

No. 729,758.

PATENTED JUNE 2, 1903.

W. T. GOODNOW & W. S. EATON.

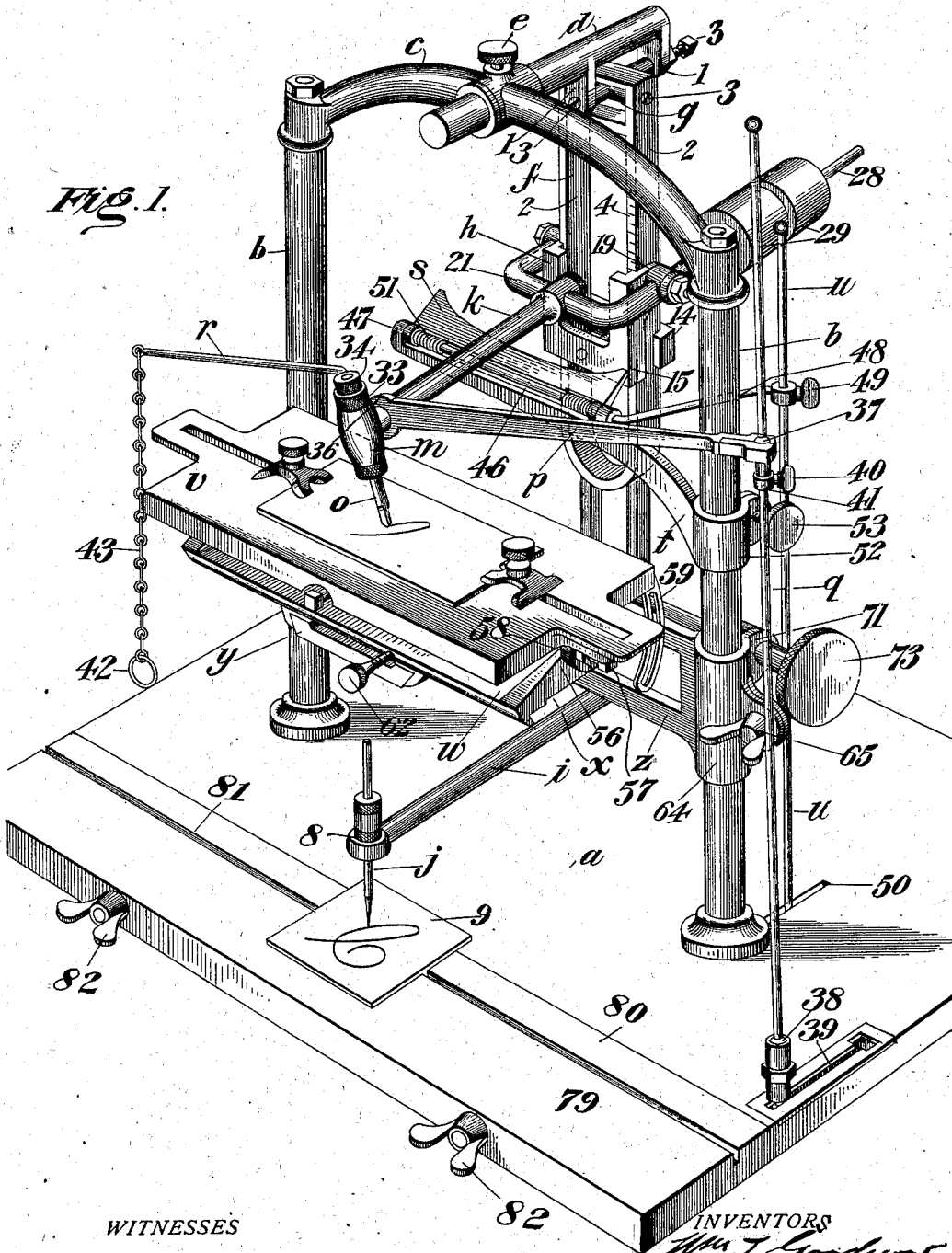
ENGRAVING MACHINE.

APPLICATION FILED SEPT. 7, 1901.

NO MODEL.

4 SHEETS—SHEET 1.

FIG. 1.



