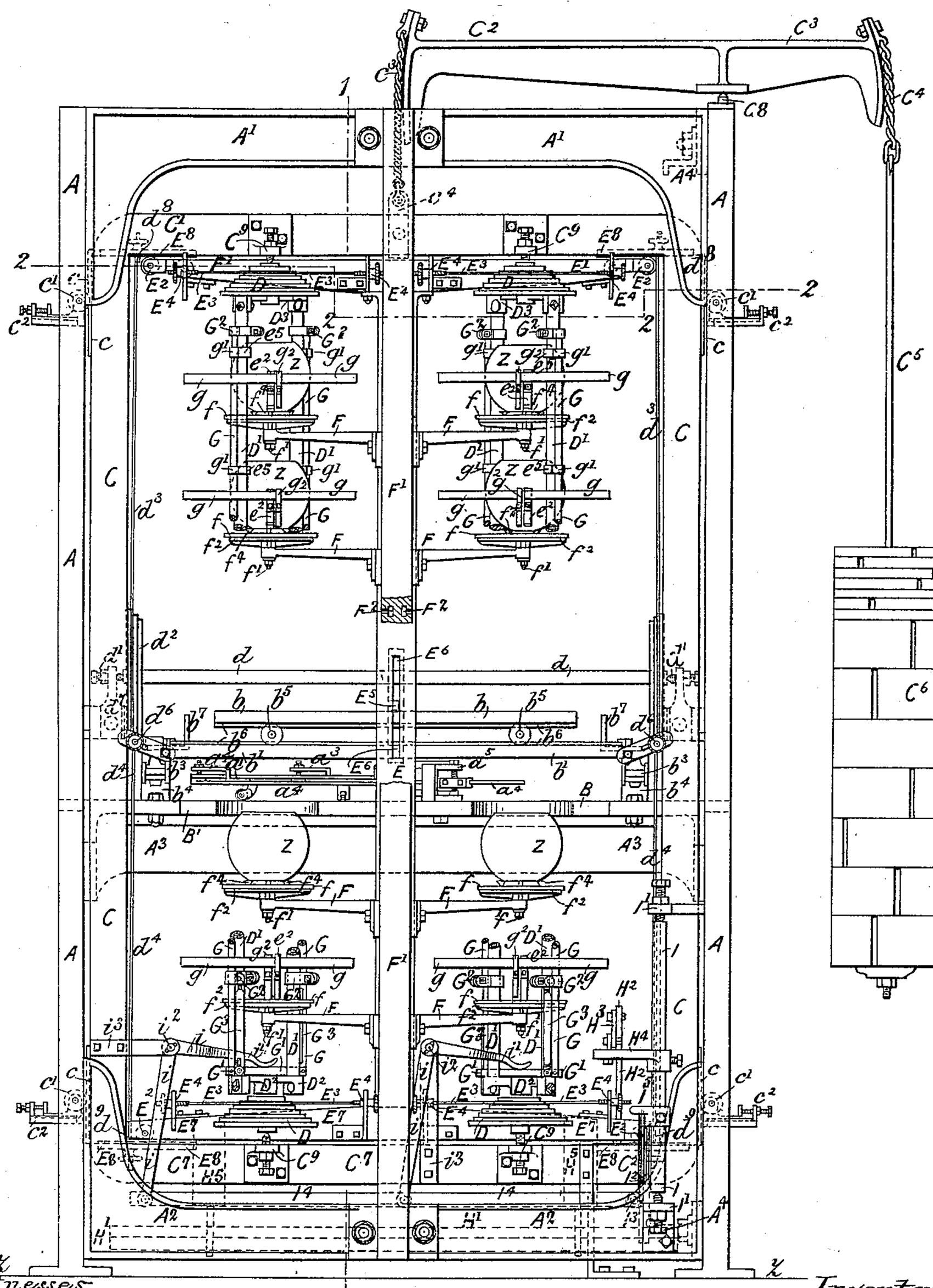
(No Model.) 4 Sheets—Sheet 1.

J. BRYCE & A. KNOX.

PANTOGRAPH TRACING AND ENGRAVING MACHINE.

No. 481,893. Patented Aug. 30, 1892.

FIG. 1.



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(No Model.) 4 Sheets—Sheet 2.

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FIG. 2.

