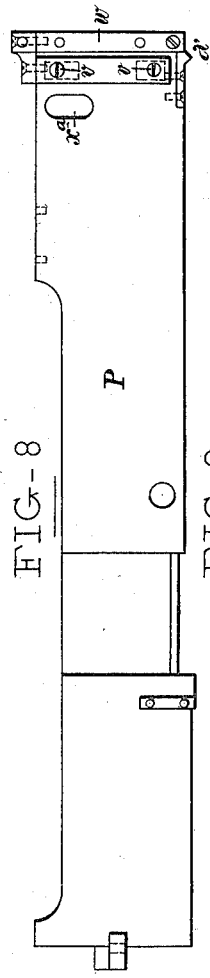

FIG-8

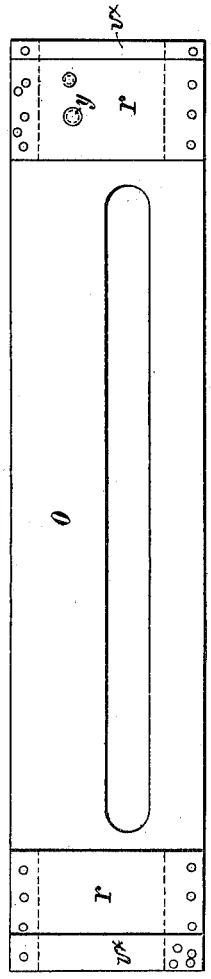

FIG-9

Witnesses

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ENGRAVING MACHINE

(Application filed July 27, 1896.)

(No Model.) 7 Sheets—Sheet 7.

FIG. 12

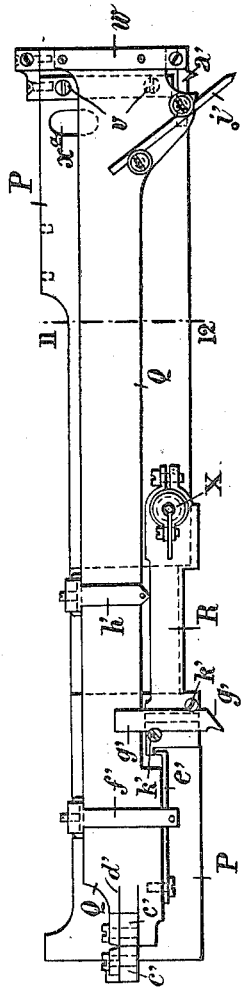


FIG. 13

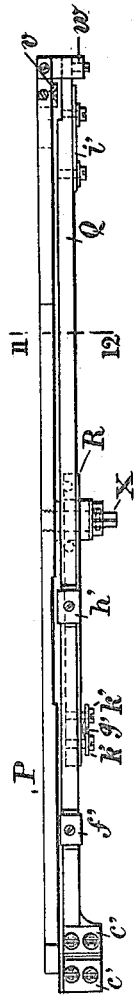
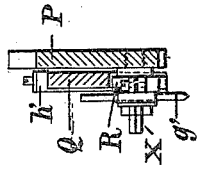


FIG. 14



Witnesses
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Xavier Janiot

Inventor.
Augustin Sartirana

UNITED STATES PATENT OFFICE.

AUGUSTIN SARTIRANA, OF LYONS, FRANCE.

ENGRAVING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 660,030, dated October 16, 1900.

Application filed July 27, 1896. Serial No. 600,663. (No model.)

To all whom it may concern:

Be it known that I, AUGUSTIN SARTIRANA, a citizen of the French Republic, residing at Lyons, in the Republic of France, have invented certain new and useful Improvements in Engraving-Machines, (for which I have obtained a patent in France, dated March 12, 1896,) of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to engraving-machines of the type shown in the French Letters Patent granted me the 29th day of November, 1894, No. 165,678, and in Swiss Letters Patent granted the 21st day of October, 1890, No. 2,805.

