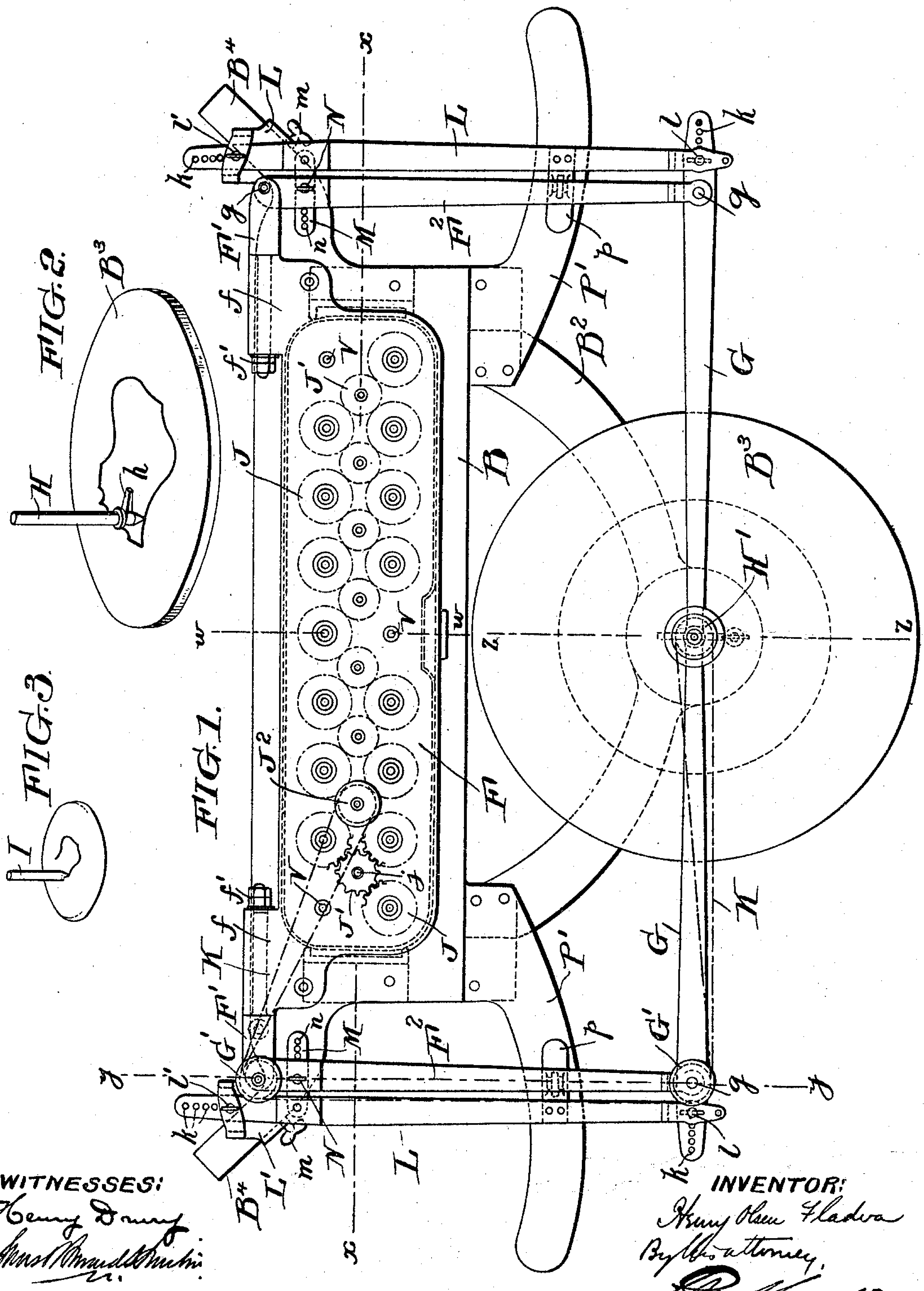
No. 638,411. Patented Dec. 5, 1899.

H. O. FLADVA.

PANTOGRAPH ENGRAVING MACHINE.

(Application filed Apr. 3, 1893.)

(No Model.) 4 Sheets—Sheet 1.



WITNESSES:

Henry Drury

Ernst Bernhard Bruhn

INVENTOR:

Henry Olsen Fladva

By his attorney,

R. H. ...

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

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4 Sheets—Sheet 2.

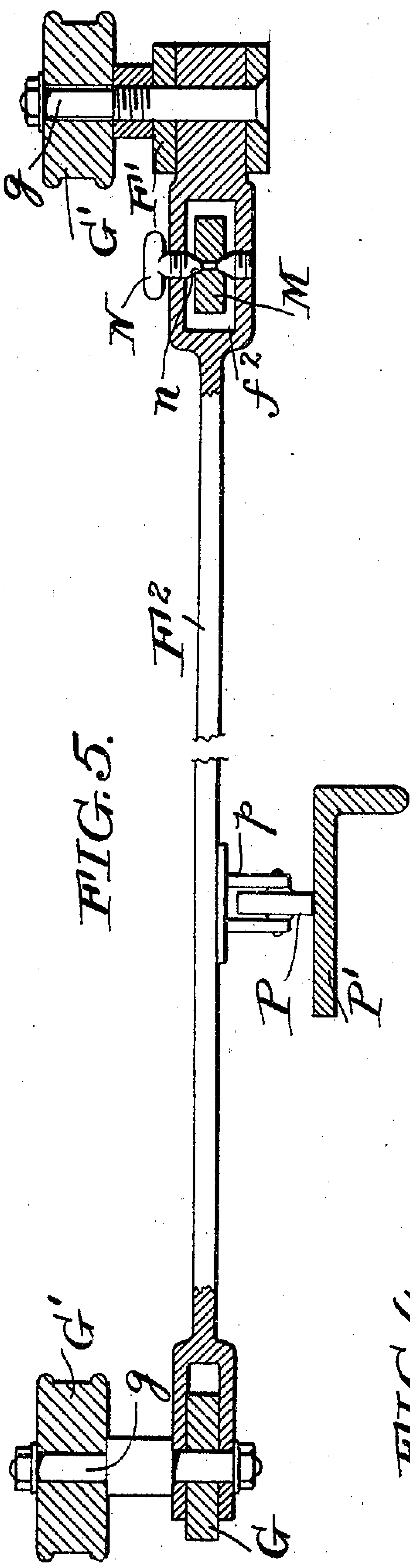

FIG. 5.