WITNESSES

Elmer Seavey
Chas. H. Dowell

INVENTORS

Wm. T. Goodnow
and Wm. S. Eaton
By *Julian C. Dowell*
Attorney

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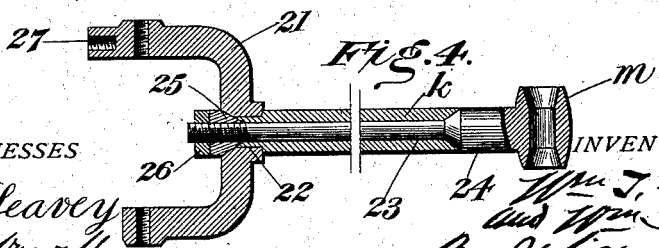
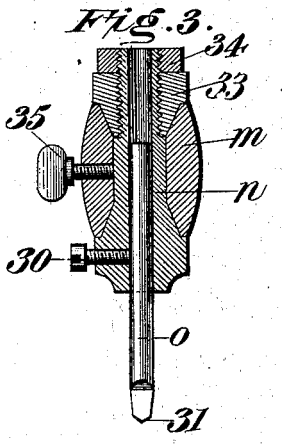
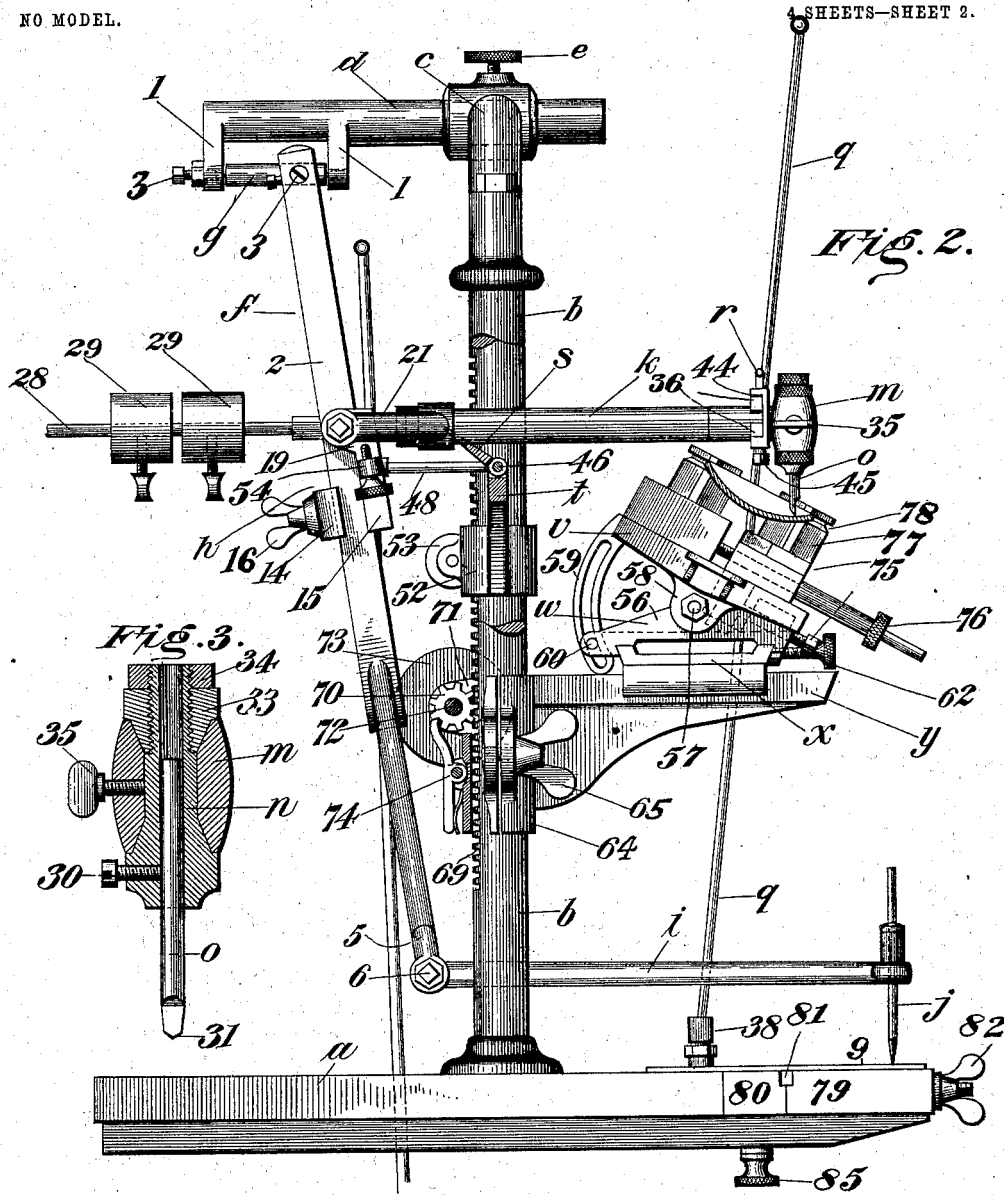
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4 SHEETS—SHEET 2.



