

No. 639,953.

Patented Dec. 26, 1899.

C. G. WARNER.

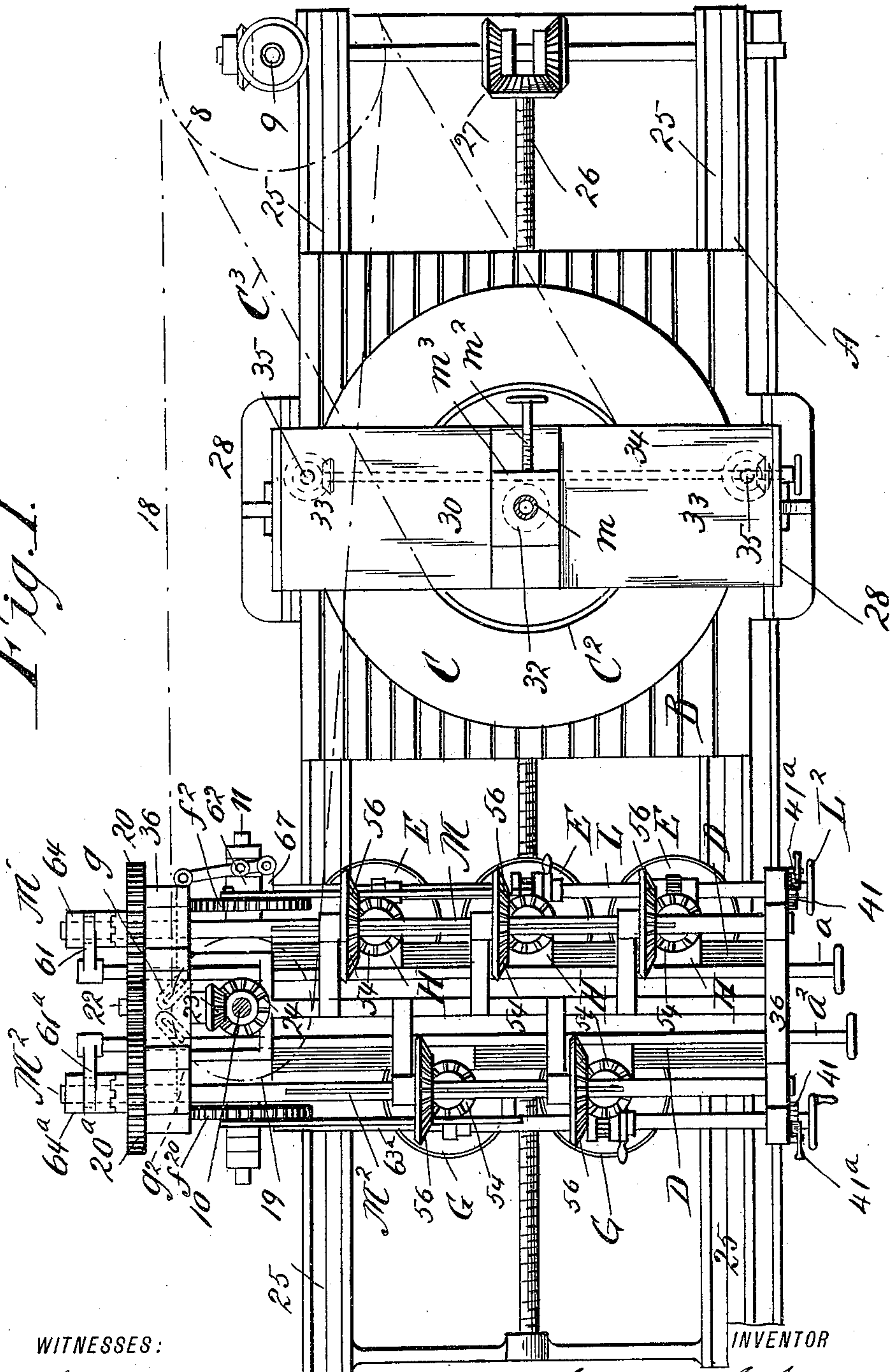
LITHOGRAPHIC STONE SURFACING MACHINE.

(Application filed June 2, 1899.)

(No Model.)

6 Sheets—Sheet 1.

Fig. 1.