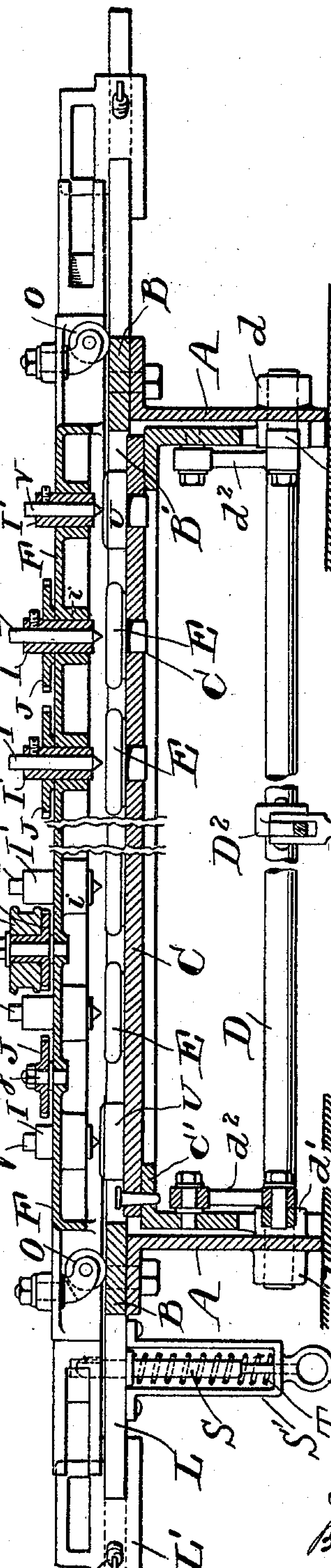

FIG. 4.

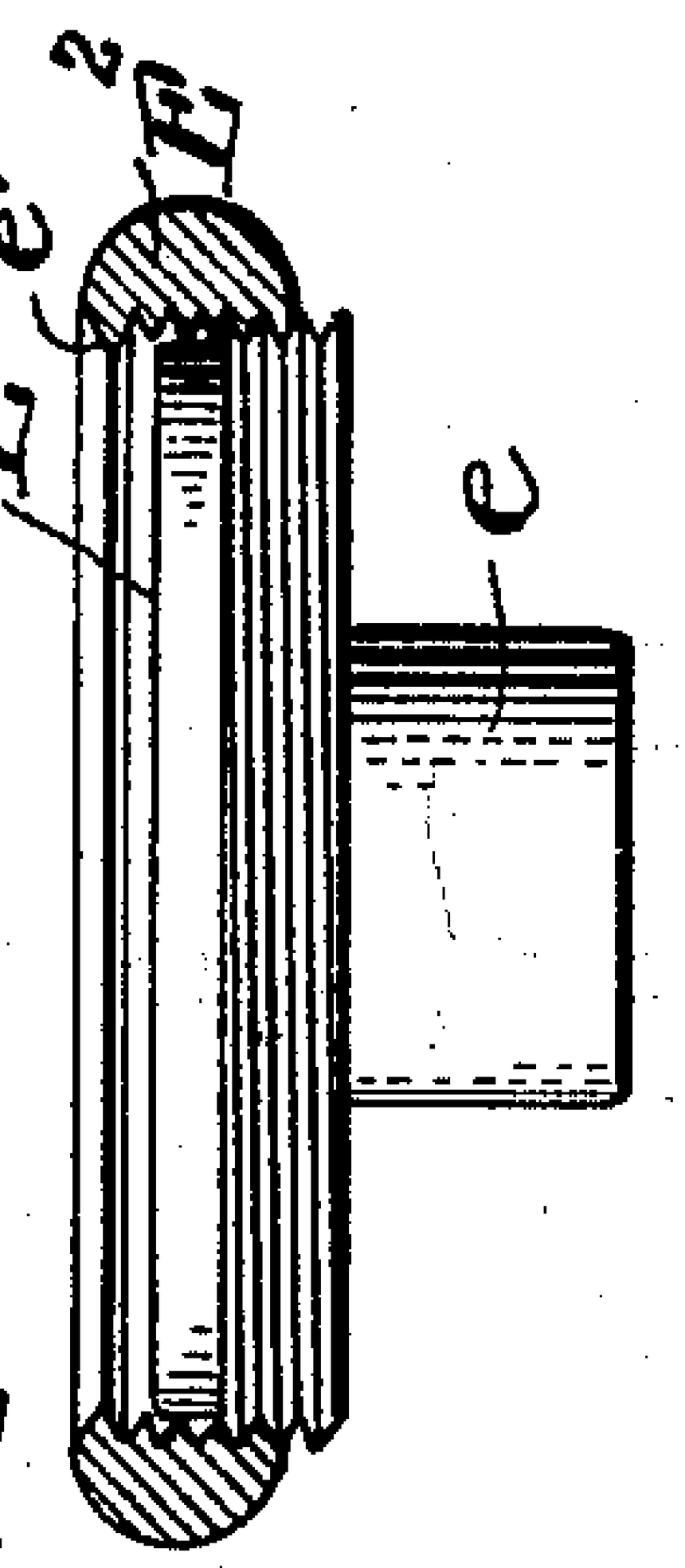

FIG. 6.