WITNESSES
 Elmer Seavey
 August H. Swarth

INVENTORS
 Wm. J. Goodnow
 and Wm. S. Eaton
 By Julian E. Bowler
 their Attorney

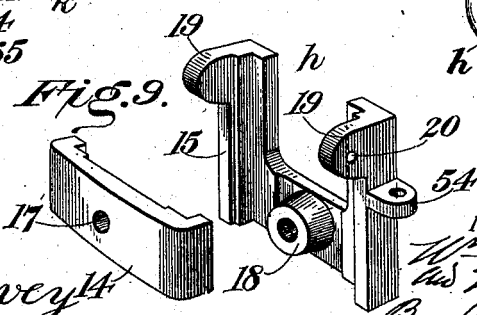
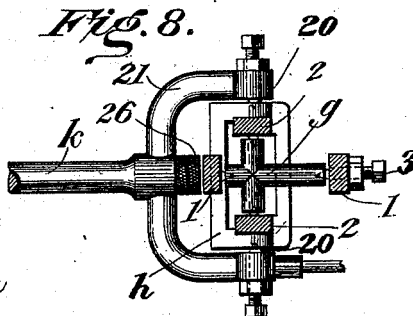
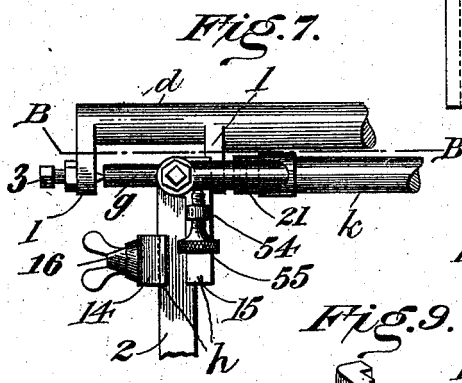
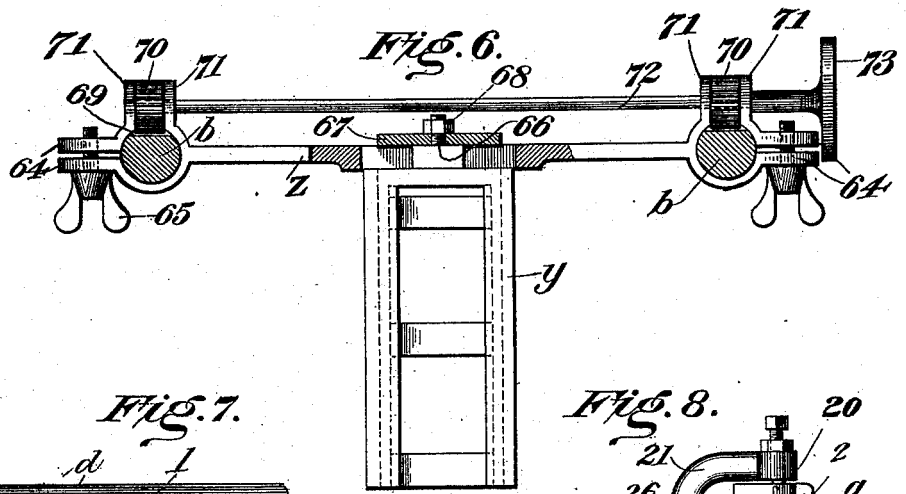
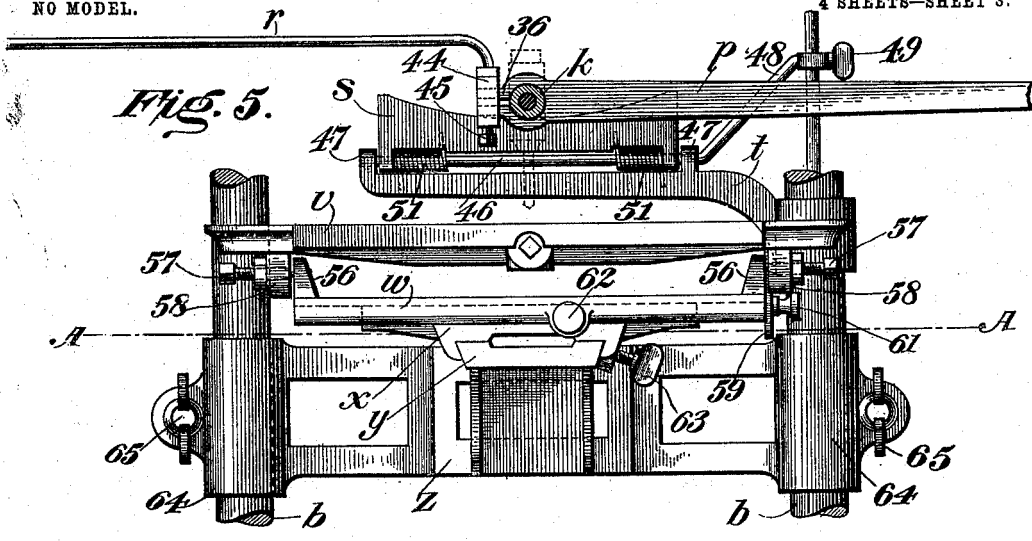
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4 SHEETS—SHEET 3.



WITNESSES
Elmer Seaver
Goodnow

INVENTORS
Wm. T. Goodnow
and Wm. S. Eaton
 By *John C. Dowell*
 their Attorney

No. 729,758.

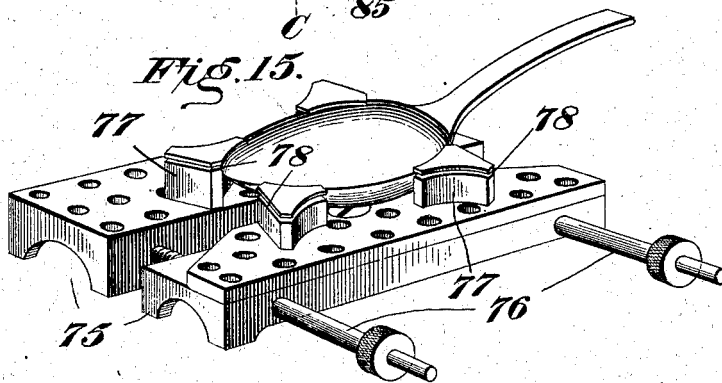
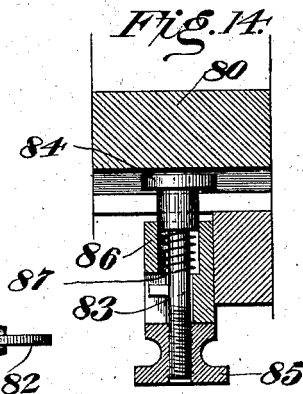
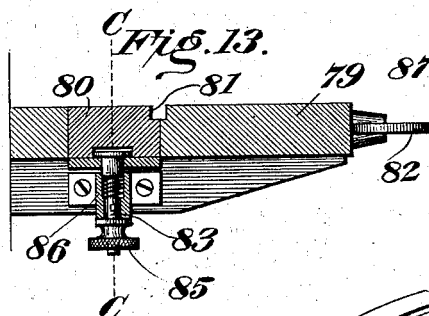
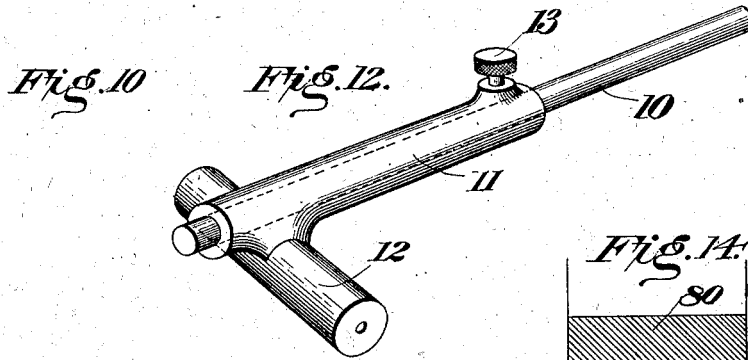
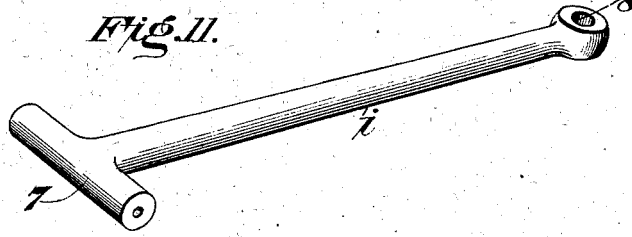
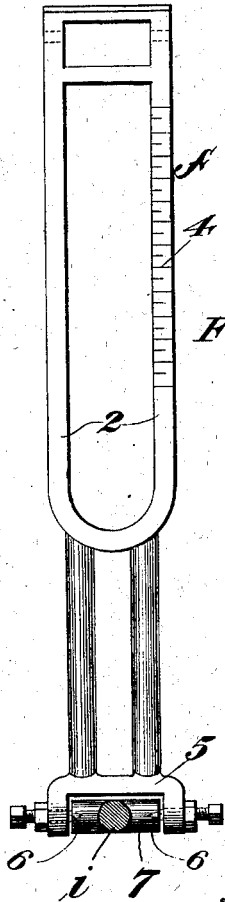
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4 SHEETS—SHEET 4.