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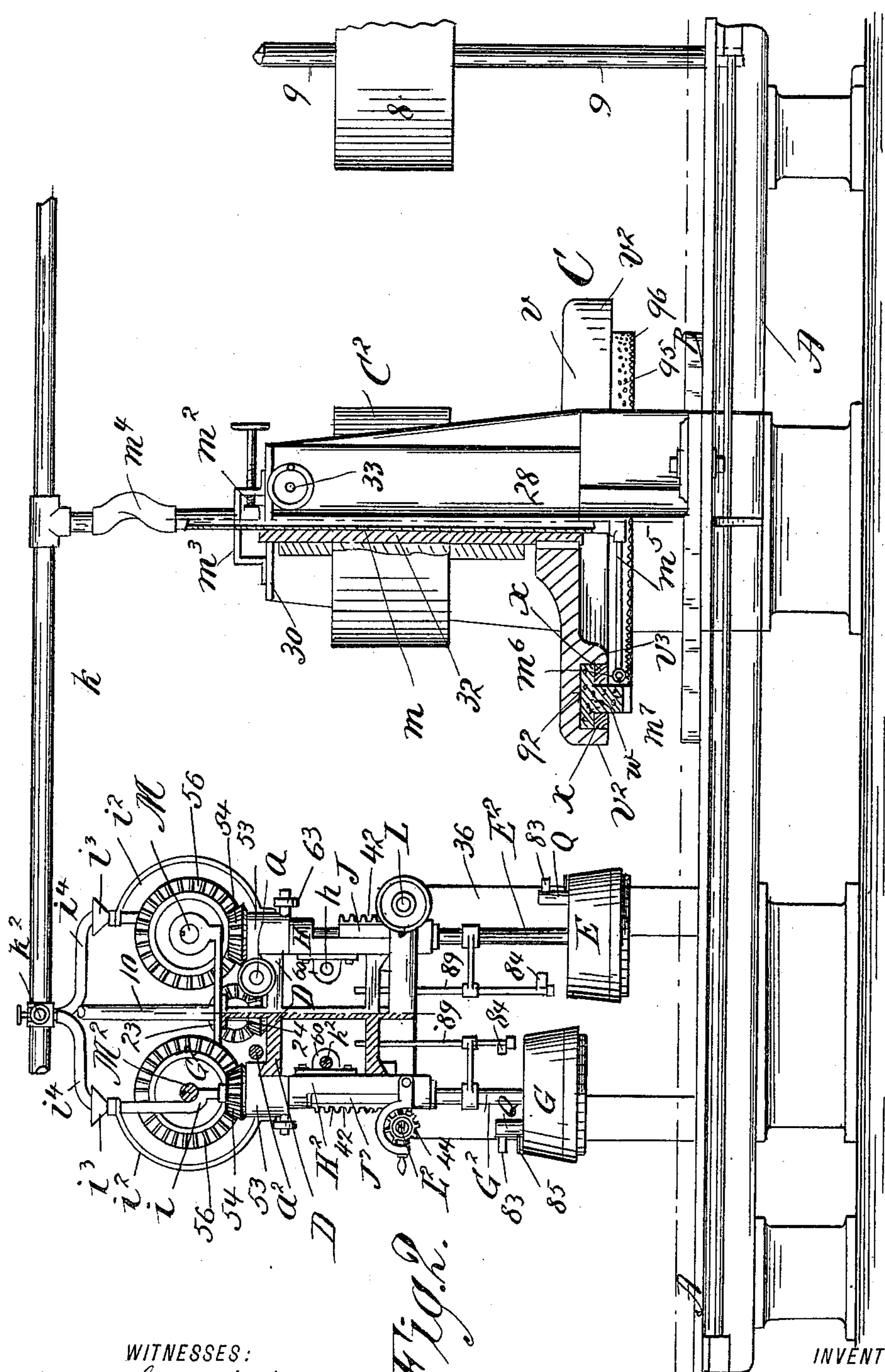


Fig. 2.