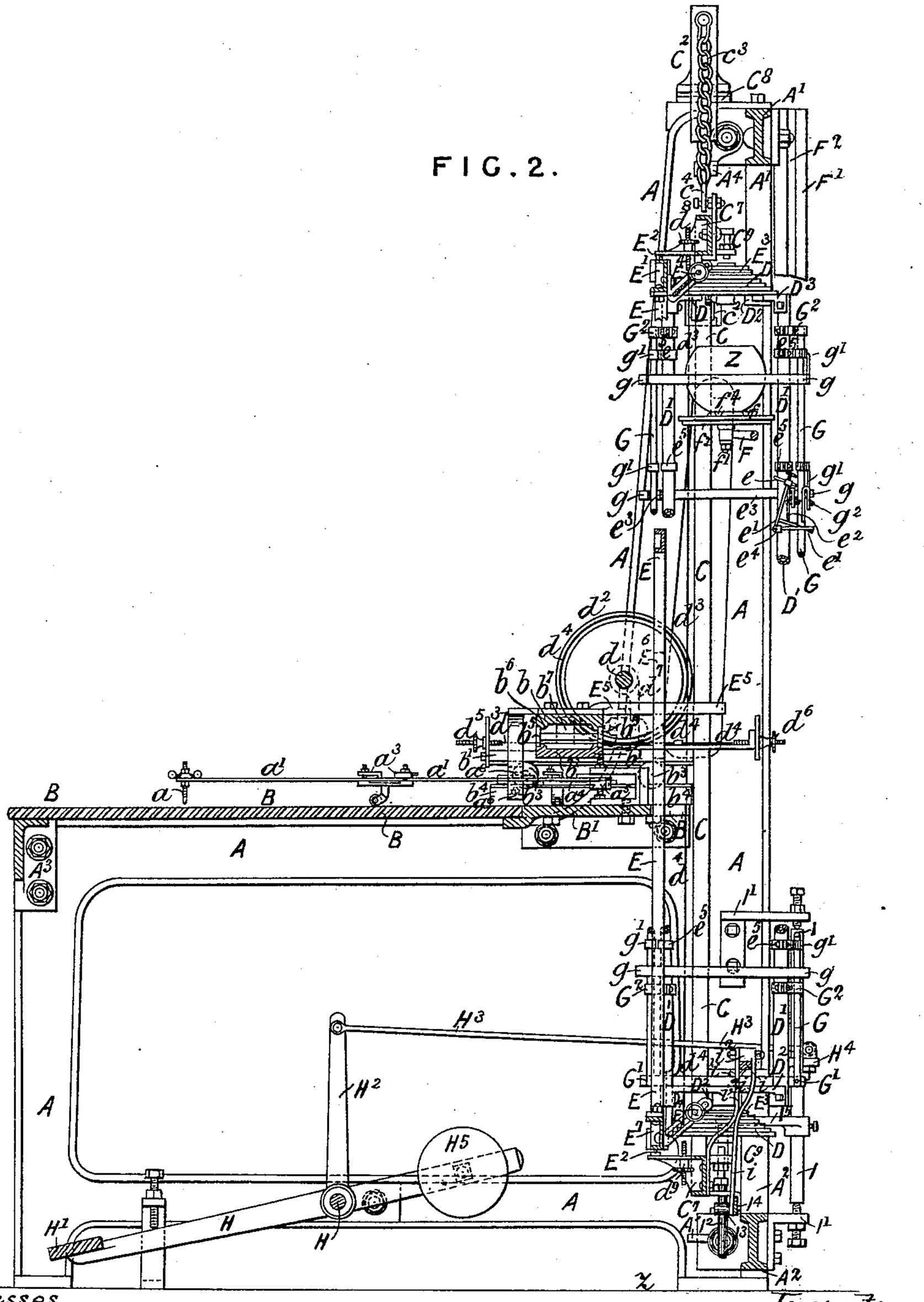

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FIG. 7.

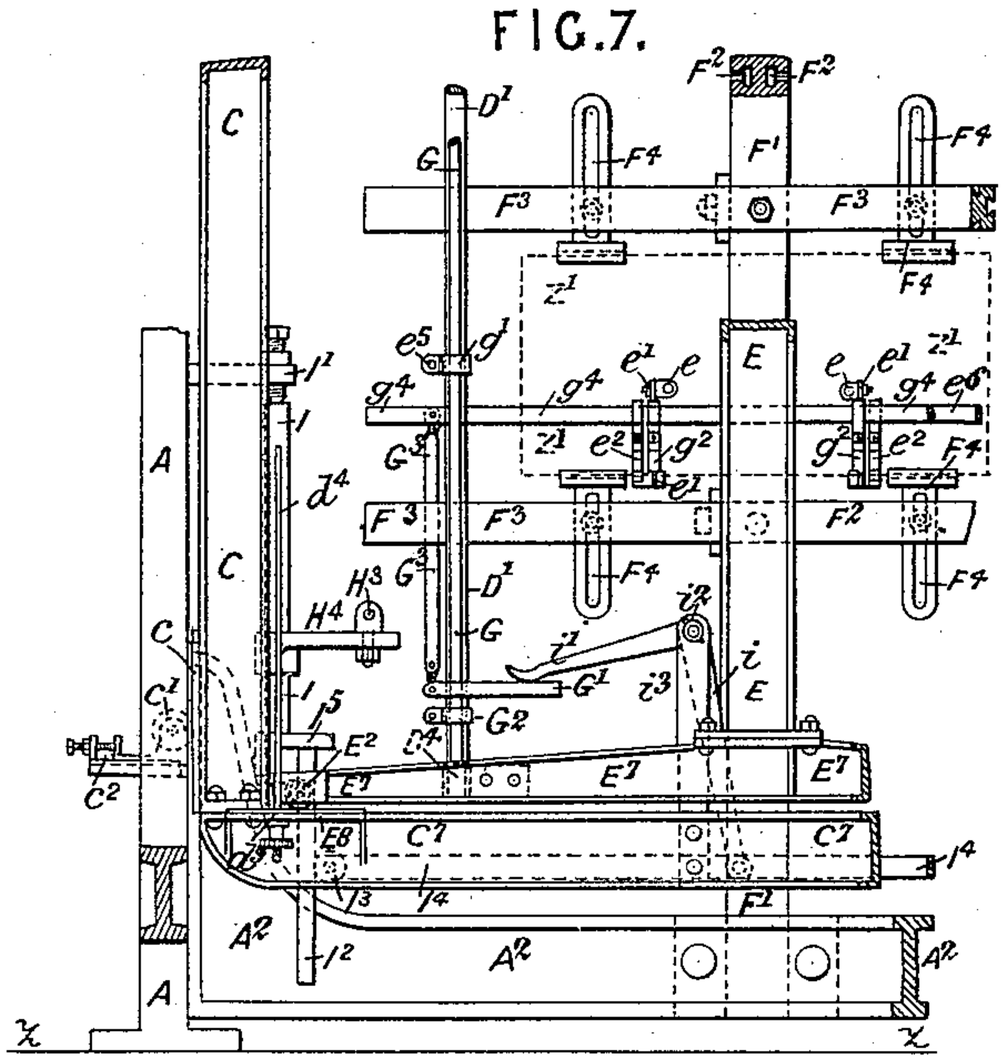

FIG. 8.