It is the purpose of said invention to provide a machine capable of producing engravings on wood or metal which are accurate reproductions of a photographic gelatin plate in relief, the latter being produced by the method well known in photolithographic work. It is my aim to provide a machine of this kind which shall be automatic in operation; and my invention consists in the parts and new combinations of parts hereinafter explained and then particularly pointed out in the claims.

For the purposes of the following description reference is had to the accompanying drawings, in which—

Figs. 1 and 1ª, taken together, represent my invention in side elevation, one end being partly in section in Fig. 1ª. Figs. 2 and 2ª, taken together, represent the machine in plan view. Fig. 3 is a section upon the line 5 6, Fig. 1ª. Fig. 4 is a section upon the line 7 8, Fig. 1. Fig. 5 is a face view or elevation of the steel slide. Fig. 6 is a view in two parts, showing the bar which carries the tracing-point in elevation and in plan. Fig. 7 is a view in elevation and in plan showing the bar which carries the graver. Fig. 8 is an elevation of the controlling-bar. Fig. 9 is an elevation of the cross-head. Fig. 10 is a view in three parts—viz., an elevation, a plan, and a section on the line 9 10—showing the support for the controlling-bar. Fig. 11 is a detail side elevation, upon an enlarged scale, showing the hooked spring and lifting device which is attached to the tracer-carrying bar. Fig. 12 is a detail view of the graver and tracer bars in side elevation. Fig. 13 is a plan view of the same. Fig. 14 is a section upon the line 11 12 in either of the figures last described.

The machine is composed of two principal parts—a fixed frame and a carriage.

The bed or table A, which may be of cast-iron or other suitable material, is of rectangular shape and has its upper surface made perfectly true. It is prepared in the same way as the surface plates employed in mechanical workshops and is strongly ribbed below its surface in order to insure its complete rigidity, which without this precaution might be destroyed owing to faulty erection, and it is absolutely necessary that it should be an exact plane. Upon the upper surface of this bed or table and in fixed positions are located two turn-tables B B′, which receive the plate to be engraved and the model in gelatin, respectively. These tables are adapted to move in two directions at right angles to each other in the same way as a slide-rest on a lathe by means of slideways *a*, attached to the surface of the bed or table and to one of the turn-tables, and adjusting-screws *b*, by which they can be made to occupy the desired position on the table or bed of the machine. Both the said tables are surmounted by a plate of bronze *c*, pivotally mounted on their centers by means of a circular tenon which fits exactly into a recess or mortise provided in the supports. Into these bronze plates, of which the arrangement has been described, two circular plates *d*, of the same metal, are carefully fitted in close contact with the surfaces of the rectangular plates. These circular plates are intended to serve the same purpose as the others, but are of smaller dimensions, so as to permit of turning the objects placed upon them through any desired angle.

The support or table B, intended for the reception of the plate to be engraved, may receive when necessary a current of hot air for raising the temperature of the said plate by means of recesses formed in the body of the support and corresponding to a circular opening *e* in the bed or table A, as shown in Fig. 1.

The bed or table is provided at each of the short sides thereof with a slideway C, of cast-iron, at each extremity of which is arranged

a bearing *f*, the said slideways being firmly fixed to the said bed by means of screws *j''* and bolts *k''* in such a manner that the axes passing through the bearings of each of the said slideways, the surface *g*, on which the carriage slides easily, and also the faces of the abutment *h* will all be strictly parallel one with another and with the surface of the bed or table A. In the bearings *f* of the slideways C two accurately-cut and similar screws D D are mounted at their extremities, which are not screw-threaded. These screws, which are normally free to turn in their bearings, may be fixed during the execution of an engraving by means of a set-screw *i* in the bearings *f* at the side where the heads of the screws are situated. They are prevented from moving in the direction of their length at one end by means of the said heads and at the other by a nut. A chain E gears with the two chain-wheels F F, arranged on the extremities of the screws D D, and enables the motion imparted to one screw by means of a crank or handle applied to the square end thereof to be transmitted to the other in whichever direction it takes place after loosening the set-screws *i*, which are situated in the bearings.