WITNESSES

Elmer Seavery
Goodnow

INVENTORS

Wm. T. Goodnow
and Wm. S. Eaton
By *Julian C. Dowell*
Attorney

UNITED STATES PATENT OFFICE.

WILLIAM T. GOODNOW, OF SAYRE, PENNSYLVANIA, AND WILLIAM S. EATON, OF SAG HARBOR, NEW YORK, ASSIGNORS TO THE EATON & GLOVER COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ENGRAVING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 729,758, dated June 2, 1903.

Application filed September 7, 1901. Serial No. 74,698. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM T. GOODNOW, residing at Sayre, county of Bradford, State of Pennsylvania, and WILLIAM S. EATON, residing at Sag Harbor, county of Suffolk, State of New York, citizens of the United States, have invented certain new and useful Improvements in Engraving-Machines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to engraving-machines, and more particularly to that class denominated in the art as "pantographic," of which an example is shown and described in United States Letters Patent No. 652,892, granted to William S. Eaton, on July 3, 1900. Such a machine usually comprises in the main a tracer carried by an arm having a pivotal connection with a lever suspended from the machine-frame, so as to swing freely in all directions, a reproducing or engraving tool carried by means adjustable on said lever and capable of a universal movement with relation thereto, a suitable support for the type or pattern to be reproduced, and an adjustable work-supporting table, adapted to be set at different positions and inclinations in accordance with the character of the work to be performed. In many former machines of this character much difficulty has been experienced on account of the binding of the graver or engraving-tool upon the work-piece and the unevenness of cut thereof, especially at the intersecting lines of letters or other irregular figures, also on account of imperfect response to the movements of the tracer, and other imperfections of action, necessitating in many instances the carrying of the engraving-tool repeatedly over the same parts, as in effecting the heavy shading of downstrokes of letters or curved figures, and consequent expenditure of extra time and labor, with frequent defective reproductions.

The principal object of the present invention is to provide a highly-efficient engraving-machine adapted to overcome the above-noted difficulties and capable of effecting various reproductions on different scales from the originals, as may be desired.

Other objects are to simplify and improve the construction of the several parts of the machine to render the action thereof sensitive and immediately responsive to the movements of the tracer, to provide simple and efficient means for effecting the shading of a design by a single stroke of the engraving-tool, and to prevent all binding and unevenness of cut of the latter, thereby imparting a superior character to the reproduction.

The invention will first be described with reference to the accompanying drawings, which form a part of this specification, and will then be pointed out more particularly in the claims following the description.

In said drawings, in which corresponding parts are designated by the same reference characters, Figure 1 is a perspective view of an engraving-machine embodying our invention as the same appears ready for the work of reproducing designs upon flat surfaces. Fig. 2 is a side view thereof, with parts broken away, as the machine appears ready for the work of reproducing designs upon concave or curved surfaces. Fig. 3 is a detail sectional view of the engraving-tool holder, showing a graver within the rotatable stock carried by said holder. Fig. 4 is a detail sectional view of the tubular graver-arm, with the stem of the engraving-tool holder rotatably secured therein, the figure being divided into two parts showing the sleeve of the tool-holder at right angles to its normal position. Fig. 5 is a fragmentary view, in front elevation, showing the carriages with the work-table and its adjusting devices, together with means for raising the engraving-tool from the work when required. Fig. 6 is a horizontal section taken on line A A of Fig. 5. Fig. 7 is a detail view, in side elevation, showing the connection between the swinging frame or lever and its supporting-arm, also showing the yoke of the graver-arm raised to its highest point on said swinging lever in order to bring the pivots of said yoke in line with the pivots of the lever. Fig. 8 is a section taken on the line B B of Fig. 7. Fig. 9 is a detail perspective view of a two-part slide or clamp adjustable on the swinging frame or lever and to which is pivoted the yoke of the graver-arm. Fig. 10 is a detail view of said swinging frame or lever

to which are pivotally connected both the tracer-arm and the graver-arm. Fig. 11 is a detail perspective view of the tracer-arm shown in Figs. 1 and 2. Fig. 12 is a similar view of an extensible tracer-arm. Fig. 13 is a detail sectional view of the slidable type-holder. Fig. 14 is a section thereof taken on line C C of Fig. 13, and Fig. 15 is a detail perspective view of a work-holder for spoons and similar articles.