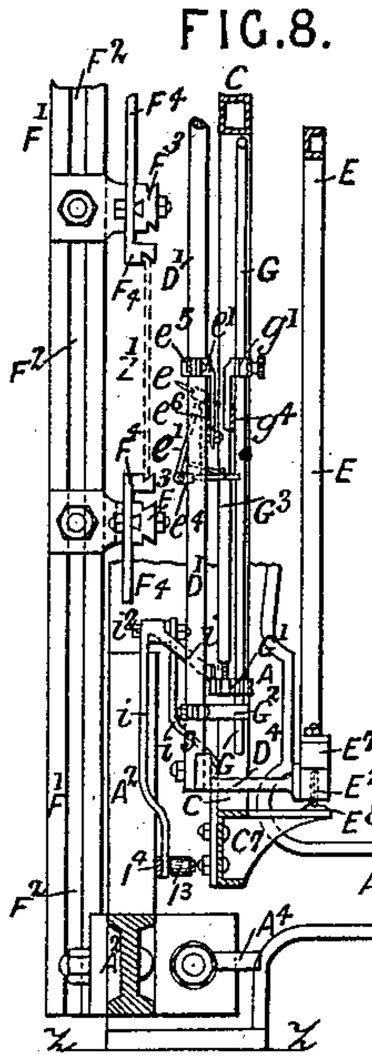

FIG. 3.

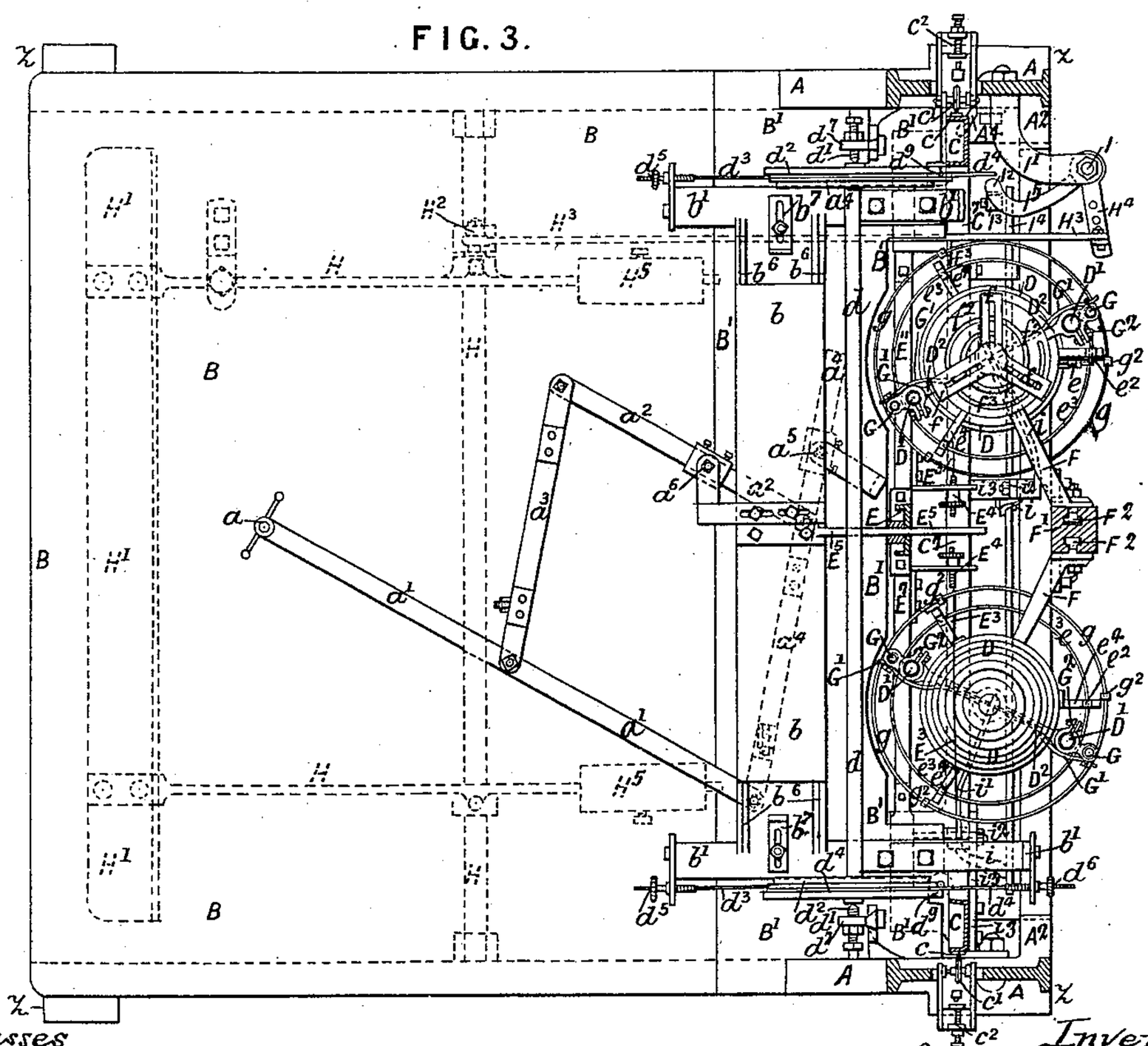

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FIG. 4.