The frame-plate or main support G of the carriage is parallel with the longer sides of the bed or table and occupies a position exactly at right angles to the slideways C C. Said frame-plate is formed of bronze and is strongly ribbed in order to make it very rigid.

The carriage-frame is supported at its extremities on the bearing-surfaces *g g*, which should be true and smooth and parallel to the surface of the table and to the abutments *h h* in the slideways C. The extremities of said frame are connected to two supports H H by strong screws, so as to be practically integral with same.

The carriage is intended to slide easily along the slideways C C, always remaining strictly perpendicular to the same by means of bronze guide-blocks *j*, with which the lower extremities of the supports H H are provided.

The supports H H, above referred to, which are of steel, carry in a recess provided for the purpose ratchet-wheels I I, the axes of which coincide with those of the main screws D D, which pass through them.

The ratchets I I are provided with levers J J, having pawls *o*, which engage the teeth of the ratchets when moved in one direction and ride over said teeth when moved in the opposite direction. Said levers J J are pivoted to rock in arcs which are concentric with the screws D, and they are moved by coupling-bars K, one at each end of the frame G. These coupling-bars are dovetailed in cross-section and lie in recesses of corresponding form in the slide N, as shown in Fig. 4.

The operation is as follows: To one of the coupling-bars K, (see the second part of Fig. 2) is attached, by means of a screw, a rider *l'*, at the end of which is seen a rod *k*, to one end of which is attached a ring *l*. A spring *n* is coiled upon the rod *k*, one of its ends pushing against the ring *l* and its other end when the carriage moves to the right against a tappet *m*, which is placed against the vertical guide *w* of the controlling-arm P. When the carriage after finishing its operative movement returns to the right in order to repeat the operation and make a new stroke of the burin, the tappet *m* presses on the spring *n*, which pushes moderately upon the ring *l*, the rod *k*, and the rider *l'*, which is attached to it. The connecting-rod *k*, which has a gudgeon at each of its extremities, is thus brought into action upon the ratchets I I through the pawl-levers J J, which turn the said ratchets through a space or arc corresponding in extent to one or more of the teeth on said ratchets. This space is regulated by the adjustment of the ring *l* upon the rod *k*. The coupling-bar K, which connects the pawl-levers, is afterward brought back to its original position by means of a stud *p*, against which the cross-head O strikes in its return movement. The ratchet-wheels carry in front on one of their diameters two projections or tenons *l'' l''*, (shown in dotted lines in Fig. 1,) engaging with the recesses *m'' m''*, provided on the rear face of the cylindrical bronze nuts L L, which are arranged upon the screws D D, between the ratchet-wheels and the engaging blocks M M, with which the supports of the carriage-frame are provided. The frame G has also fixed by three screws *g* on its front face a steel support N, from end to end of which the cross-head O travels with a reciprocating motion, which is imparted to it by a motor S through the speed-reducing gear T. Said cross-head O carries with it three bars P Q R, these being the parts which sustain the graver and tracer. These parts are denoted by the letters P, R, and Q, the bar R carrying the graving-tool *g'* and the bar Q carrying the tracing instrument *i'* and so connected that the movements given to the latter by passing over the reliefs of a pattern will be reproduced in the former, so that if an operative movement is at the same time imparted to the bars the graver will be caused to cut in a plate submitted to its action an accurate imitation of the pattern. The specific functions and relations of these parts will be explained in their order hereinafter.

The cross-head O (shown separately in Fig. 9) is provided near its ends with bronze boxes *r*, having flanges $v^{\times}$ arranged vertically on said boxes at the ends of the cross-head O. The cross-head is guided on the support N by blocks *t*, which are adjusted by set-screws *u*. (Shown in Fig. 4.)