The letter *a* in the drawings denotes a suitable supporting-base, on which are mounted a pair of standards or uprights *b b*, connected at their upper ends by a detachable arch or cross piece *c*. Projecting rearwardly from said cross piece is an adjustable arm *d*, which, as represented, is slidably fitted in a sleeve or socket in the cross-piece and secured in any desired position by means of a set-screw *e*. A swinging frame or lever *f*, to which are connected both the tracer and the engraving-tool, is suspended from the arm *d* in such manner as to adapt it to swing freely in all directions, one member of a cruciform coupling *g* being pivotally secured between a pair of lugs 1, depending from said arm *d*, while the other member of said coupling is similarly pivoted between the side portions 2 2 of the lever *f*, whereby the latter is permitted to swing forwardly and rearwardly as well as from side to side of the machine. To secure sensitive pivotal movements, the extremities of the cruciform coupling *g* are preferably notched or concave, and fitting delicately therein are the pointed ends of bearing-screws 3, inserted through the lugs 1 and sides 2 of the swinging lever, respectively, which screws may be easily removed to detach the several parts. The screws in the swinging lever are preferably countersunk or flush therewith to prevent interference with the movements thereon of an adjustable clamp or slide *h*, which has a pivotal connection with the engraving-tool, and said lever (shown detached in Fig. 10) may have inscribed on one of its side portions a graduated scale 4, whereby to determine the proper adjustments of said slide, as will be hereinafter explained. In the construction shown the swinging lever is formed at its lower end with a yoke 5, and delicately pivoted between the members of said yoke, as by point and socket bearings 6, similar to those already described, is the short cross-piece 7 of a tracer-arm *i*, which is thus rendered capable of an independent pivotal movement with relation to the lever in a vertical plane. The said arm *i* carries at its free end a suitable tracer *j*, secured within an opening 8 therefor in the arm and which in the engraving operation is moved by the hand of the operator over the lines of the pattern-plate 9 or other design to be reproduced. In Figs. 1, 2, and 11 the tracer-arm is shown as a solid member, though for the purpose of increasing the range of the machine we may employ an adjustable or extensible tracer-arm, as shown in Fig. 12, wherein 10 designates the tracer-holder proper

which is adjustable within a sleeve or socket 11, having a cross-piece 12 to be secured between the members of the yoke 5 in the manner already described, the said holder being retained at any desired position by a set-screw 13 or other suitable means.

The slide or clamp *h* above mentioned may comprise two clamp members 14 and 15, which slidably embrace the swinging lever and may be connected and held in desired position thereon by any suitable coupling device, as a screw 16, passing through an opening 17 in one of said members and engaging an interiorly-threaded boss 18 on the other. (See Figs. 1, 2, 7, and 9.) The side parts of the clamp member 15, which are shown extended upward, are formed with lugs or projections 19, and delicately pivoted to said lugs, as by point and socket bearings 20, similar to those hereinbefore described, are the two members of a yoke 21, formed upon or rigidly secured to the rearward end of the graver-arm *k*, which arm, similarly to the tracer-arm *i*, is thus rendered capable of an independent pivotal movement with relation to the swinging frame or lever in a vertical plane.

The graver-arm carries at its forward end the graver or engraving-tool *o*, to which the movements of the tracer in passing over the lines of the design to be engraved are imparted through the swinging lever *f* and appurtenances thereof in an obvious manner. The said graver-arm consists of a tubular member, the rearward end of which is represented, Fig. 4, fitted in a socket-opening 22 therefor at substantially the middle point of the yoke 21, said member having rotatably fitted therein the stem or rod 23 of the holder proper, *m*, for the tool or graver *o*. The bore of said tubular member is preferably formed conical at its forward end in conformity with the similarly-formed enlarged portion 24 of the stem of the tool-holder, and the opposite end of said bore, as well as the socket 22 in the yoke 21, are similarly formed to receive a conical nut 25, fitted on the threaded end of the stem and secured in place by a jam-nut 26, whereby the said stem is furnished a close and smooth rotatable bearing within the tube, while the parts may be easily detached or adjusted. One member of the yoke 21 may be provided with a rearward threaded socket 27, in which is secured an end of a rod 28, supporting one or more weights 29 to counterbalance the graver-arm and parts carried thereby. (See Figs. 4, 1, and 2.) The engraving-tool holder *m* is in the form of a sleeve, the bore of which is at right angles to the stem 23 thereof and flaring or conical at the ends, as shown in Figs. 3 and 4, and rotatably fitted within said sleeve or holder is a tool-stock *n*, having a central opening for the engraving-tool or graver *o*, which may be secured in the stock by a set-screw 30 or other suitable means. For general purposes we preferably employ a straight engraving-tool formed with a diamond-point or cutter 31, inclined or beveled at each side thereof, since

by properly inclining such tool to the work-piece one is enabled to produce shade-lines of gradually-varying width with but a single stroke of the instrument, though for special purposes we may employ tools of different construction. The tool-stock *n* is of proper exterior formation to fit closely within the holder *m*, its lower portion being enlarged or conical in conformity with the lower conical bore of said holder, while its upper end is preferably reduced and screw-threaded, and screwed upon said threaded portion is a cone 33, fitting the upper conical bore of the holder and secured in place by a jam-nut 34, whereby the stock is furnished a smooth bearing within the holder, adapting it to rotate freely therein when desired, while the parts are thus adapted to be readily adjusted or assembled and detached. By reason of such provision for free vertical rotation the graver may be made to conform readily to all curvilinear or other movements of the tracer in passing the latter over the lines of the pattern being engraved and to follow all intersecting curves or angles of the design without binding or scraping the work-piece, the tool being adapted to be readily turned by the hand of the operator independently of its traveling motion, so as to present the flat or broad side of its cutting-point always at substantially right angles to the direction of travel, while by reason of the axial movement of the stem of the tool-holder within the tubular graver-arm *k* the graver may be held at varying angles or inclinations, thereby producing gradually increasing or diminishing shading of letters or figures with but a single stroke of the instrument and without the necessity for repeatedly passing the graver over the same lines. By the described construction, incorporating provisions for imparting a rotary movement to the graver and axial movement to the stem of its holder, we are enabled to dispense with comparatively complicated and expensive mechanism formerly employed for similar purposes.