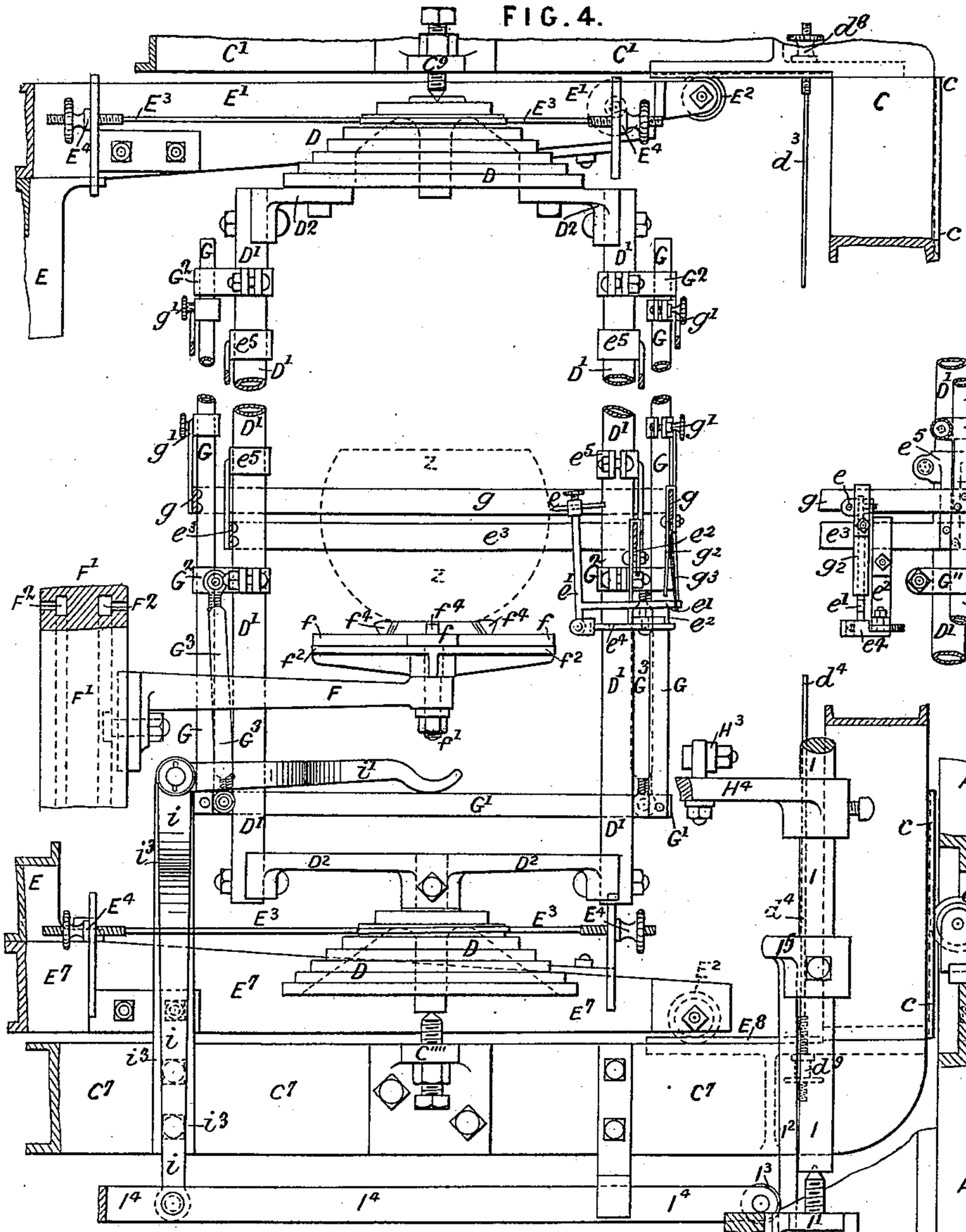


FIG. 5.

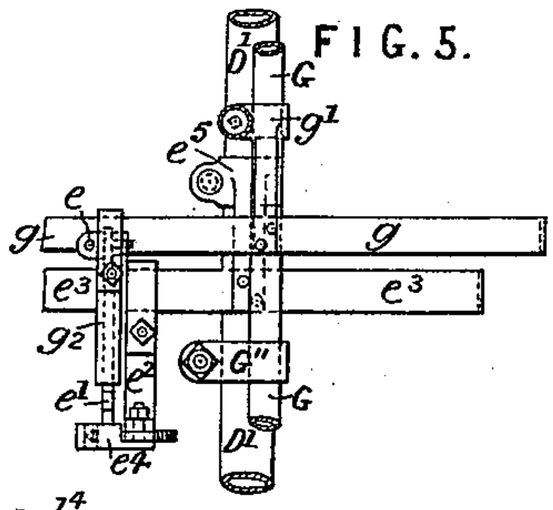
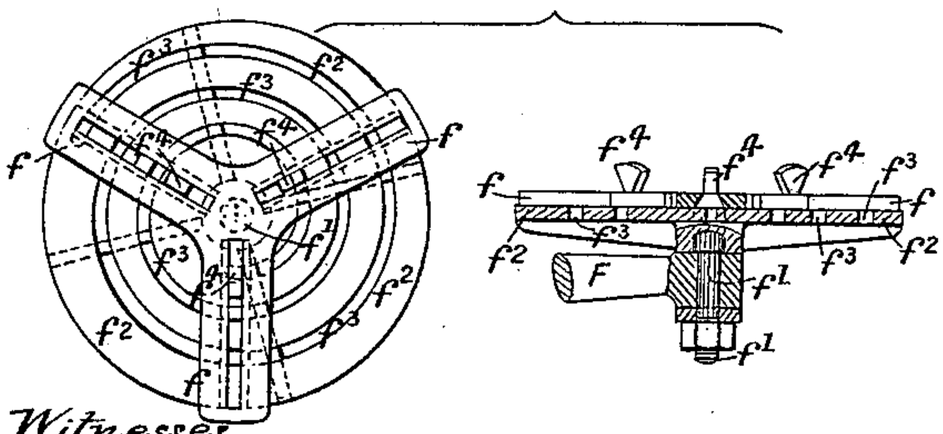