The bar P, which is arranged against the boxes *r* of the cross-head O and which is free to move in a vertical direction, slides between the flanges $v^{\times}$ on the bronze cross-head boxes. This bar, which I term the "controlling-bar,"

carries at one of its ends, secured thereto by screws v, a vertical guide w, and its motion of translation is imparted to it by the cross-head O, which carries it along by the engagement of a stud y, which is screwed into a threaded opening in that one of the bronze cross-head boxes r which overlies the opening or mortise x^a in the end of the controlling-bar P, as shown in Fig. 9. When the parts P, Q, and R are operatively connected, as shown in Figs. 12, 13, and 14, and arranged on the cross-head, the stud y lies in the opening x^a and the controlling-bar P is carried along thereby, accompanying the movement of the cross-head O. The horizontal position which it assumes is obtained by its resting on one side by means of its support U, which is located at some point of its length upon the plate z to be engraved and on the other side at its extremity by means of a shoulder a', formed on its edge and intended to slide upon the bridge V, which is itself supported upon the edges of the glass support b' for the gelatin print. At the other extremity of the controlling-bar P and at such a height as to insure that the bar Q, carrying the blunt or tracing point, shall have as nearly as possible a corresponding position to that occupied by the controlling-bar jaws c' are arranged to connect the two bars by means of a thin steel blade d', which serves as an axis and at the same time leaves the bar Q perfectly free to move vertically without causing wear or allowing play between the extremities of the parts. This bar Q, carrying the blunt or tracing point, has on its lower edge a spring e', the tension of which can be easily regulated by means of the slide f' according as it is necessary to increase or diminish the penetrating force of the graver g' to obtain an engraving more or less deep. A second slide h', similar to that just referred to, which is also fixed to the bar Q, transmits to the bar R, carrying the graver, the movements which are imparted to the bar Q by the blunt point i', which is fixed to it, in following the reliefs of the gelatin print j'. The bar R, carrying the graver, which is below the bar Q, is fixed to the controlling-bar P by an axis X, around which it can oscillate in a vertical direction, pressed above or below by the slide h' and the spring e'. This bar R carries, fixed firmly to its front face by two set-screws k', a graver g' for cutting the metal plate.

The engraving-machine, the details and working of which have been hereinbefore described, produces really good results only when the tool acts on the forward stroke. If it cut the metal during the reverse movement—that is to say, when the apparatus is resuming its initial position—in other words, that which it had at first—the metal would not offer a suitable surface for the firm and free cut which is required in my system of engraving. In order to remedy what is, in my opinion, a grave defect in spite of all the attempts which I have made to apply to this part of my machine the advantages which it was thought to obtain by the employment of electricity, I arrange on the support N two small brackets l^a and l^b, which support parallel to the bar Q, carrying the blunt point, a horizontal rod m', provided with two tappets n' and s'. These tappets are capable of adjustment upon the rod m', so that they can be separated by a greater or less distance, according to the dimensions of the print to be reproduced. The two tappets n' and s' remain without movement during the action of the engraving-tool g'. Said tappets accompany the frame G in its movement of displacement along the slides C C, said movement being produced by the screw-shafts D D; but they are fixed, so far as regards longitudinal movement, in a line parallel with the cutting movement of the engraving-tool. As the graving-tool moves forward a pin o' at the end of the bar Q is brought into engagement with the tappet n' and rides upward upon an inclined face on said tappet until a spring-hook p', also mounted on the bar Q, as seen in Fig. 11, is forced against and over a lug q', which projects from the vertical guide w upon the end of the controlling-bar P. This operation raises the tracer-carrying bar Q, and by the adjustment of the tappet n' upon the rod m' the tracer is raised from the pattern at the exact point required, the graving-tool being also raised at the same instant. Both tools are held in raised position by the engagement of the spring-hook p' with the projecting lug q' during the movement which precedes another operation of the graver. Upon the completion of this movement the pin o' is brought into engagement with the other tappet s', which forces the bar out of engagement with the guide. The pin o' then falls upon the flat face of the tappet s' and upon the forward or operative movement of the parts resumes its normal position.