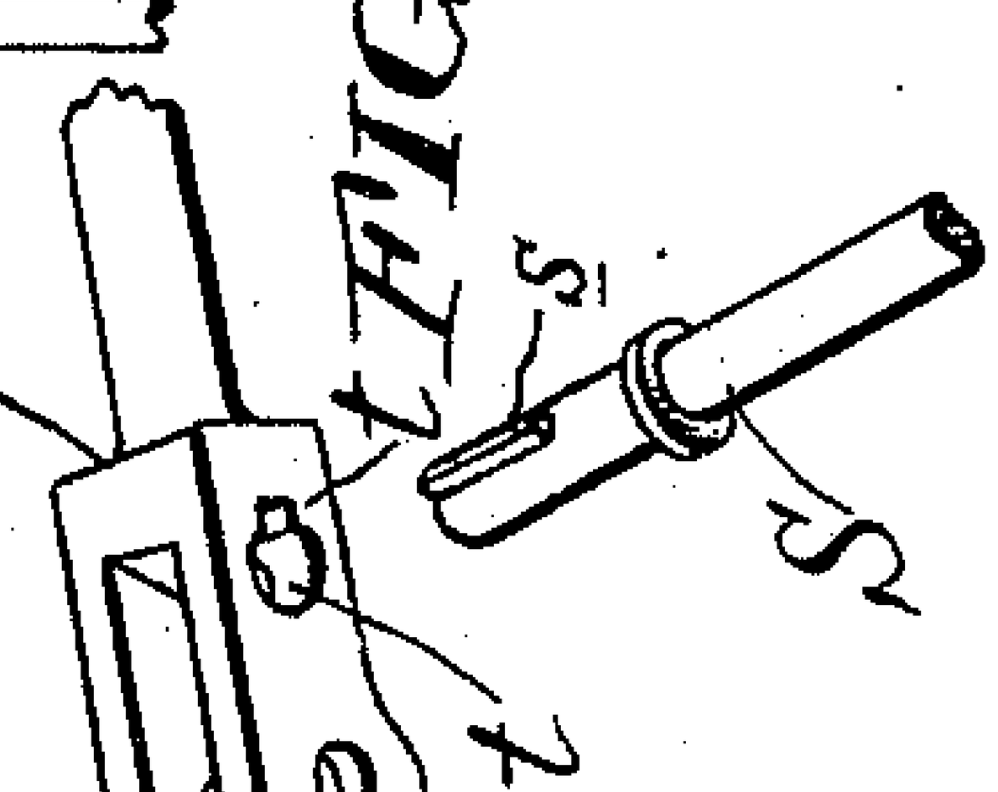

FIG. 8.

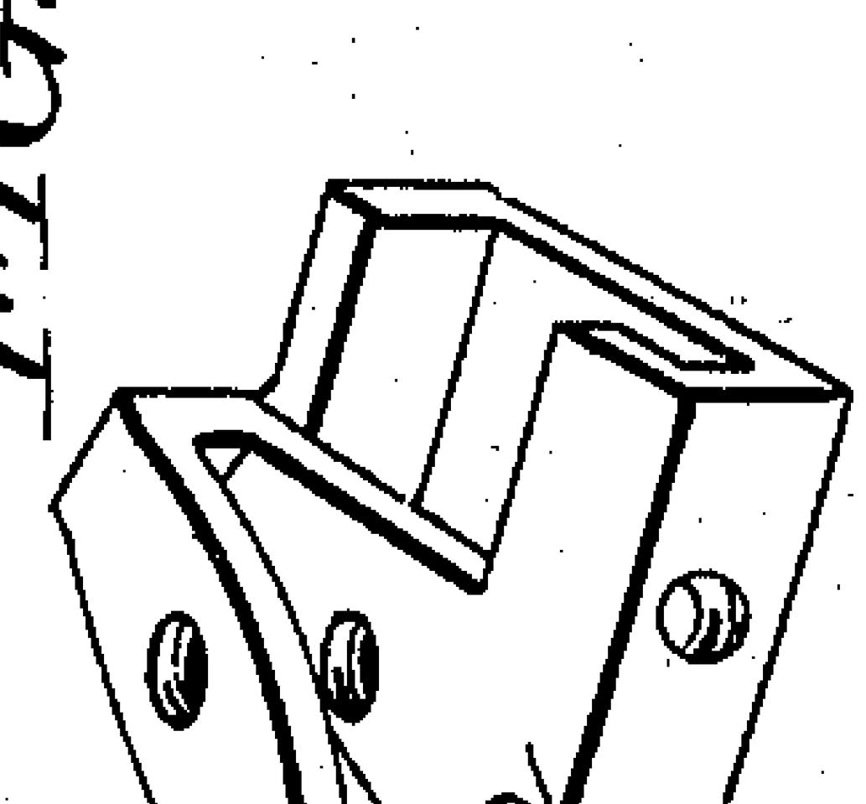

FIG. 7.

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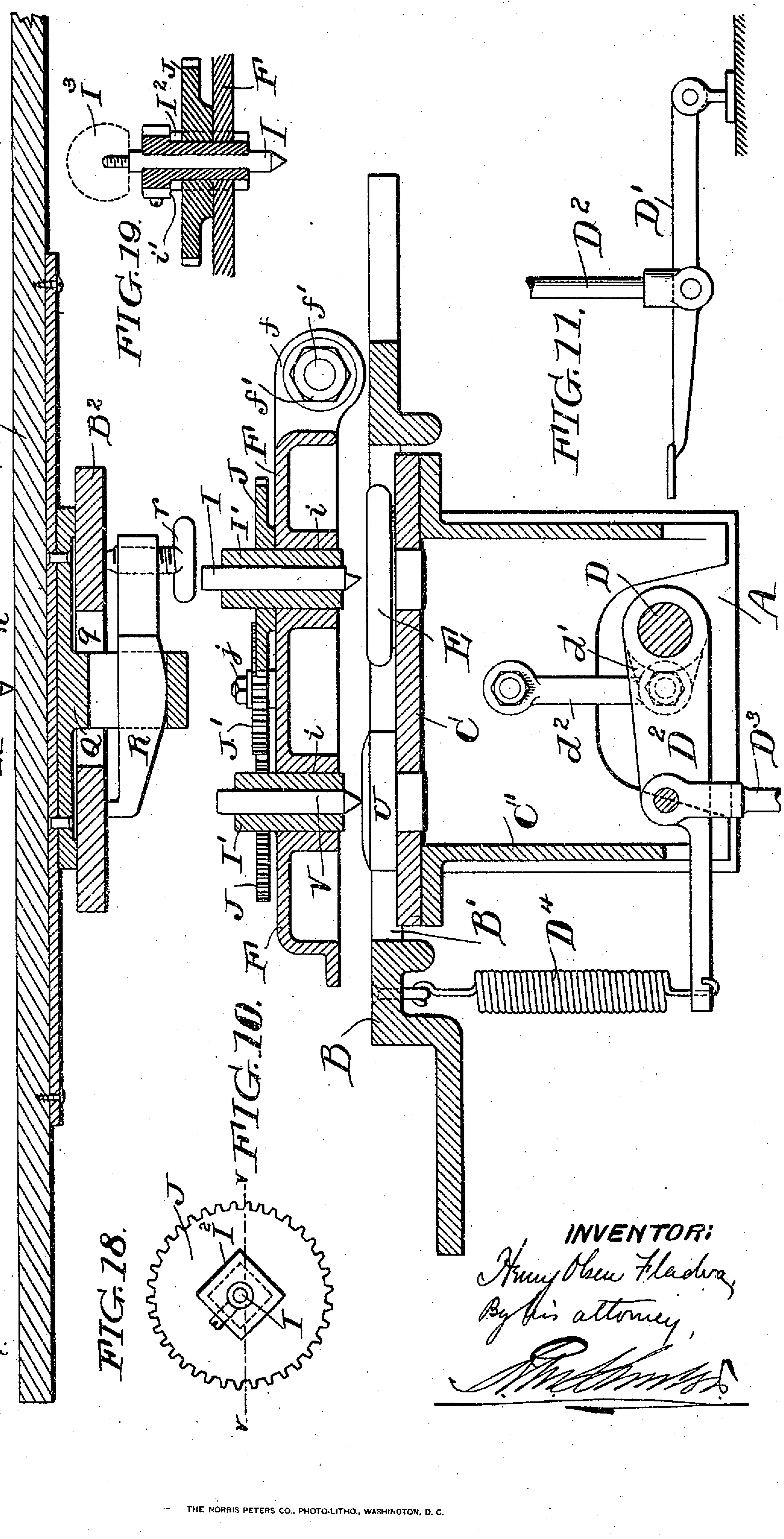
(No Model.) 4 Sheets—Sheet 3.