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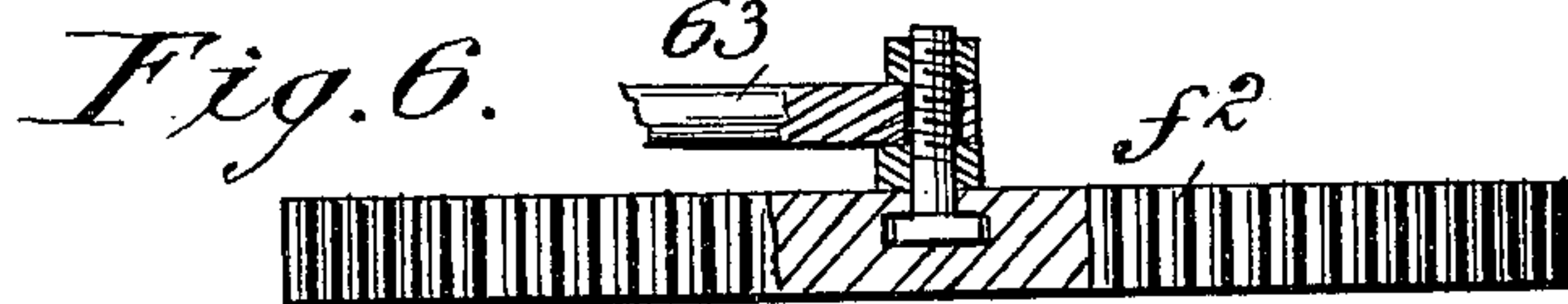