FIG. 6.



Witnesses
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UNITED STATES PATENT OFFICE.

JOHN BRYCE AND ADAM KNOX, OF GLASGOW, SCOTLAND, ASSIGNORS TO THE GLASS AND METAL ENGRAVING COMPANY, LIMITED, OF SAME PLACE.

PANTOGRAPH TRACING AND ENGRAVING MACHINE.

SPECIFICATION forming part of Letters Patent No. 481,893, dated August 30, 1892.

Application filed June 17, 1891. Serial No. 396,569. (No model.) Patented in England September 12, 1888, No. 13,173.

To all whom it may concern:

Be it known that we, JOHN BRYCE, engraver, and ADAM KNOX, engineer, both of Glasgow, in the county of Lanark, Scotland, subjects of the Queen of Great Britain and Ireland, have invented Improvements in and Relating to Pantograph Tracing and Engraving Machines, (for which we have obtained Letters Patent in England, dated September 12, 1888, No. 13,173,) of which the following is a specification.

Our invention has reference to the construction of pantograph tracing and engraving machines for the tracing or engraving of ornamental designs on the surface of gas moons or globes, tumblers, glasses, vases, and other circular or cylindrical objects, such as copper rollers or conoidal or polygonal objects, whether made of glass, metal, or other material, and comprises a novel combination of mechanism and mechanical motions to be applied to and actuated by the ordinary mechanical pantographic motions of the tracing and engraving machines heretofore in use.

The main improvement and departure of this invention from ordinary pantographic tracing and engraving machines consists in fixing and mounting the objects on a stationary frame and bracketed arms, already in axial line when round or cylindrical objects are used within a rotating open cylindrical cage, with longitudinal vertical bars outside, on which the finger-levers of the tracing points or diamonds are secured in any desired number to suit the design or number of patterns to be treated round the circular objects. By these improvements a large number of objects can be operated on in the machine at one time, while more elaborate and superior designs and repeats of the patterns can be traced or engraved on the objects in less time and at smaller cost than has heretofore been done.

In order to enable others skilled in the art to which our invention relates to understand how it may be carried into effect or practice, we have hereunto appended four explanatory sheets of drawings, in which the same reference-letters are used to indicate corresponding parts in all the figures where shown.

Figure 1 is a back end elevation of a pantograph tracing or engraving machine as fitted with our improvements, showing the fixed frame carrying the objects and the balanced raising and lowering frame and lateral traversing frame, with the rotating cylindrical cages carrying the diamonds or tracing-points. Fig. 2 is a side sectional elevation as taken at right angles to and near the vertical line 1 1 of Fig. 1. Fig. 3 is a plan view corresponding to Figs. 1 and 2 and as taken on the line 2 2 of these figures. Fig. 4 is an enlarged back sectional elevation broken away, corresponding to Fig. 1, to show particularly the mode of securing the clips and levers carrying the diamonds or points to the vertical rotating cage-bar; and Fig. 5 is an edge view showing this at right angles to the position shown in Fig. 4. Fig. 6 is a sectional elevation and a plan, respectively, of the disk plate or chuck on which the circular objects are secured and carried. Fig. 7 is a detailed elevation of part of the machine as looking from the front, and Fig. 8 a corresponding side sectional elevation as modified to suit for engraving flat objects.

Referring to the drawings, the machine consists, as usual, of two strong stationary open side or end frames A A, strongly bound together by suitable fixed stay cross bars or rails A' A^2 A^3, which make the whole a rigidly-strong frame for carrying all the working parts, free from vibration, and secured by broad-flanged feet to the floor or other foundation at *z*.

The pantograph mechanism of the machine is of the ordinary flat-table class, with the table B B′ secured rigidly and horizontally in front of the two said frames A A, and cross-rails A' A^2 A^3 for laying the paper with the outlined design on, or the tracing or the engraved or scored pattern-plates at a convenient height for the operator tracing with and guiding the point *a* of the pantograph *a* to a^4.

Over the part B of the table B B′ the hand-arm a', with its tracing-point *a* of the lower pantograph horizontal, traversing parallel acting bars a' a^2 and a^3 a^4, or other equivalent frame, is made to traverse, as usual, on the fixed center bracket a^5, secured to the part B′

of the stationary frame or table B by the action of this proportional pantograph-frame a' to a^4 to traverse the frame b laterally on the lower frame b' by the action of the moving arm center bracket a^6, secured to this upper frame b, which also by its roller-pulleys b^5 and rails b^6 traverse the frame b' below it longitudinally to and fro from front to back, and vice versa, on pulleys b^3 and rails b^4 between them on the table part B', so as to actuate or traverse the engraving or tracing points e. The lower frame b' is thus moved parallelly to and fro longitudinally on the rollers b^3 on the rails b^4 of the table part B', and from which ordinary pantograph traversing compound frame a to a^6 and b to b^7 all the new mechanical motions of the tracing-points e and machines are taken.