The principal parts constituting my automatic engraving-machine when constructed with precision and assembled in the manner above described insure an exact and regular action of the rectilinear perpendicular movements to which the assemblage of the three coupled bars P, Q, and R is fitted. These parts effect the work required of them—that is to say, that by their arrangement I reproduce the reliefs of gelatin prints obtained by photographic means in either simple parallel cuts or cross-hatchings of a width exactly proportional in every point to the print which serves as a model. As a result of this the surface of the metal plate receives the inking medium employed in such a manner that by the juxtaposition of the lines I obtain, when printing from the plate, prints to any number, which reproduce with the greatest fidelity the model from which it was desired to form an engraving, even when the printing has been done on the quick rotary machines now in use, while doing away with punching and considerably reducing the preliminary

operations. Another condition fulfilled by this method of reproduction is that it is not essential, as in the different engraving processes now in use, that the metal employed should be of an absolutely plane surface, a simple cleaning of the same being all that is required to make it as ready for use as the most carefully-prepared plates.

Owing to the special arrangements applied to my automatic engraving-machine, as above described, and to the absolute exactness of its construction, I am able to execute a relief-line engraving which has parallel lines only on metal or on wood in the following manner: I uncover sufficiently the turn-tables *d d* in sending back the carriage by means of the screws D D, which I actuate by a handle applied to the square end of one of them after having previously freed the ratchet-wheels from the pawls. I then fix upon the bronze plates *d d*, above referred to, either with wax or otherwise, the substance to be engraved, whether metal, wood, or any other suitable substance, upon its glass support *b'*, and the gelatin print in the same way, the engraving-plate at *z* and the gelatin at *j'*, the gelatin having been obtained by exposure to the sun's rays behind a negative photographic plate representing any subject whatever which it is desired to reproduce by my engraving process. The plates so fixed should have their centers upon one and the same line parallel to the slide N and should correspond as nearly as possible with the centers of the tables upon which they are fixed. Their dimensions should be such that while the blunt point *i'* is traversing the surface of the gelatin *j'* the graver *g'* does not leave the engraving-plate *z*. I then move the carriage back until the blunt point *i'* coincides with a point upon the gelatin print corresponding with the point where the work of the graving-tool should begin upon the plate *z*. At the same time I cause the nose or shoulder *a'* of the controlling-bar P to rest upon the upper surface of the bridge V, holding it there by means of the screw *t'* and the spring *u'*. The bridge V lies parallel with the line of movement of the blunt point *a'* and tracer *i'*. The lower face of said bridge is recessed to prevent it from coming in contact with the surface of the gelatin print, and its ends rest on the edges of the glass support *b'*, on which said print is placed. Said bridge receives movement from the frame G, by which it is carried step by step from one side of the gelatin print to the other. It preserves the same position relatively to the blunt point *a'* throughout the process of engraving. The head of the binding-screw *y'* of the support U (see Fig. 10) now rests upon the steel ribbon *v'*, which is suitably stretched by a threaded bolt Z' (Figs. 1 and 2) on the surface of the engraving-plate *z* in such manner that it is exactly opposite the point of the graver *g'*, fixed to the graver-arm R, and the shoulder *a'* bears the same relation, so far as its position is regarded, to the blunt point *i'*. The graver *g'* in the position which is given to it should be at such a height that when the required cuts have been made it will skim over or barely touch the surface of the metal in the parts corresponding to the highest reliefs of the gelatin print, and if it has been set in such a manner as to have the necessary angle it should impart to the plate the exact effect of the model. At the same time also I fix the screws D D in their bearings *f f* by means of the set-screws *i i*. I arrange the shoulders of the rods *b'' b''* at the required distance for reversing the movement when the blunt point coincides with each side of the frame *i'' i''* of the gelatin proof. I also regulate the distance separating the tappets *n'* and *s'*, which raise and depress the tracer-carrying bar Q, in order that said tracer, as well as the graver, shall execute their work exactly in the limits of the frame which has been decided upon. The ring *l* of the rod *k* is in its turn arranged in such a manner that the blunt point *i'* being upon the edge of the frame containing the gelatin print the block *m*, by means of the spiral spring *n* (which actuates the pawl-levers through the said rod *k*) shall have moved the pawls of the levers J J to the extent of their travel. The stud *p* on the coupling-bar K having also been arranged so that during the backward movement, which will afterward be imparted to it by the cross-head, the pawls *o* will pass the same number of teeth previously decided upon, the machine is now in working order. If I wish to execute an engraving, I complete the electric circuit by actuating the lever of the contact-breaker *g''*, which is arranged upon the frame. The main current immediately excites the poles of the reversible motor. A part of the current now traverses the commutator Y, passing by two of its contacts to the armature, which it sets in motion in such a direction that after having been reduced by a device T, which includes a pulley upon which a traction-cable *d''* is wound, the cross-head and the arms, with which it is provided, move in a regular manner while the graver makes a cut. During this movement the tracer-carrying bar Q is raised and depressed in a vertical direction by the action of the controlling-bar P sliding upon a smooth surface of the engraving-plate *z* and then by the blunt point *i'*, which follows the reliefs of the gelatin print. As a consequence of the movements of the said arm Q the arm R, carrying the graver, with which it is in constant contact through the spring *e'*, which presses it against the slide *h'*, executes the same movements and in the same direction as those of the tracer-arm Q—movements which will be of a magnitude which can be confined within the desired limits by adjustment of the slide *h'*. The graver *g'*, which is firmly fixed to the arm R by set-screws *k' k'* and to which motion is imparted by the travel of the apparatus along