When engraving upon the inner surfaces of annular bodies and at other times, it may be desirable to render the graver non-rotatable, which may be accomplished by screwing down the cone 33 and jam-nut 34 to tighten the stock within the holder *m*, while the rigidity of said stock may be further maintained by means of a set-screw 35, entered through said holder. To facilitate loosening or tightening of the cone and nut and manipulation of the engraving-tool while imparting rotary movement thereto, they are preferably milled or roughened at their outer surfaces, as shown in Figs. 1 and 2, and the lower outer portion of the tool-stock may also be milled to facilitate turning the stock or adjusting the cone and nut.

To-maintain the graver at any desired inclination to the work-piece, we preferably employ a lever *p*, the inner end of which is rigidly secured to the outer enlarged portion 24

of the stem of the tool-holder, as by means of a split ring 36, embracing the same, Figs. 1, 2, and 5, while the outer end of said lever is connected by a slidable ball-and-socket joint 37 to an upstanding rod *q*, mounted on the supporting-base *a* by means of a ball-and-socket joint 38, slidably fitted on said base, whereby the said lever *p* is enabled to conform readily to all movements of the graver when in operation. The ball-and-socket joint 37 is adjustable on the rod *q* in accordance with the desired inclinations of the graver or in conformity with adjustments of the slide *h* on the swinging lever *f*, being secured in proper position on said rod by a set-screw 40, entered through a sleeve 41 below the joint. The socket member of the joint 38 is likewise adjustable along a slot 39 in the supporting-base *a* in conformity with the forward and rearward adjustments of the swinging lever or the work-table.

The graver may be held upon its work with any degree of pressure desired by means of an arm or rod *r*, Figs. 1 and 5, attached to the tool-holder and having a pull cord or chain 43 depending therefrom and provided with a ring or handle 42, which the operator grasps with one hand, while his other hand is engaged in moving the point of the tracer over the design or pattern to be reproduced; but when manipulating the graver to impart rotary movement thereto pressure is directly applied by taking hold of the cone or adjusting devices on the tool-stock. To properly attach said rod *r* to the tool-holder, the inner end thereof may be provided with a clip 44, which embraces the projecting lips of the split ring 36 of the lever *p*, and is secured thereon by means of a set-screw 45, as shown in Figs. 2 and 5.

In order that the graver may be lifted and sustained out of contact with the work when the machine is not in operation, the graver-arm *k* may be supported upon the upper curved edge of a hinged plate or rest *s*, which normally stands upright or in position to maintain the graver raised from the work, as illustrated in Fig. 5, wherein the graver and holder therefor are indicated by dotted lines; but said rest is adapted to be inclined or depressed to lower said graver to the work, as illustrated in Figs. 1 and 2. To this end the hinged plate or rest *s* may be rigidly secured to a rod 46, pivoted in suitable lugs or bearings 47 on a supporting-bracket *t* and having an arm or bent portion 48, adjustably secured, as by means of a collar and set-screw 49, to an upstanding rod *u*, which rod passes through a slot or opening 50 in the supporting-base *a* and is connected to a treadle (not shown) beneath said base. The said rest may be maintained normally upright by means of springs 51, surrounding the rod 46 and having their ends bearing against the rearward sides thereof and the supporting-bracket *t*. In order to lower the graver to its work, the treadle beneath the base may be depressed, thereby

inclining the rest against the force of springs 51, while to elevate the graver it is only necessary to release the treadle. The bracket *t* may project from a clamp 52, adjustable up and down on one of the standards *b* and secured thereon by means of a tightening-screw 53, and it will thus be seen that the rest *s* may be adjusted to any desired position in conformity with the position of the slide *h* on the swinging lever *f*. It is frequently desirable to raise the graver momentarily from the work without releasing the treadle, and for this purpose the clamp member 15 of the slide *h* may be provided with an apertured lug 54, Figs. 2, 7, and 9, from the under side of which a screw 55 may be entered and adjusted to bear upwardly against one member of the yoke 21, and thereby support the graver-arm with its appurtenances.

Any suitable means may be employed for securing the work-piece or article to be engraved upon the work-table *v*, Figs. 1, 2, and 5. Said table is preferably supported upon a carriage *w*, being provided with depending lugs 58 at its ends, through which are entered bearing-screws 57, fitted in sockets therefor in upstanding lugs 56 on said carriage, the table being also provided with a depending slotted sector-plate 59, which works on a threaded pin 60, projecting from the carriage and provided with a fastening-nut 61, whereby the table may be secured at any desired inclination. The carriage *w* is slidable longitudinally across the front of the machine upon a second carriage *x*, being secured at any position thereon by means of a set-screw 62, and the carriage *x* is transversely movable upon a platform or support *y*, being similarly secured at any desired position thereon by means of a set-screw 63, Fig. 5. The platform *y* projects forwardly from a supporting-beam *z*, fitted to and adjustable up and down the standard *b b*, as by means of clamps 64 and tightening-screws 65 therefor. The platform may be secured to said supporting-beam by means of a threaded stud 66, projecting from the platform through an aperture in the beam, an apertured plate 67, fitted on said stud, and a fastening-nut 68, as illustrated in Fig. 6.