A long vertical frame C C' C^7, preferably of a strong light construction of cast-iron with strong vertical side rails C C and transverse upper and lower rails C' C^7, is made to traverse on plain guides c and pulleys at c' near the upper and lower parts of the side rails C C, the pulleys c' being carried in adjustable screw-brackets c^2, secured to the upper and lower parts of the main stationary frames A A. This frame C C' C^7 is thus mounted and guided between the stationary end frames A A of the machine, and behind the transverse and longitudinal horizontal traversing frames b to b^7 of the pantograph mechanism to reciprocate freely up and down on the antifriction-wheels c' on the guides c when the horizontal traversing frame b' is moved to and fro forward and backward from the vertical reciprocating frame C C' C^7. This vertical reciprocating frame C C' C^7 is shown carried, preferably, by a chain c^3, attached by a stud at c^4 to the center of the top rail C', passed over the segmental end of the longer arm of a lever C^2 C^3, fulcrumed on a steelyard bearing at C^8 on the top of one of the side frames A, and has a chain C^4 passing down over the short segmental arm C^3 of this lever C^2 C^3, mounted with a rod, and weights C^5 C^6 to counterbalance or rather more than counterbalance the weight of the frame C C' C^7 and the transverse traversing frame E E' E^7 carried on it and all the cylindrical rotating cages D to D^3 and tracing points or diamond mechanism carried on these frames.

A horizontal spindle d is mounted laterally across the front of the machine above the horizontal pantograph traversing frames b b', its ends being carried in adjustable center screw-pins d', carried in brackets d^7, attached to the fixed frame A A of the machine, or it might be in antifriction-roller bearings in the end frame of the machine. Stepped pulleys or cones d^2 are mounted near the ends of this spindle d, and steel bands d^3 d^4 are turned or coiled round these pulleys d^2 and have their one ends attached to top and bottom at d^8 d^{89}, respectively, of the vertically-movable frame C C' C^7, and have their other ends attached to adjustable screw-brackets at d^5 d^6 on the forward and backward ends of the longitudinal pantograph traversing frame b b' in such a manner that when the pantograph-frame is drawn longitudinally toward the front of the machine it pulls down the balance-frame C C' C^7, and when pushed back from the front of the machine it raises this frame, or it might be vice versa, or the weight might be made to assist the raising of the frame in the upward direction.

The balanced raising and lowering vertical frames C C' C^7 carry one, two, or more open-barred vertical cylinders or cages D to D^3, with end driving-cones D mounted in anti-friction adjustable screw centers or bearings at C^9 in them, secured to the upper and lower rails C' C^7, along the lateral width of the machine or frame, which move vertically with and rotate or oscillate on these centers C^9 on the cone-pulleys D D of the frame D to D^3 within the vertical frame C C' C^7.

The vertical bars or tubes D' are secured at their upper ends by brackets D^3 to the upper driving-band cone D and at their lower ends by a transverse frame D^2, carrying the lower driving-band cone D. To these vertical bars D' of the frame D to D^3 diamonds or points e are mounted by light spring bell-crank levers e', and securing clip-brackets e^2 e^4, mounted on ring-frames e^3 e^3, actuated by the turning of the frame D to D^3, as hereinafter described, the springs g^3 of the levers e' keeping each diamond or tracing point e into action to trace or engrave the design on the globes or objects Z, (indicated by sharp lines in Figs. 1 and 2 and by dotted lines in Fig. 4,) and which are held vertically and stationary over each other in fixed brackets F by gripping chuck-holders f to f^4, one form of which is shown in section and plan in Fig. 6, carried on a center screw-securing-spindle f', one for each object Z, to be engraved within the center of each rotating cage D to D^3, and attached by the adjustable brackets F to a main standard F' at the back of the stationary framing of the machine, preferably with T-slotted vertical guides F^2, for securing brackets F by screws in these slots at any desired height within the cages D to D^3, as will hereinafter be described. The vertical motion of the balance-frame C C' C^7 and cylinders or cages D to D^3 with the diamonds or points e produce the lines in the vertical direction on the objects Z, while the lines in the circular direction are produced by the rotation of the open-barred cylinder or cages D to D^3, with the diamonds or points and their levers e e' secured on the vertical bars D' of these cages D to D^3.

The circular or oscillatory motion of the cylindrical cages D to D^3 is given as follows: by another vertical wheeled frame E E' E^7 with one central feather-rail E and an upper and a lower transverse rail E' E^7, traversing by rollers E^2 on the two latter horizontally, and laterally on guides at E^8 within or on the horizontal bars C' C^7 of the vertical balance-

frame C C′ C⁷, carrying the cylinders and cages D to D³, so as to traverse with it vertically. To this horizontal traversing frame E E′ E⁷ are attached one or more bands E³ by their ends with tightening-screws to brackets at E⁴, secured to the upper and lower horizontal frames E′ E⁷ on each side of each end cone or pulley D of the rotating cages D to D³, and round which cones each band E³ is passed to turn the cages D to D³, so that on this horizontal frame E E′ E⁷ being transverse in one direction in the cages C C′ C⁷ the one end of the bands E³ turns the cylindrical cages D to D³ round in the corresponding direction, while the traversing of the horizontal frame E E′ E⁷ in the other direction causes the bands E³ to turn the cylindrical cages D to D³ in the opposite direction, and thus the points or diamonds *e* trace the circular lines in either direction on the objects Z to the extent or size of the motion of this frame D to D³, and proportionate to the motions given to it by the pantograph, this horizontal moving frame E E′ E⁷ being moved by the upper horizontal lateral traversing frame *b b* of the pantograph by an arm E⁵, secured on it, working on a long vertical slot E⁶ in the vertical frame E of the frame E E′ E⁷.