the slide N of the frame G and of the arms, cuts the metal in transforming the reliefs of the gelatin print into cuts of corresponding size. At the moment when the blunt point i' is at the end of the travel which has been assigned to it—that is to say, at the other extremity of the frame for the gelatin print—the cross-head O having with one of its ends struck against the stud p of the coupling-bar K, connecting the pawl-levers, the pawls o, carried by said levers, are caused to engage with the teeth of the ratchets at such points as to produce the next ensuing movement of the frame or carriage G. In effecting this engagement the levers J J are turned upon their supports in such a direction that the pawls will ride over the teeth of said ratchets without operating the latter. The pin o', which in this motion of translation of the cross-head O, with which it is connected, has remained free at a small distance from and above the rod m' of the lifting tappets s' and n', strikes against the tappet n', and by the form which is given to this tappet the bar Q, carrying the point to which it is firmly fixed, rises and is held in this new position by the hooked spring p', which bears against the piece q', fixed to the vertical guide w. The graver and the point immediately leave the surfaces upon which they are resting. In this motion of the cross-head O from the gelatin print j toward the engraving-plate z the shoulder of one of the rods b'', situated behind the said cross-head, actuates the lever of the commutator and the direction of the current is instantaneously reversed. The return of the cross-head O to its initial position takes place immediately. During this movement the coupling-bar K, connecting the pawl-levers, is urged in the opposite direction to the end of its stroke by the pieces m n, which force the nuts L L to turn with a progressive movement equivalent to the distance between the cuts and so advance the carriage and all the parts attached to same by the same movement. This advance of the carriage G may be obtained either by causing the nuts L L to turn, as shown in the accompanying drawings, and keeping the screws D D fixed or equally well by fixing the nuts L L and causing the screws D D to rotate. At the same moment the pin o' strikes against the upper portion of the other tappet s' the hooked spring p' leaves the piece q' and the tracer-carrying bar Q rests the blunt point on the gelatin print. The graver, which has made the same movement, again places itself in contact with the engraving-plate, the switch has resumed its original position through contact with the forward shoulder of the rod b'', the current passes through the armature in the reverse direction, and a second cut is executed, after which the cross-head takes back the apparatus in the same manner ready for the next cut, and so on, as before, until the whole surface of the gelatin has been gone over by the blunt point, after which the machine ceases working altogether, the current being interrupted by the action of a projection h'' upon the circuit-breaker g''.