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(Application filed Apr. 3, 1893.)

(No Model.) 4 Sheets—Sheet 4.

FIG. 12.

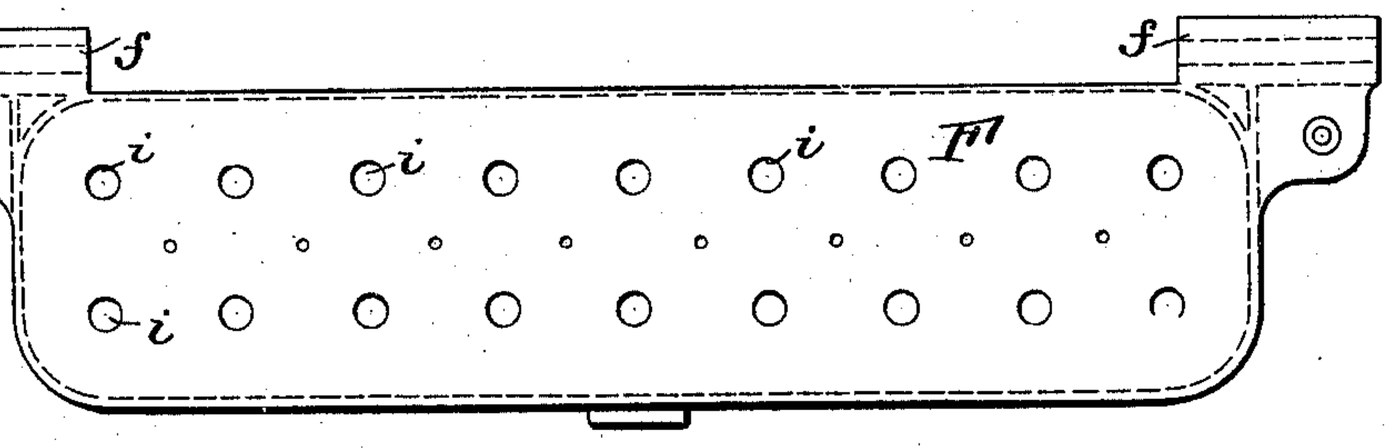


FIG. 13.