From the construction described it is evident that the work-table and work supported thereon may be brought to any desired position within the range of the machine for execution of various kinds of engraving. As a means for elevating and lowering the platform, with the carriages and work-table supported thereby, racks 69 may be formed at the rearward sides of the standards *b b*, as shown in Figs. 2 and 6, said racks being engaged by pinions 70, arranged between duplicate extensions 71 on the clamps 64 and secured to an operating-rod 72, provided with a hand-wheel 73. On loosening the screws 65 of clamps 64 the several elements referred to may be raised or lowered to any desired position, being held at such position

by means of a spring-pressed dog or pawl 74 on one of the clamps engaging the corresponding pinion.

In reproducing designs from flat originals upon the bowls of spoons or other concave surfaces it is desirable that every portion of the work successively traversed by the graver be brought as nearly as possible in a horizontal plane, which is accomplished by means of the adjustments of the work-table and carriages above explained, as illustrated in Fig. 2. In said figure a suitable work-holder for spoons or other concave or irregular articles is shown, the same comprising a two-part clamp 75, (shown also in Fig. 15,) the members of which are adjustably held together by screw-rods 76 and are provided with plugs or lugs 77, formed with grooves 78 therein, which receive the rim of the bowl. Other articles may be secured to the clamp by other suitable means.

The pattern-plate or type to be reproduced may be secured upon the supporting-base *a* in any suitable manner; but for the purpose of engraving progressively from a full line of type we preferably provide a slidable type-holder, which may be adjusted lengthwise to bring the type or pattern successively within range of the tracer, while the work-table is correspondingly adjusted to bring fresh portions of the work-piece successively within range of the graver. This obviates the former necessity and trouble of engraving long designs or sentences from several separate pattern-plates substituted one for another until the entire design is engraved. In the form shown (see Figs. 1, 2, 13, and 14) the said slidable type-holder comprises two members 79 and 80, constructed to provide a longitudinal groove or slot 81 between them, in which slot the flanges or lugs formed on the under sides of the type may be fitted and clamped to secure the type in desired position after the manner of securing the pattern-plate 9, as illustrated in Fig. 1. The two members 79 and 80 of the said type-holder are connected by bolts having thumb-nuts 82 thereon, whereby the front or outer member may be loosened to permit insertion or removal of the type. One member, preferably the rear or inner member 80, is provided on its under side with an elongated T-shaped slot or slots or with a plate having such a slot therein, in which are fitted the flanged heads 84 of bolts 83, which extend through suitable bearings 86 on the base or frame of the machine and are provided with fastening-nuts 85 on their threaded ends. Springs 87, fitted on the bolts 83, are adapted to lift the same when the fastening-nuts 85 are loosened, so as to release the inner member 80 of the type-holder and permit the latter to be moved lengthwise, after which it may be secured in position by tightening said nuts, and thus binding the type-holder to its seat. An extended line of type or portions of a long pattern may thus be

copied progressively by moving the type-holder endwise step by step and clamping the same in each adjusted position by fastening the nuts.

5 The operation of the machine will be understood from the foregoing description, taken in connection with the accompanying drawings. The size of the reproduction is of course relative to the distance of the graver from the
10 tracer, diminishing with each degree of elevation of the graver-arm, and when the pivots of the yoke 21 are in the same horizontal plane with the transversely-disposed pivots of the swinging lever *f*, as shown in Fig. 7, substantially
15 no effect will be produced on the graver by movements of the tracer.

It will be understood that the machine is susceptible of various modifications in details of arrangement and construction without departing from the scope of the invention, and hence we do not desire to be limited to the specific construction shown and described.

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

1. In an engraving-machine, the combination with the base having a slot therein, and a socket movable in said slot, of a vertically-disposed rod supported in the socket by a
30 universal joint, a rotatable stem supporting an engraving-tool, a lever rigidly connecting at one end with said rotatable stem, and at the other end with said vertical rod by a ball-and-socket joint, and means for adjusting
35 the latter end of said lever upon the vertical rod, substantially as and for the purpose described.

2. In an engraving-machine, the combination with the base and standards thereon, and the arch connecting said standards and having the socket therein, of the arm adjustable in said socket and having the pendent lugs, the cross-shaped coupling pivotally supported
40 between said lugs, the swinging frame or lever pivotally suspended from said coupling, the tracer-arm pivotally suspended in the lower end of said frame and carrying a tracer, and an independently-swinging yoke on said frame
45 having means supporting an engraving-tool, substantially as described.

3. In an engraving-machine, the combination with the standards having the racks and the supporting-beam, clamps securing said
50 beam to said standards, pinions in said clamps engaging said racks and provided with an operating-rod, a dog or pawl engaging one of said pinions, and a work-table mounted on said beam; substantially as described.

4. In an engraving-machine, the combination with the frame-standards and a cross-bar
60 connecting the same, of an arm adjustably secured to said cross-bar and having depending lugs, a cross-shaped coupling, a swinging lever suspended therefrom, said coupling
65 having two of its arms pivotally secured to said lugs and its other two arms pivotally connected with said swinging lever, the latter

having a tracer-arm pivotally connected thereto and an engraving-tool operated thereby; substantially as described. 70

5. In an engraving-machine, the combination with a tracer of a supporting-base having a slot therein, fastening means adjustable
75 along said slot, a vertically-disposed rod having a universal-joint connection with said fastening means, a tool-holder comprising a sleeve having a vertically-disposed bore, a tool-holding stock fitted in said bore, a lever
80 for turning said sleeve connecting the same with said vertical rod and having a universal-joint connection with the latter, means for adjusting the latter connection on said rod, and adjusting means carried by the stock and working in the sleeve adapting the tool
85 to be rotated independently of the sleeve, at will, substantially as described.