As above stated, the engraving the production of which we have been considering is a plate representing any desired subject in relief by parallel lines only; but supposing it is desired to reproduce in relief the same subject by cross-hatching and with equal exactitude, such as cannot be attained by any process hitherto in use because of the length of time during which the action of the acids employed has to continue, (more especially when a relief-engraving is required,) which action diminishes the strength of the drawing and endangers its sharpness, the arrangement of the machine as above described is in no wise altered. It is sufficient to simply arrange the gelatin print and the engraving-plate upon the turn-table c c or d d, according to their dimensions, in the manner already indicated for an engraving with parallel lines only, taking the precaution, however, to make their centers coincide as exactly as possible with those of the turn-tables and to see that the distance which separates these centers is exactly equal to the distance separating the point of the graver g' and the point of the tracer i'.

The first operation (that of producing the parallel cuts) may be executed in the manner above described, the cross-cuts being produced in the same way after the turn-table has been caused to turn through the desired angle.

From the above description of the succession of operations in engraving by my process by means of a gelatin print and a machine arranged as above set forth it is clear that if the angle of the graver has been correctly determined and suitably located on the apparatus at the required height, (which it is quite easy to effect,) the distances between the cuts being known, as well as the maximum height of the reliefs on the gelatin, it will be possible to obtain, by simply completing the electric circuit and without its being necessary to superintend the successive operations of engraving, a plate engraved in relief, either in parallel lines only or cross-hatching, which is an exact reproduction of the subject selected, capable of being used for printing immediately without requiring any retouching and for a large number of impressions, even with the quick rotary machines which are now employed.

Should it be impracticable to make use of an electromotor for actuating the machine, any suitable and independent motor may be used.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In an engraving-machine, the combination with a bar Q having a tracing-point at one end, of a bar R carrying a graving-tool, a cross-head O, a support on which the cross-

head is movable, a controlling-bar P lying parallel with and pivotally connected to the bar R, a box upon one end of the cross-head provided with a stud lying in an opening in the controlling-bar P, a flexible connection between the bar Q and the controlling-bar P, and a slide on the bar Q resting on the edge of the bar R, substantially as described.

2. In an engraving-machine, the combination with a bar Q having a tracing-point, of a bar R lying beneath the bar Q and carrying a graving-tool, a controlling-bar P lying against the bars Q and R, and having a pivotal connection with the latter, a cross-head O movable on a suitable support, one end of said cross-head having a fixed stud to engage an opening in one end of the controlling-bar P, a flexible connection between the latter and the bar Q at the end farthest from the tracer, and a slide on the bar Q resting on the edge of the bar R, substantially as described.

3. In an engraving-machine, the combination with a bar Q having a tracing-point at one end, of a controlling-bar P parallel with said bar Q and flexibly connected to it at the other end, a bar R pivotally connected to the controlling-bar P between the ends of the latter and lying beneath the bar Q, a graving-tool carried by the end of said bar R, an adjustable slide on the bar Q to rest on said bar R between its pivotal point and the end carrying the graver, and a cross-head parallel with the controlling-bar P and having at one end a loose connection with the same, substantially as described.

4. In an engraving-machine, the combination with a cross-head O, movable on a support N and having at one end a fixed stud, of a controlling-bar P provided with an opening near one end to receive said stud and having at the same end a blunt point a' projecting below its lower edge, a bar Q having a tracing-point lying beneath the blunt point a' and flexibly connected to the controlling-bar P at its other end, a bar R having one end pivotally connected to the controlling-bar P near the middle of the latter and carrying a graving-tool on its other end, a slide on the bar Q resting on the edge of the bar R, a support for a gelatin print, and a bridge V having its ends movable on said support and spanning the print, substantially as described.

In testimony whereof I have hereunto set my hand this 8th day of June, 1896.

AUGUSTIN SARTIRANA.

Witnesses:
JEAN GERMAIN,
XAVIER JANICOT.