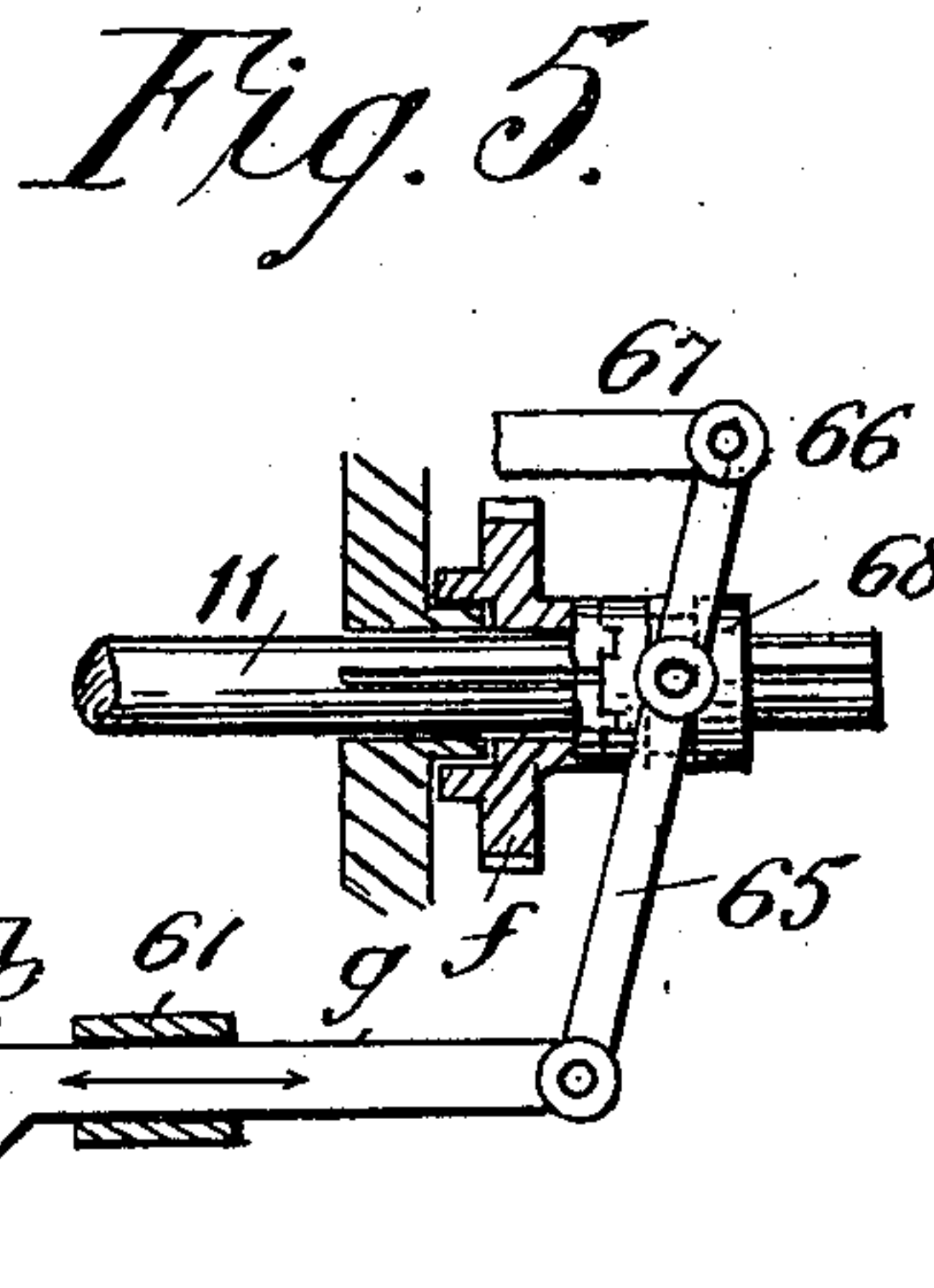
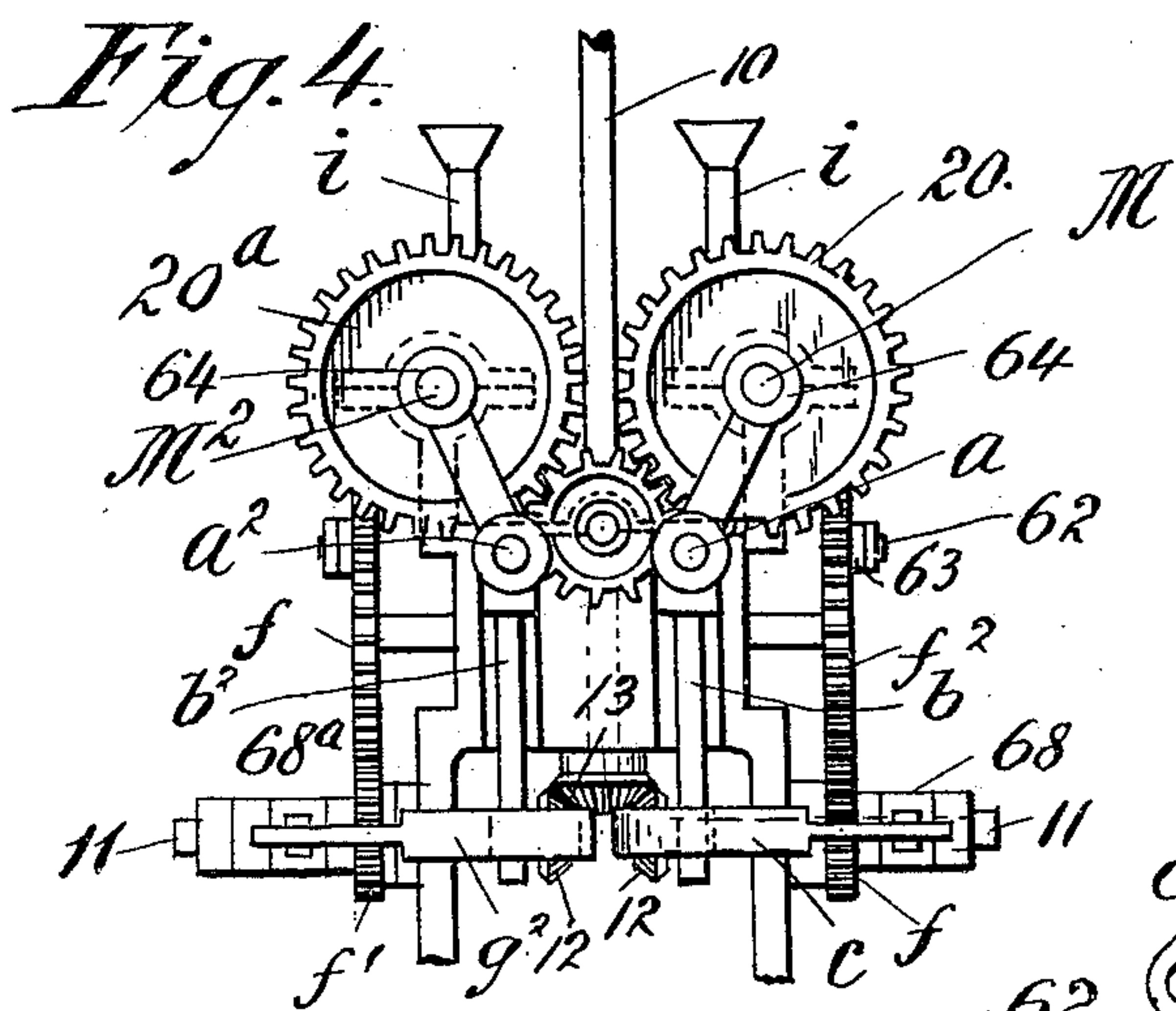
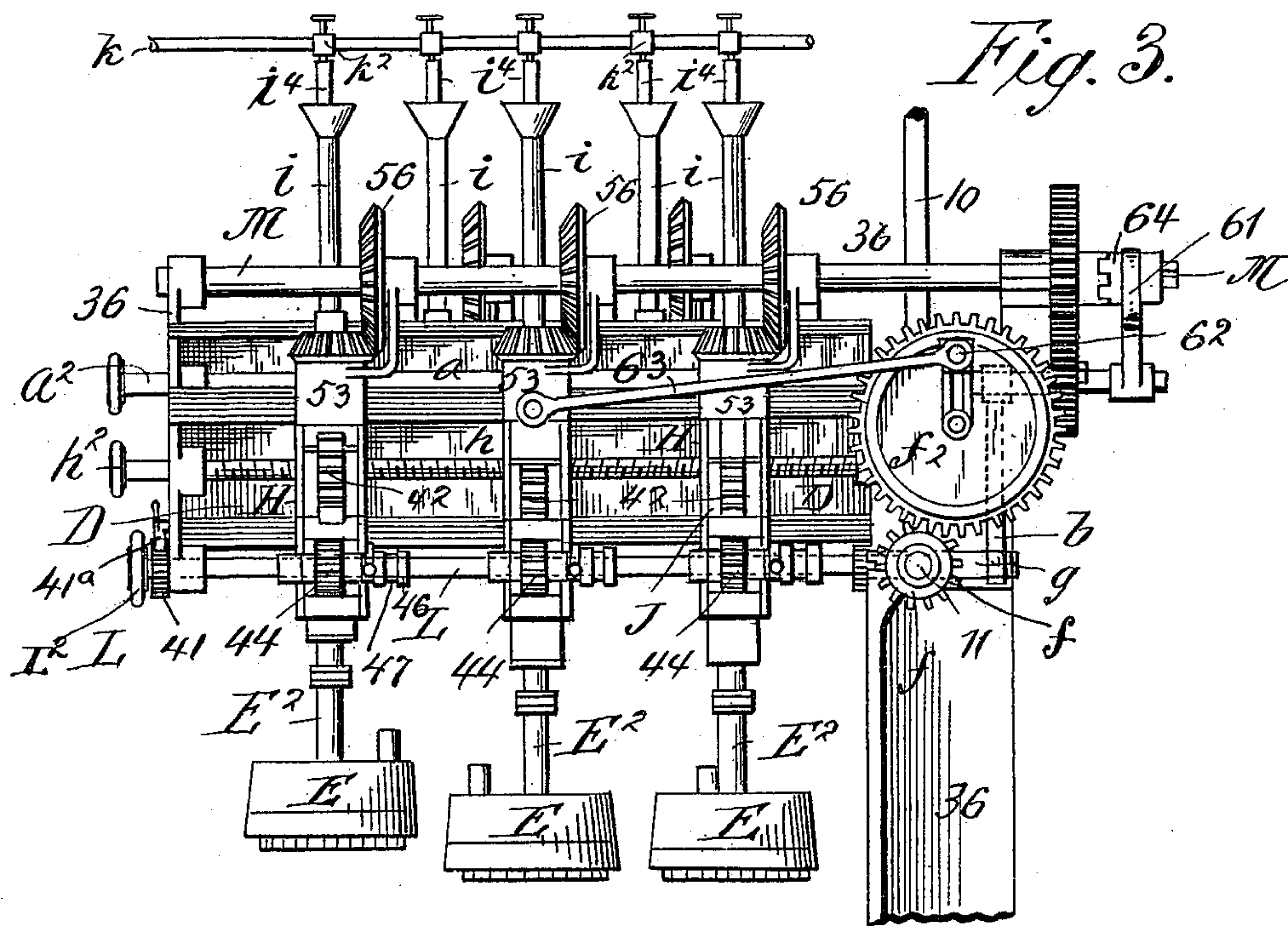