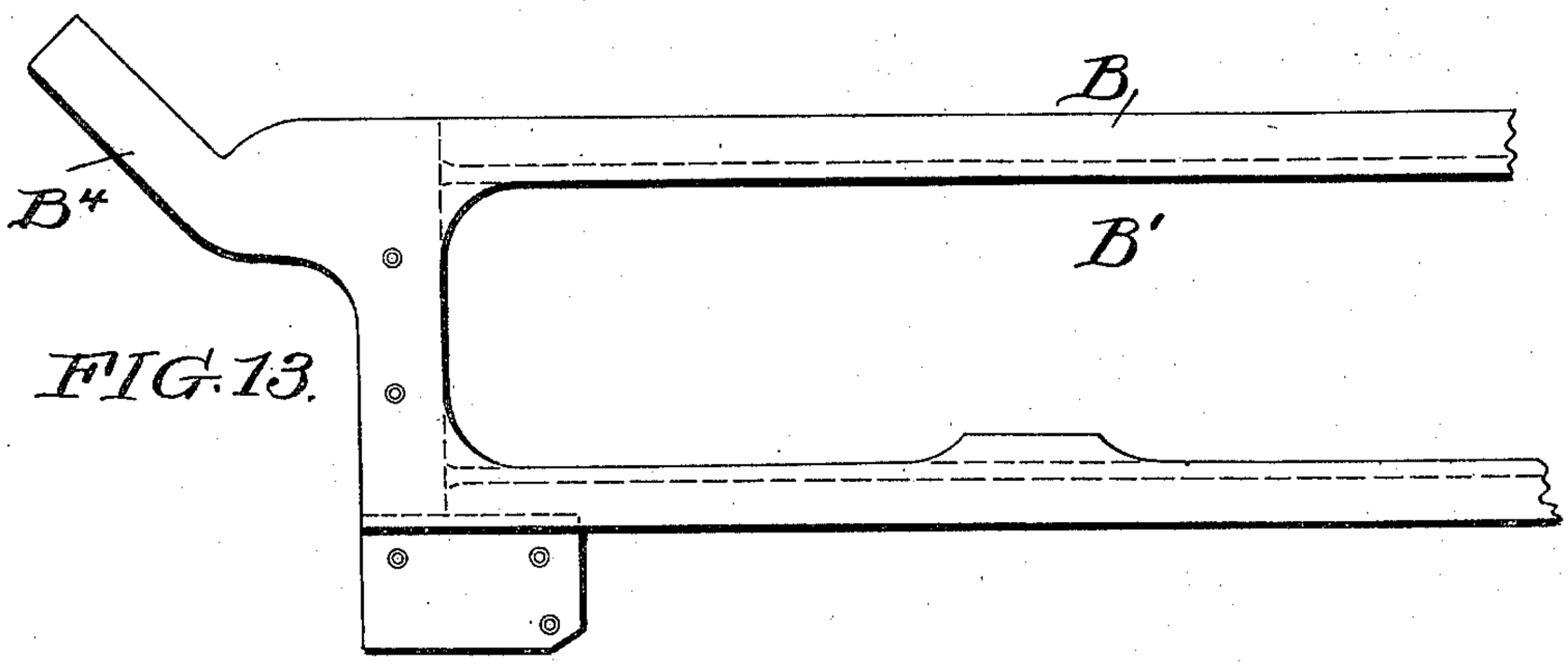


FIG. 14.

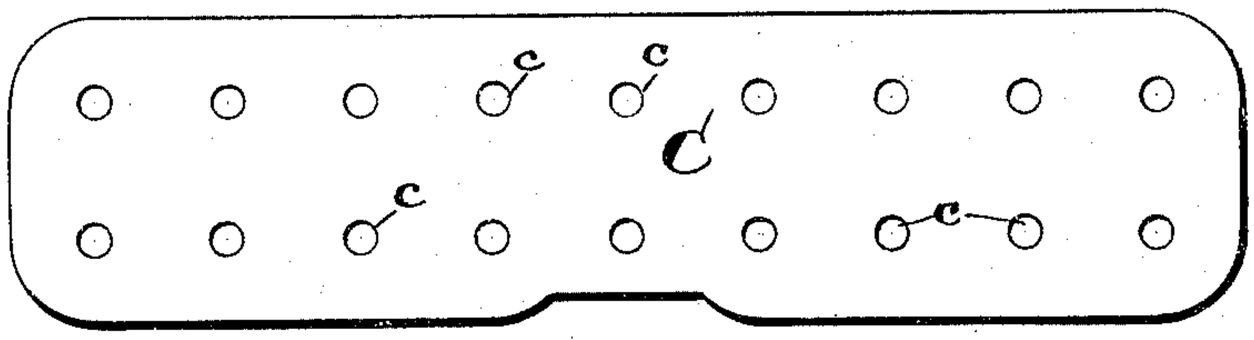


FIG. 15.

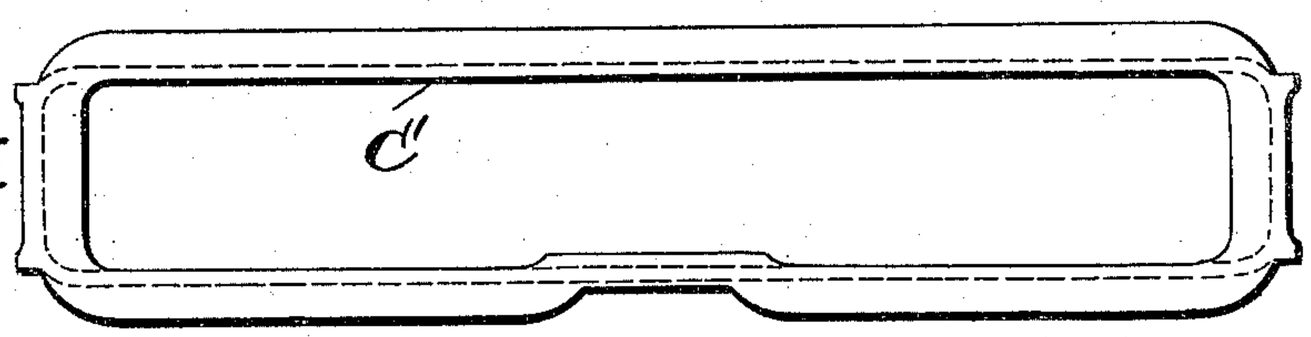
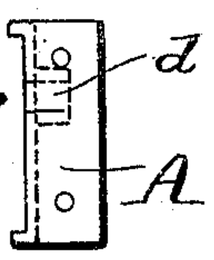


FIG. 16.

FIG. 17.



WITNESSES:

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Thos. H. Russell Butler

INVENTOR:

Henry Olaus Fladva

By his attorney

Thos. H. Russell Butler

UNITED STATES PATENT OFFICE.

HENRY OLSEN FLADVA, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE KEYSTONE WATCH CASE COMPANY, OF SAME PLACE.

PANTOGRAPH ENGRAVING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 638,411, dated December 5, 1899.

Application filed April 3, 1893. Serial No. 468,761. (No model.)

To all whom it may concern:

Be it known that I, HENRY OLSEN FLADVA, of the city and county of Philadelphia and State of Pennsylvania, have invented an Improvement in Pantograph Engraving-Machines, of which the following is a specification.

My invention relates to pantograph engraving-machines; and it consists of certain improvements which are fully set forth in the following specification and shown in the accompanying drawings, which form a part thereof.

My invention is more especially designed for engraving watchcase backs or covers and similar objects, but is not necessarily limited to such use and may be employed for any of the purposes of a pantograph.

The particular object of my invention is to provide a pantograph apparatus for engraving simultaneously a number of watchcase backs or covers, &c., and to accurately reproduce the design or figure in clean and sharply-defined lines upon the metal surfaces, so that the engraving may possess as nearly as possible the character of handwork.

It is also the object of my invention to enable the pantograph to be easily adjusted to suit variations in size of the objects to be engraved.

In carrying out my invention I employ a supporting-table for the watchcase-covers or other articles to be operated upon, a movable carriage provided with the operating-tools, a jointed pantograph-operating frame connected with the carriage, and a tracing-tool carried by the pantograph-operating frame and causing the tool-carrying carriage to move over the supporting-table when the tracing-tool is moved over the design. To obtain a clean sharp cut from the engraving-tools, I arrange them in the movable carriage with freedom to rotate upon their axes, and I connect them by suitable power-transmitting connections with the tracing-tool, which is also rotatable upon its axis, so that as the tracing-tool is turned by the hand of the engraver as it is moved over the lines of the design each of the engraving-tools will be similarly turned upon its axis. By this means the sharp cutting edges of the tools may always be presented to the metal in the direction of the movement of the tool in cutting, so that a clean sharp cut will be obtained, as in handwork.