6. In an engraving-machine, a transversely-adjustable type-holder consisting of two members separably secured together having their
90 confronting edges constructed to clamp between them the type or pattern plate, in combination with means for adjusting said type-holder endwise and securing the same in different positions without loosening the type;
95 said adjusting means comprising a T-shaped slot extending longitudinally of one of said members on the under side thereof, fastening-bolts having flanged heads fitted in said slot, nuts on said bolts for holding said type-holder
100 to its seat, and springs for lifting said bolts and releasing the type-holder when said nuts are loosened, substantially as described.

7. In an engraving-machine the combination with the supporting table or base having
105 a slot therein, a vertically-disposed rod, securing means adjustable along said slot, having a universal-joint connection with said rod, an engraving-tool carried by a rotatable stem or support, and a lever for turning the latter
110 extending therefrom to said vertical rod and having a universal-joint connection therewith, and means for adjusting the latter connection on said rod, substantially as described.

8. In combination with the swinging lever
115 and tracer pivotally connected thereto, the tubular graver-arm having a yoke pivotally connected with said lever, a tool-holder having a stem rotatively fitted therein, and an engraving-tool fitted in said holder with provision for rigidly securing the same thereto
120 or permitting rotary movement within the holder, together with a lever for turning said stem, and a vertically-disposed rod having an adjustable universal-joint connection with
125 said lever and adjustably supported on the machine frame or base, substantially as described.

9. In combination with the swinging lever, having a tracer-arm pivotally connected
130 thereto, a graver-arm operated from the tracer having a yoke whose arms are pivotally connected with said swinging lever and a tubular member projecting from said yoke, a tool-holder having a stem rotatably fitted in

said tubular member and carrying an engraving-tool, with provision for securing the latter either non-rotatively or rotatively within the holder at will, and means for turning said stem to change the inclination of the tool and maintaining the tool in such inclined position, said means consisting of a lever for turning said stem and a vertically-disposed rod having an adjustable universal-joint connection with said lever and adjustably supported on the machine frame or base, substantially as described.

10. In combination with the adjustable supporting-arm, and the swinging lever suspended therefrom by a pivotal connection therewith, a tracer-arm pivoted to said swinging lever and a graver-arm also pivoted thereto and operated from the tracer, a tool-holder rotatably secured to said graver-arm to permit the tool to be inclined as desired, a lever for turning said tool-holder, a vertically-disposed rod having a vertically-adjustable universal-joint connection therewith, a coupling having a universal-joint connection with one end of said rod, and means for adjusting said coupling to shift the position of the end of said rod when said supporting-arm is adjusted, substantially as described.

11. In combination with the adjustable supporting-arm, and the swinging lever suspended therefrom by a pivotal connection therewith, a tracer-arm pivoted to said swinging lever and a graver-arm also pivoted thereto and operated from the tracer, a tool-holder rotatably secured to said graver-arm to permit the tool to be inclined as desired, a lever for turning said tool-holder, a vertically-disposed rod having a vertically-adjustable universal-joint connection therewith, a coupling having a universal-joint connection with one end of said rod, and means for adjusting said coupling to shift the position of the end of said rod when said supporting-arm is adjusted, together with means for rendering the tool rigid or permitting it to rotate at will, substantially as described.

12. In combination with the frame-standards and connecting-bar, the projecting arm adjustably secured thereto, the freely-swinging lever suspended from said arm, the tracer-arm pivotally connected with said swinging lever, the graver-arm also pivotally connected therewith at a point between said projecting arm and tracer-arm, a tool-holder rotatably mounted on said graver-arm, a vertically-disposed rod, a coupling which may be

adjusted in conformity with the adjustments of said projecting arm having a universal-joint connection with said rod, and a lever extending from said rotatable holder and having an adjustable universal-joint connection with said vertical rod, whereby the engraving-tool may be adjusted over the surface of the work-table, and inclined and maintained in different positions; substantially as described.

13. In combination with the frame-standards and cross-bar connecting the same, the supporting-arm adjustably secured to said cross-bar, the swinging lever having a universal-joint connection with said supporting-arm, the tracer-arm pivotally connected with said swinging frame and the graver-arm also pivotally connected therewith at a point between said supporting-arm and the tracer-arm; said graver-arm carrying at its free end a tool-holder which is rotatably mounted thereon for changing the inclination of the tool, an upstanding rod, a coupling adjustably secured to the machine frame or base, and having a universal-joint connection with the lower end of said rod, whereby said lower end of the rod may be adjusted in conformity with the adjustments of said supporting-arm, and a lever fixed to said rotatable holder and having an adjustable universal-joint connection with said rod, substantially as described.

14. In combination with the adjustable supporting-arm, and the swinging lever suspended therefrom by a pivotal connection therewith, a tracer-arm pivoted to said swinging lever and a graver-arm also pivoted thereto and operated from the tracer, a tool-holder rotatably secured to said graver-arm to permit the tool to be inclined as desired, a lever for turning said tool-holder, a vertically-disposed rod having a vertically-adjustable universal-joint connection therewith, and a coupling having a loose connection with said rod and adjustable in the direction in which said supporting-arm is adjusted, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

WILLIAM T. GOODNOW.

WILLIAM S. EATON.

Witnesses to signature of William T. Goodnow:

GEO. E. LUCE,
LEWIS KINSMAN.

Witnesses to signature of William S. Eaton:
PERCY EATON,
ALICE M. EATON.