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6 Sheets—Sheet 3.



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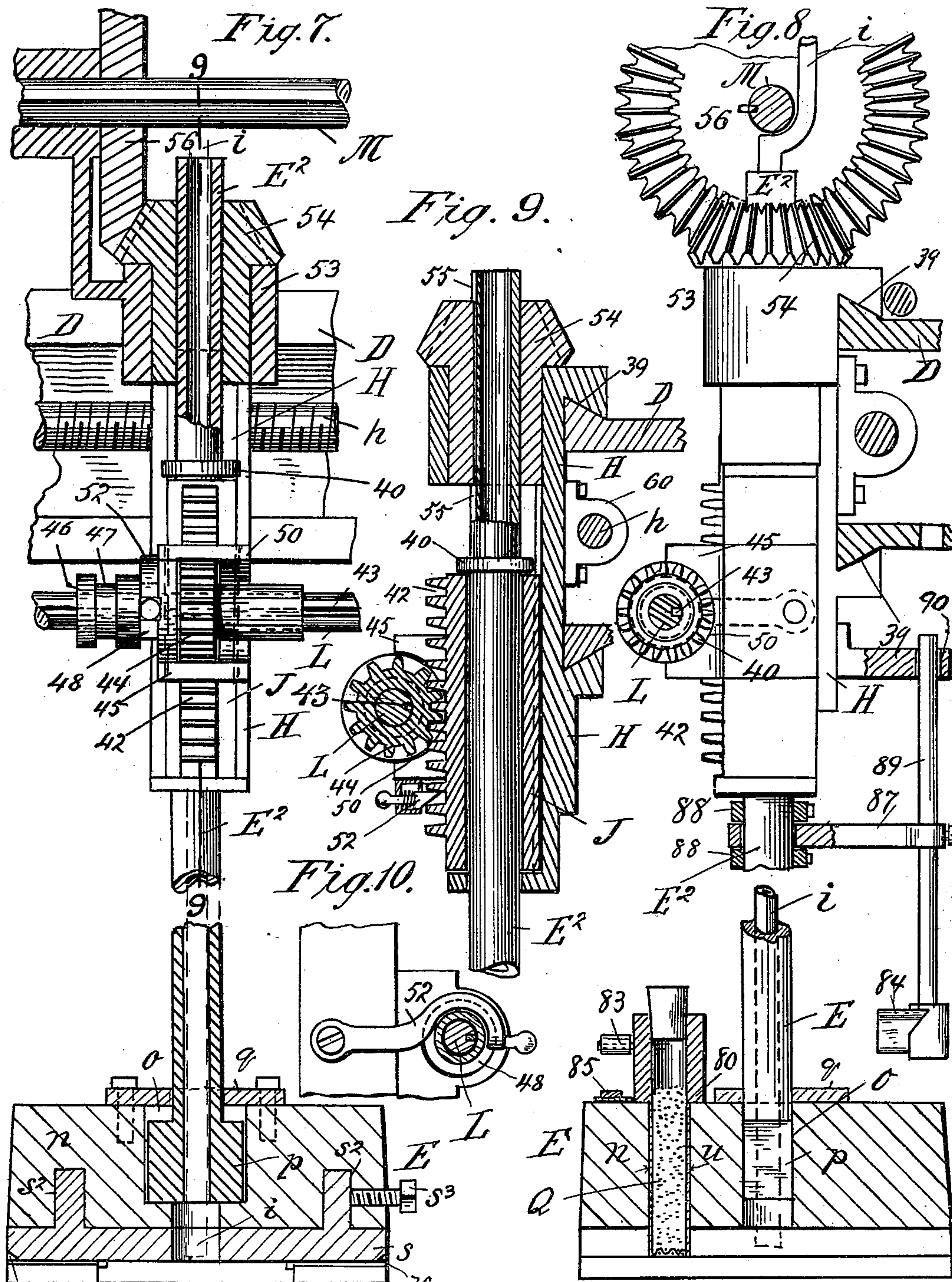
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