My invention above relates to improvements in the construction of the pantograph-operating frame and to various combinations of parts, which are fully described hereinafter and claimed.

I shall now refer to the drawings for the purpose of particularly describing the construction and mode of operation of my improved pantograph.

Figure 1 is a plan view of my improved pantograph engraving-machine. Fig. 2 is a perspective view of the tracing point or finger and the design-plate. Fig. 3 is a similar view of one of the engraving-tools and objects to be engraved. Fig. 4 is a longitudinal sectional view of the machine on the line *x x* of Fig. 1. Fig. 5 is a transverse vertical sectional view on the line *y y* of Fig. 1, on an enlarged scale. Fig. 6 is an enlarged sectional view of one of the supports for the objects to be engraved. Figs. 7 and 8 are perspective detail views of detached portions of the machine. Fig. 9 is a transverse vertical sectional view on the line *z z* of Fig. 1, on an enlarged scale. Fig. 10 is a transverse vertical sectional view on the line *w w* of Fig. 1, on an enlarged scale. Fig. 11 is a side elevation of the foot-lever device for operating the object-supporting frame or table. Fig. 12 is a detail plan view of the tool-holding carriage. Fig. 13 is a detail plan view of a portion of the supporting and guiding frame of the tool-holding carriage. Fig. 14 is a detail plan view of the supporting table or frame for the objects which are to be ornamented. Fig. 15 is a detail plan view of the supporting-frame for the table shown in Fig. 14. Figs. 16 and 17 are detail views of supporting-plates carried by the frame shown in Fig. 15. Fig. 18 is a plan view of one of the engraving-tools and its operating devices, illustrating a modification; and Fig. 19 is a vertical sectional view of the same on the line *v v*.

A A are stationary side frame pieces or supports which may be secured to the work table or bench.

B is a horizontal stationary guide-frame car-

ried by the pieces A A and having a central opening or aperture B′.

B^2 is a bracket carried by the frame B, upon which is supported the tracing frame or plate B^3.

C is the table or support for the objects to be engraved or drawn, located within the opening B′ of the guide-frame B and movable therein.

C′ is a movable frame carrying the table or support C and adapted to be raised and lowered for the purpose of moving the table C in the opening B′. For this purpose I prefer to employ a rock-shaft D, journaled in suitable bearings *d* in the stationary frames A and having arms *d′* connected by links d^2 with the sides of the frame C′. The rock-shaft D may be rocked by a foot-lever D′, connected with an arm D^2 of the rock-shaft D by a connecting-rod D^3.

D^4 is a spring acting on the arm D^2 to normally hold it in an elevated position, and thus normally hold the table C raised. Other suitable lifting devices for raising the table C may be substituted for those shown without in any way departing from the invention.

The table C is provided with a series of sockets *c*, adapted to receive the chucks E, which carry the watchcase-backs or the other objects to be engraved or ornamented. In Fig. 6 I have shown in detail the preferable construction of these chucks. This consists of a disk E′, having a shank *e* adapted to fit the socket *c* of the table, and a screw-threaded clamping-ring E^2, adapted to be screwed upon the threaded periphery of the disk E′ and having a clamping-ring *e′* which is adapted to fit upon the edge of the watch-back or other object and clamp it firmly in the disk. This form of chuck is particularly adapted for use with watchcase covers and backs. If desired, however, any other suitable form of chuck may be employed.

F is a movable carriage located over the table C and carrying the operating-tools. This carriage is hinged on a horizontal axis at its rear by the extensions *f* and nuts *f′* to the pieces F′, which are connected by pivoted links F^2 F^2 with the two bars G, which are pivoted together over the tracing plate or frame B^3 and carry the tracing-tool H at their point of juncture.

G′ represents idler rollers located at the joints of one link F^2 with the bar G and piece F′. In the drawings I have shown these idlers G′, carried on the extended ends of the pivot-bolts *g*.

H′ is a band-wheel carried by the shank of the tracing-tool H and adapted to turn with the tracing-tool, which is free to turn on its axis at the point of juncture of the bars G G. In Fig. 9 I have shown the preferable construction for connecting the arms G G. For this purpose I form the end of one of the arms forked and the end of the other arm single and lying between the forked ends of the first arm. These ends are then pivotally connected by a bushing H^2, screwed into a nut *h′*, upon which the wheel H′ rests. The tool H is sleeved in the bushing H^2 and is free to turn therein. This particular construction for joining the bars G G, while preferable, is of course not essential to the invention. The end of the tool H is provided with a projecting finger-piece or index extension *h*, by which the tool H may be turned by the fingers of the operator.

I represents the engraving-tools, of which a series are employed. These engraving-tools are carried in sleeves I′, journaled in vertical bearings *i* in the frame or carriage F.

J represents gear-wheels carried by the sleeves I′ and gearing with intermediate pinions J′, carried on studs *j* on the frame F. One or more of these pinions J′ is provided with a driving-wheel J^2.

K is a driving band or belt passing from the driving-wheel H′ on the tracing-tool about the idlers G′ to the driving-wheel J^2, by which any movement of the tool H on its axis is transmitted to the wheel J^2 and thence through the train of gears J and J′ to all the engraving-tools I in the frame F. The object of this construction is to cause all of the engraving-tools I to turn with any turning of the tracing-tool H, so that their cutting edges will always be presented to the metal in the line of movement of the tool as it is carried by the carriage F. This is clearly illustrated in Figs. 2 and 3. Fig. 2 shows the tracing-tool H in the act of tracing the outline on the plate B^3, and Fig. 3 shows the corresponding position assumed by the tool I. The arrows in these figures indicate the direction of the movement of the tool. The turning of the tool H may be controlled by the finger-piece *h*, which also acts as an index to indicate at any movement the position of the tools I. As the tool H is moved over the surface of the tracing or drawing on the plate B^3 the piece *h* will be made to follow in the line of the tracing. By this means a clean cut will always be produced by the tools I and scratching will be avoided. The engraved figure produced by the tools I will have the clean sharp character of hand-engraving.