The action so far of the mechanism is as follows: When the horizontal traversing frame *b b* or *b′ b′* of the pantograph is moved laterally or longitudinally by moving the hand-tracing arm *a a′* above the outlined design or sprig laid on the stationary front table B of the machine, corresponding parallel oscillating or rotating motions are transmitted to the cylindrical cages D D³, carried on the vertical movable frame C C′ C⁷, through the lateral motions of the frame E E′ E⁷, and the tracing diamonds or points *e* on the bars of these cages D to D³ would by these parallel motions trace or engrave the design on the surface of the circular or cylindrical object Z, secured, as hereinbefore described, to the stationary frame of the machine. Thus when the tracer-arm *a* of the pantograph and horizontal traversing frame *b b* are moved to the right or left laterally across the machine a corresponding circular motion is transmitted to the rotating cylindrical cages D to D³ and tracing or engraving points *e*, and when the tracing-arm *a* and traversing frame *b′ b′* of the pantograph are moved horizontally and longitudinally forward or backward a raising and lowering parallel motion is given to the vertical balanced frame C C′ C⁷ and cylindrical cages D to D³, and a vertical parallel motion is thus transmitted to the diamond or tracing points *e* and produce the vertical lines on the objects Z. The short bell-crank levers or arms *e′* for holding each tracing or engraving diamond or point *e* are hinged or jointed at their inner lower ends to the adjusting-screw clamping or bracket part *e*² *e*⁴, the latter of which clamps is secured to the ring-frame *e*³, bolted by clamp-brackets *e*⁵ to the rigid vertical bars D′ D′ at any height desired of the hollow open rotating cylindrical cages D to D³, so as to enable the levers E and points *e* to be swiveled and set to any angle tangentially to the surface of the parts of the particular globular, conical, or circular work being engraved, one lever *e′* and pointer *e* being used for each flower or repeat division of the pattern on the object being engraved. Each rigid bar or tube D D′ of the frame D to D³, carrying these bell-crank arms *e′*, with the diamonds *e*, is further fitted with a vertical reciprocating bar-frame G G′ and bar G, working and mounted parallel to the bars D′ in guide-clamps G², secured to these bars D′. The lower cross-bar G′ of each of these vertical reciprocating frames G G′ is pulled upward by springs G³ secured at their upper ends to the guide-clamps G², when the attendant puts his foot on a treadle mechanism, and pulled downward by the automatic action of the weighted levers H to H⁵ of the treadle mechanism. An upper bow or ring moving frame *g* is secured by the clamps *g′* to the vertical sliding bars G of the frame G G′, so as to rise and fall with this frame by the action of the before-mentioned springs and treadle mechanism, and a light screw-clip *g*² is secured on the ring *g* just over the horizontal arm of each bell-crank *e′*, so that the lower end of each clip *g*² comes in contact with the horizontal arm when this frame is brought down by the automatic working of the treadle mechanism against the power of the spring G³ to take all the tracing-points *e* of the vertical arms of the bell-cranks *e′* out of action, and a small india-rubber or other spring *c*³ is attached to the screw or other part of the clip *g*² and to the horizontal arm of the lever *e′*, the strength of which might be regulated by a screw to keep the tracing-points *e* of this lever in action when the attendant puts his foot on the tread-board of the treadle mechanism and allows the spring G³ to draw up the frame G G′, so that the stop-arms of the clip *g*² are clear of the horizontal arm of the tracing bell-crank lever *e′*, and also allows the bell-crank lever *e′* freedom to act, so that the point *e* would trace over an irregular surface object Z only with the slight pressure of the spring *g*³.

The treadle mechanism consists as follows: A counterweighted lever-spindle H is mounted in bearing-brackets in the lower part of the side frames A A below the table B, with a tread-board H′ in front, where the attendant sits, and counterweighted levers H⁵ behind, which automatically raise the tread-board H′ when not pressed down by the foot of the attendant. A vertical lever H² is mounted at one end of the spindle H, connected by a rod H³ and differential lever H⁴ to the vertical spindle I, carried in brackets I′, secured to the back part of the side frames A A, so as to swivel it slightly, and also a lever I⁵ on it, carrying a long vertical stud I². This stud I² acts on a roller at I³ on one end of the reciprocating bar I⁴, carried on the lower ends of

the vertical bell-crank levers i i', fulcrumed on brackets i^2, secured at i^3 to the vertical reciprocating frame C C' C^7. Thus it will be seen that the horizontal arm i' of these bell-cranks i i' acts on the lower bar G' of the frame G G' to pull this frame G G' down against the power of the spring G^3 automatically, as before described, and remove the tracing-points e from the object by the weighted levers H^5 of the treadle mechanism, while the pressing down of the tread-board H' raises these levers i' and allows the spring G^3 to pull up the frame G G' and cause the tracing-points e to act as described.

Referring to Figs. 4 and 6, for securing each globe or other circular object Z to be engraved concentrically and stationary within the cages D to D^3 the rigid lateral arms F project from a fixed slide-guide vertical bar F' F^2, secured to the center of the upper and lower transverse rails A' A^2 of the main frame A A at the back, as seen in Fig. 1. The outer end of each arm F carries on a vertical center stud f' in the axial line of the eye of the chuck f f^2 an arrangement of three horizontal slide-gripping pawls or clips f^4, working in radial dovetailed slots or slide-arms f, analogous to a differential gripping-chuck, the pawls f^4 being moved in their slide-guide stationary arms f out and in by a loose scroll grooved or equivalent disk f^2, mounted on the center stud f' below the fixed gripping-chuck and pawls f f^4, a pin or stem on each pawl f^4 projecting down and working into the scroll-groove f^3 in the loose disk f^2, all so that the turning of the scroll-disk f^2 in one direction traverses the clip f^4 equally and radially inward to grip the base of the globes Z concentrically on the chuck in the center of the vertical cage D to D^3, and vice versa, and turning the scroll-disk f^2 in the opposite direction loosens them for the insertion of new globes.

Although this machine in its more full and complete construction, as described, is mainly designed for engraving glasses and other irregular circular work or objects Z, secured on separate chucks f to f^4 and arms F on a fixed frame F', it is to be understood that it might also trace or engrave patterns on copper rollers or long cylindrical objects, one secured stationary in like manner within each frame D to D^3 on the fixed frame F F' without chucks f to f^4.

Referring to Figs. 7 and 8 this shows an arrangement suitable for making the same machines trace or engrave flat surfaces or polygonal objects with flat surfaces secured on a suitable fixed part of the frame. (Indicated by dotted lines Z' in these figures.) The objects would be secured by adjustable shifting screw-clips F^2, secured to horizontal bars F^3, screwed or otherwise adjustably fixed to the stationary vertical back frame F', secured to the upper and lower transverse stays A' A^2 of the main framing A to A^3, to suit the size of objects to be clamped. In this case it is preferred to remove the oscillating or rotating frames or cages D to D^3 from the machine and fix the vertical bar D' D' direct by brackets at D^4 to the lower and upper arms E' E^7 of the horizontal moving frame E E' E^7 within the frame C C' C^7 and secure to these rods D' D' straight bars e^5, instead of the ring-bars e^3, described in the previous figures, and carry on these, the tracing bell-cranks e' in an equivalent manner to that described in reference to the former figures, so as to traverse laterally and act on the flat stationary surface Z' with the motion of the frame E E' E^7, instead of in a circular manner, as before described, and then mount a moving straight frame or bar g^4 on the reciprocating bars G, instead of the ring g of the former figures, to carry the stop clips and springs g^2 g^3 at the side of each tracing-lever e e' to act on the horizontal arm of these tracing-levers to take these out of action or put them into action by the treadle mechanism H to H^5 and I to I^5, all substantially as described and lettered to correspond in reference to the former figures. The extreme vertical motion of the frame C C' C^7 is stopped in the upward and downward direction, respectively, by the brackets A^4 A^4, secured over and under it to one fixed side frame A of the machine, and the extreme transverse motion of the frame E E' E^7 is stopped by the ends of its moving frame b b coming against the stops b^7 b^7, secured to the longitudinal frame b' b', traversing with and under this frame b b, all as seen more particularly in Figs. 1 and 2.

What we claim is—

1. A pantograph-machine for tracing and engraving objects, comprising a stationary frame on which the objects are mounted, in combination with cylindrical cages carried and rotated in a balanced frame moved vertically, said cages being turned by a laterally-moving frame within the balanced frame, these frames being moved in their respective directions by and proportionally to the motion of the ordinary pantograph pointer and mechanism, substantially as set forth.

2. In a pantograph tracing and engraving machine, the combination comprising a stationary frame and bracketed arms carrying the objects, with open cylindrical cages rotated and moved vertically and carrying vertical and hoop bars outside, and tracing points or diamonds secured on said bars to engrave the designs in both directions on the stationary objects, substantially as and in the manner set forth.

3. In a pantograph tracing and engraving machine, a vertically-moving balanced frame, in combination with rotating open-barred engraving-cages mounted on said frame, substantially as and for the purposes set forth.

4. In a pantograph tracing and engraving machine, the combination comprising a balanced raising and lowering vertical frame with open-barred vertical rotating cylindrical cages, and spring-clip shifting and setting

levers with tracing points or diamonds attached to said bars, the frame and cages being actuated by and proportional to the motion of the ordinary pantograph pointer and mechanism, substantially as and for the purposes set forth.

5. In a pantograph tracing and engraving machine, the combination comprising rotating cylindrical cages carrying tracing points or diamonds, a vertically moving balanced frame on which said cages are mounted, and a vertical wheeled frame traversing horizontally and laterally on the vertical balanced frame and having bands and pulleys to rotate the cages, substantially as and in the manner set forth.

6. In a pantograph tracing and engraving machine, the combination comprising rotating cage-bars and vertical shifting ring-bars, levers with tracing points or diamonds, and reciprocating frame for putting the points and levers into or out of action, substantially as and for the purposes set forth.

7. In a pantograph tracing and engraving machine, the combination comprising rotating cylindrical cages with a clutch having rigid lateral arms and gripping-pawl clips and a scroll-grooved disk for securing the objects to be treated, substantially as and in the manner set forth.

8. In a pantograph tracing and engraving machine, the combination comprising a fixed frame and vertical and transverse moving balanced frames having flat surfaces or objects secured to the fixed frame and parallel to the moving frames, with adjustable lateral arms carrying the levers of tracing points or diamonds on the lateral traversing frame, substantially as and in the manner set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JOHN BRYCE.
ADAM KNOX.

Witnesses:
W. R. M. THOMSON,
JOHN SIME,
Both of 96 Buchanan Street, Glasgow, Scotland.