In the drawings I have shown a single driving-wheel J^2 upon one side of the frame F. If desired, however, a second wheel J^2 may be employed on the other side, driven by a second belt K from the wheel H′, passing about the idlers G′, located at the joints of the other bar F^2. As it is desirable that there shall be practically no lost motion between the train of gears J and J′, it is preferable to locate the wheel J^2 near the center of the train instead of at the outer edge.

To impart the necessary pressure to the engraving or operating tools I independently of the pressure exerted by the tool-carrying frame F, so that each individual tool may have an independent pressure upon the surface metal, the tools I may be each made movable in their supports. In Figs. 18 and 19 I have

shown such a construction. Instead of round sleeves I′, I employ angular sleeves I^2, which fit angular apertures in the gears J, so as to rotate with them, but to have freedom of vertical movement in the gears. The tools I are carried by these sleeves I^2 and may be provided with weights I^3 (dotted lines) to normally depress the tools I and their sleeves I^2. These weights I^3 may be made removable, so that they may be replaced by others to regulate the pressure desired according to the character of the work to be done. Instead of additional weights I^3 the weight of the tool and sleeve may be relied upon to impart the pressure, or springs bearing upon the tool or sleeve may be employed. The angular sleeves I^2 may be provided with shoulders or stops i' to limit their movement. Instead of angular sleeves I^2 a feather and guide may be employed or any other of the well-known constructions for connecting parts together for rotary motion while permitting vertical movement. Instead of making the sleeves I^2 movable in the gears J the tool I may be made to move in the sleeves in a similar manner.

L L are bars or links parallel to the bars F^2, adjustably pivoted, as at l, at their forward ends to the ends of the bars G G beyond their points of connection with the bars F^2. The rear ends of these bars L L are pivoted, as at l', to adjustable blocks L′, movable upon angular extensions B^4 of the frame B. The extensions B^4 project at an angle rearwardly and outwardly from the frame B. The blocks L′ are free to move upon the extensions B^4 and are secured thereto in any adjusted position by set-screws m.

M are tongue-pieces carried by the bars L and forming a link connection between the bars L L and F^2 F^2. For the purpose of connecting these tongue-pieces M with the bars F^2, I prefer to construct the bars F^2 each with a slot f^2, into which the tongues M may project, and to connect the bars F^2 with the tongue by set screws or pins N, fitting a seat or hole n in the tongue. To permit adjustment of the bars L and F^2 at this point, the tongue M may be provided with a series of holes or seats n.

To permit the adjustment of the forward ends of the bars L upon the bars G, the latter may be provided with a series of sockets or holes k, any one of which may receive the pivot pin or screw l.

To adjust the bars L at their rear ends, they may be provided with a series of sockets or seats k', any one of which is adapted to receive the pivot pin or screw l', carried by the adjustable block L′. The block L′ may be adjusted upon its guide extension B^4 to suit the adjustment of the rear end of the bar. The bars G G, F^2 F^2, and L L constitute the pantograph-operating frame.

O O are casters carried by the frame F and running upon the surface of the frame B to permit the frame F to move freely. I prefer to locate these casters as near the rear of the frame as is possible, so that the weight of the frame may act upon the tools I to press them upon the metal.

P P are rollers carried in brackets p on the bars L and running on horizontal guide-brackets P′ P′, carried by the frame B. These rollers thus act to support the arms L L and F^2 F^2. I prefer that the design-plate B^3 shall be detachable from the supporting arm or bracket B^2, and for this purpose I have shown it constructed with a slotted boss Q upon the bottom, adapted to be inserted in an aperture q in the bracket B^2 and clamped by an adjustable clamp R, inserted through the slot of the boss Q and clamped by the screw r, which bears upon the base of the bracket B^2.

For the purpose of arresting the frame F and centering it with reference to the table C, I employ a spring-bolt S, provided with a spline or feather s and carried in a bracket or support S′ on the frame B. This bolt is adapted to enter a recess t in one of the end pieces F′, which receives the feather s of the bolt and locks the parts together. T is the spring which acts on the bolt to normally elevate it into engagement with the piece F′. These parts are shown in Figs. 4 and 8. The bolt may be provided with a head or eye u, by which it may be drawn down to unlock the frame F.

One or more (preferably three) of the sockets c in the table C may be provided with disks U, corresponding in surface and size with the watchcase-back or object to be engraved, and in the sleeves I′ in the frame F over these disks U are tracing-points V instead of engraving-tools I. As the frame F is moved these points V travel over the surfaces of the disks U and control the downward pressure of the frame F, causing it to rise or fall slightly as the points V move over the curved or uneven surfaces of the disks. As these surfaces correspond with those of the watchcase-backs or the other objects acted upon, the tools I are correspondingly raised and lowered slightly to suit the curved surfaces of the objects which are being engraved. The tools I thus act evenly upon the metal throughout the curved surface of the object, and the depth of the cutting may be controlled. I prefer to arrange these guiding-disks U and points V one at each end and one at or about the middle of the apparatus, as is shown in Fig. 1, so that they may act evenly throughout the frame F.

While I prefer the details of construction which have been shown, I do not mean to limit myself to them, as it is apparent that they may be varied without departing from the invention.

I shall now describe the mode of operation of this machine. The tracing, drawing, or design of the object to be engraved is fastened upon the plate B^3, which is clamped upon the bracket B^2 in the manner heretofore described. The frame F is swung up upon its hinges f, so as to expose the table C. The chucks E

are furnished with the watchcase-covers or other objects which are to be engraved and the frame F is lowered upon its hinges, so that the engraving-tools I are each in position over a cover. By means of the bolt S the frame F is properly centered, as has been described. This also centers the tracing-tool H on the design-plate B^3. The lever D′ is then operated to lift the table C until the engraving-tools I are pressed upon the surface of the metal of the covers and the tracing-points V are in contact with the surfaces of the guide-disks U. The bolt S is then withdrawn to release the frame F, and the engraver or operator moves the tracing-tool H over the lines of the drawing upon the plate B^3. Every movement given to the tool I is transmitted to the frame F through the jointed pantograph-operating frame, consisting of the bars G, F^2, and L, so that the frame F is moved over the table C as the tool H is moved over the design on the table or plate B^3. The bars L L swing on their pivots *l l′* at their rear ends when their front ends are moved by the bars G G under the action of the tracing-tool H. This rocking of the bars L L transmits a parallel movement to the bars F^2 F^2, and by the latter the frame F is correspondingly moved. The frame F is moved over a proportionally small area or extent by the movement of the tracing-tool H. This proportion depends upon the length of the operating bars or links and may be adjusted by the adjustment of the bars. Large movements of the tracing-tool H thus produce small movements of the frame F and of the tools I, so that a large design or pattern may be employed to produce a very fine and delicate engraving. As the tool H is moved over the lines of the design upon the plate B^3 the tool is turned in the manner heretofore described, so that the cutting-point of each of the tools I is presented to the metal in the line of movement of the tool. This, as has been previously explained, is accomplished through the belt or cord K and the train of gears J J′.

The apparatus is readily adapted for engraving watchcase-covers of different sizes or objects of different shape. For this purpose the chucks E and the guiding-disks U are removed and are replaced by others suited in size and shape to the objects to be engraved.

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

1. In a pantograph engraving-machine, the combination of a supporting-table for the objects to be operated upon, a movable carriage arranged over the table, a tracing-tool, a jointed operating-frame between the tracing-tool and the movable carriage, a series of tools carried by the movable carriage, and a hinge connection between the movable carriage and the jointed operating-frame, on which the carriage with its tools may be raised to expose the supporting-table and the objects to be operated upon.

2. In a pantograph engraving-machine, adapted to simultaneously engrave a number of objects, the combination of a horizontal stationary frame having an aperture in its face, a movable carriage located above the stationary frame and extending over the aperture therein, a series of engraving-tools carried by the movable carriage, a vertically-movable table located in the aperture of the horizontal stationary frame and provided with a series of supports for the objects to be engraved, means for raising and lowering the table, a tracing-tool, and a jointed pantograph-operating frame between the tracing-tool and the movable carriage.

3. In a pantograph engraving-machine, adapted to simultaneously engrave a number of objects, the combination of a horizontal stationary frame having an aperture in its face, a movable carriage located above the stationary frame and extending over the aperture therein, a series of engraving-tools carried by the movable carriage and rotatable in bearings thereon, gearing between said rotatable engraving-tools, a vertically-movable table located in the aperture of the horizontal stationary frame and provided with a series of supports for the objects to be engraved, means for raising and lowering the table, a tracing-tool rotatable in its bearings, power-transmitting connections between the rotatable tracing-tool and the gearing between the rotatable engraving-tools, and a jointed pantograph-operating frame between the tracing-tool and the movable carriage, whereby the movement of the tracing-tool over the pattern-plate will correspondingly move the carriage and engraving-tools and the turning of the tracing-tool in its bearings will correspondingly turn all of the engraving-tools.

4. In a pantograph engraving-machine, the combination with a movable carriage of a jointed pantograph-operating frame connected with the carriage, a tracing-tool carried by the pantograph-operating frame, and rotatable operating-tools carried by the movable carriage, a train of gears between the series of operating-tools, idlers on the joints of the pantograph-operating frame, and an endless cord passing from the rotatable tracing-tool about the idlers to the train of gears.

5. In a pantograph engraving-machine, the combination with the movable tool-carrying carriage, of the pantograph-operating frame consisting of the jointed bars G, G, the end bars L, L, pivoted to a stationary part at their rear end and at their front ends to the bars G, G and the link-bars F^2, F^2 pivotally connected at their extremities with the bars G, G and with the movable carriage and having a link connection with the bars L, L, and a tracing-tool carried at the joint of the bars G, G.

6. In a pantograph engraving-machine, the combination with the movable tool-carrying carriage, of the pantograph-operating frame consisting of the jointed bars G, G, the end

bars L, L adjustably pivoted to a stationary part at their rear end and at their front ends to the bars G, G and the link-bars F^2, F^2 pivotally connected at their extremities with the bars G, G and with the movable carriage and having an adjustable link connection with the bars L, L, and a tracing-tool carried at the joint of the bars G, G.

7. In a pantograph engraving-machine, the combination of a stationary frame having guide extensions, adjustable pieces carried by the side extensions and adjustable therein, a movable tool-carrying carriage, a pantograph-operating frame consisting of the side bars L, L pivotally connected at their rear ends to the adjustable pieces on the stationary frame, the jointed bars G, G pivoted at their extremities to the front ends of the bars L, L, the link-bars F^2, F^2 pivotally connected at one end with the movable carriage and at the other end with the bars G, G and having a link connection with the bars L, L, and a tracing-tool carried at the joint of the bars G, G.

8. In a pantograph engraving-machine, the combination of a stationary frame, a supporting-table located therein, a jointed pantograph-operating frame, a tracing-tool carried by the pantograph-operating frame, and a tool-carrying carriage hinged to the pantograph-operating frame and located over the supporting-table, and carrying a series of engraving-tools, whereby said carriage and all of the engraving-tools may be raised simultaneously to expose the work.

9. In a pantograph engraving-machine, the combination of a supporting-table for the objects to be engraved, a movable carriage located above the supporting-table and free to rise and fall with reference thereto, a series of engraving-tools carried by the movable carriage, one or more guiding-points carried by the movable carriage and adapted to raise and lower the movable carriage and the engraving-tools carried thereby to correspond with variations in the surface of the work being operated upon, and a pantograph-operating frame connected with the movable carriage for imparting movements thereto.

10. In a pantograph engraving-machine, the combination of a supporting-table for the objects to be engraved, a movable carriage located above the supporting-table and free to rise and fall with reference thereto, a series of engraving-tools carried by the movable carriage, one or more guiding-points carried by the movable carriage, one or more guiding-plates corresponding in surface with the work to be engraved upon which said guiding-points rest, whereby said guiding-points are caused to raise and lower the movable carriage and the engraving-tools carried thereby to correspond with variations in the surface of the work being operated upon, and a pantograph-operating frame connected with the movable carriage for imparting movements thereto.

In testimony of which invention I have hereunto set my hand.

HENRY OLSEN FLADVA.

Witnesses:
ERNEST HOWARD HUNTER,
FRITZ MINK.