6 Sheets—Sheet 4.



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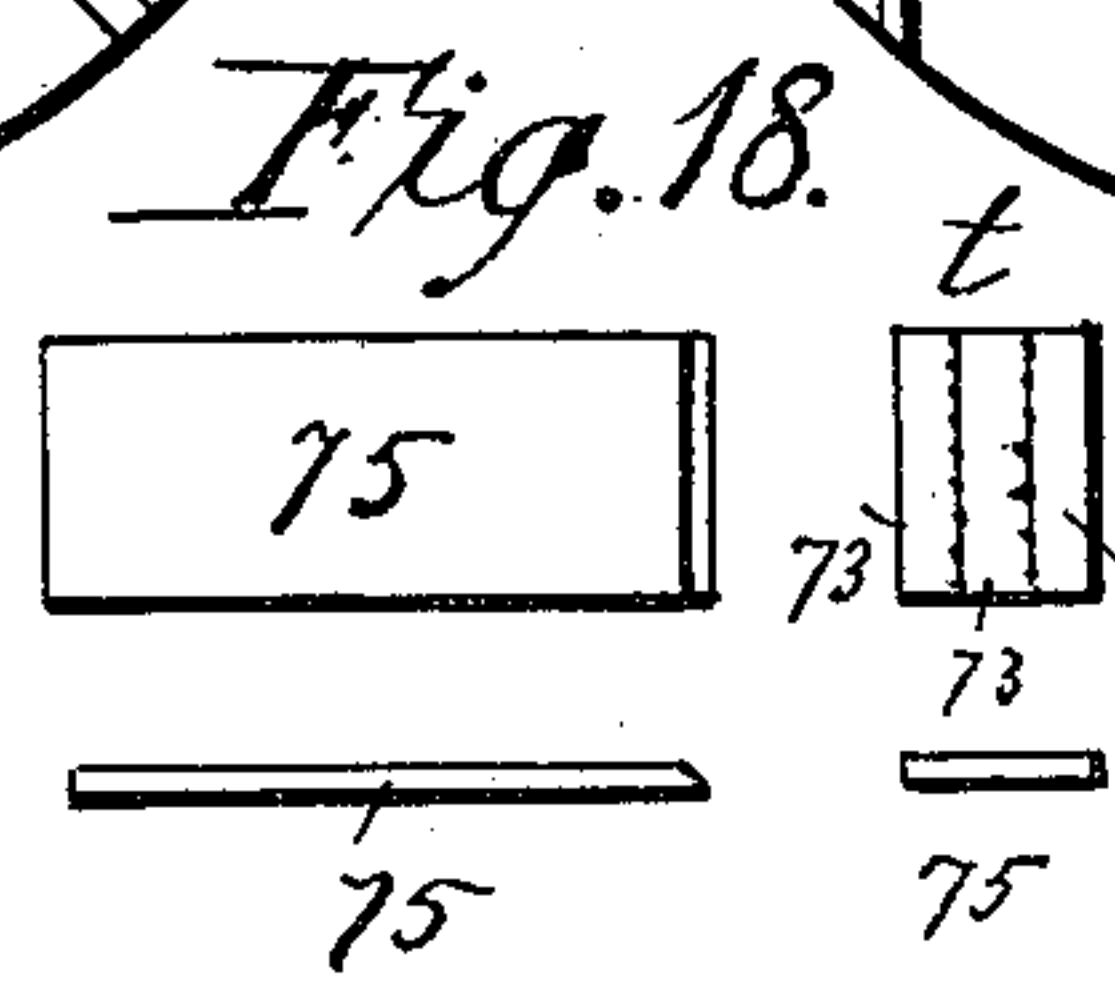
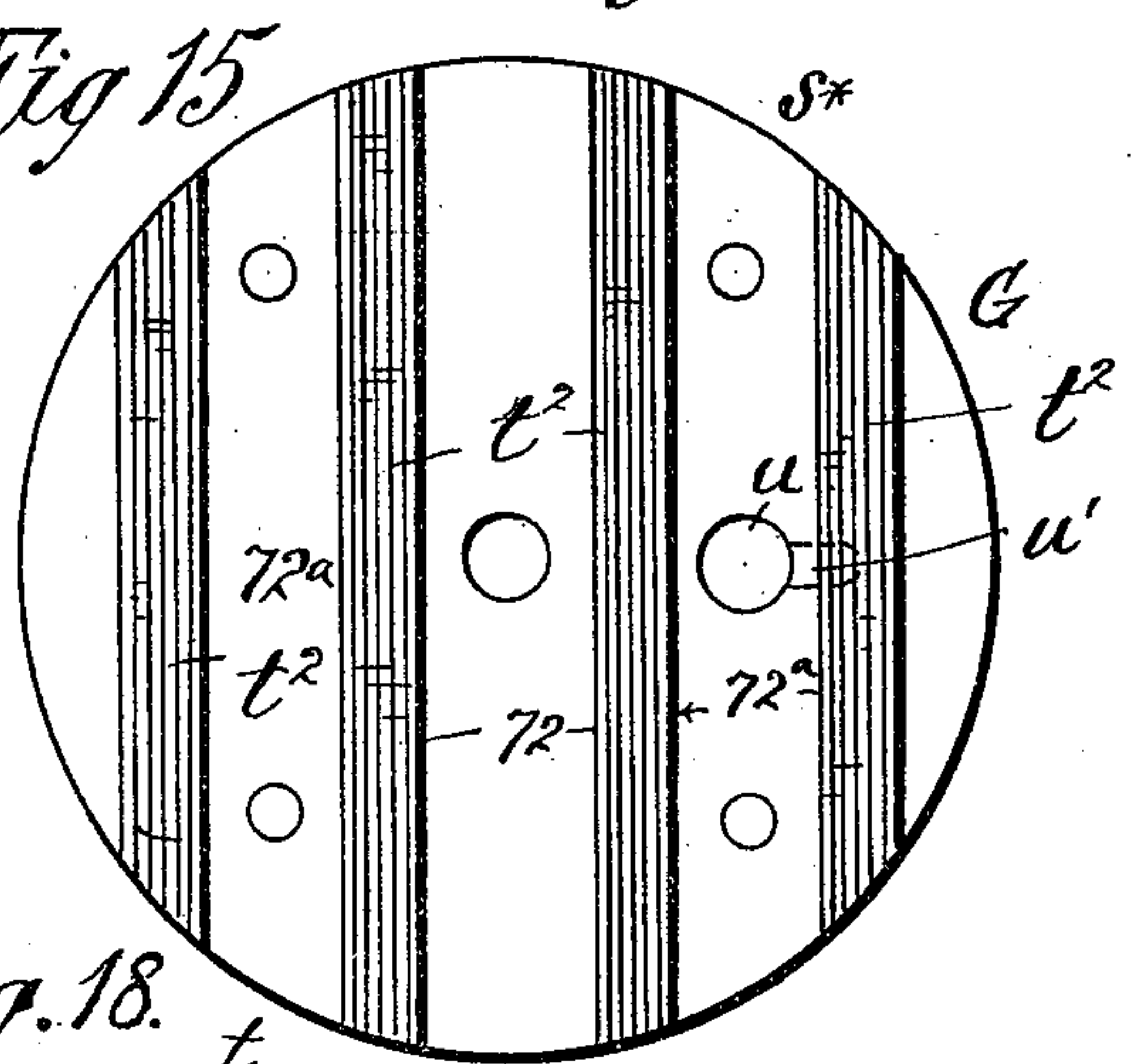
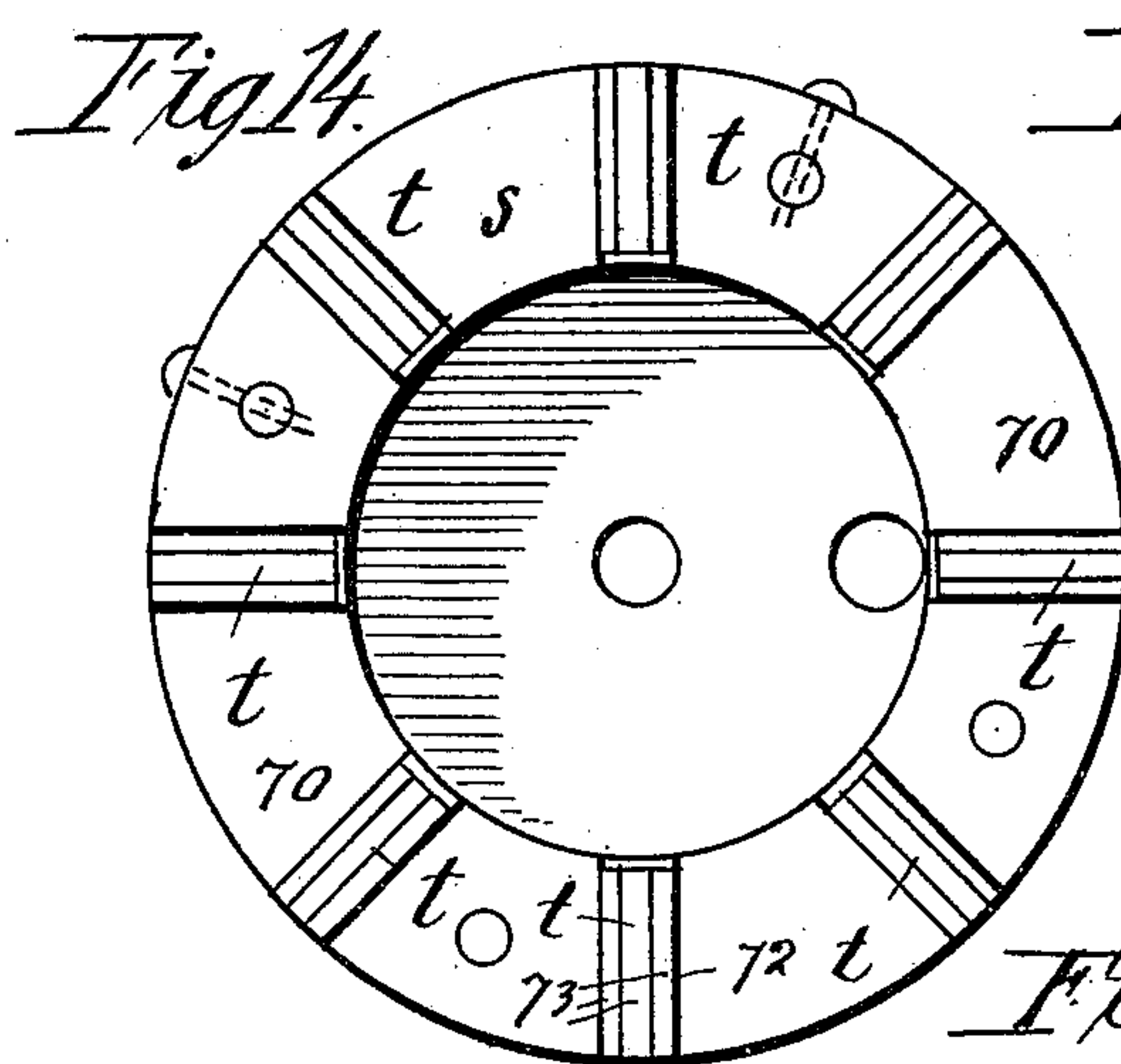
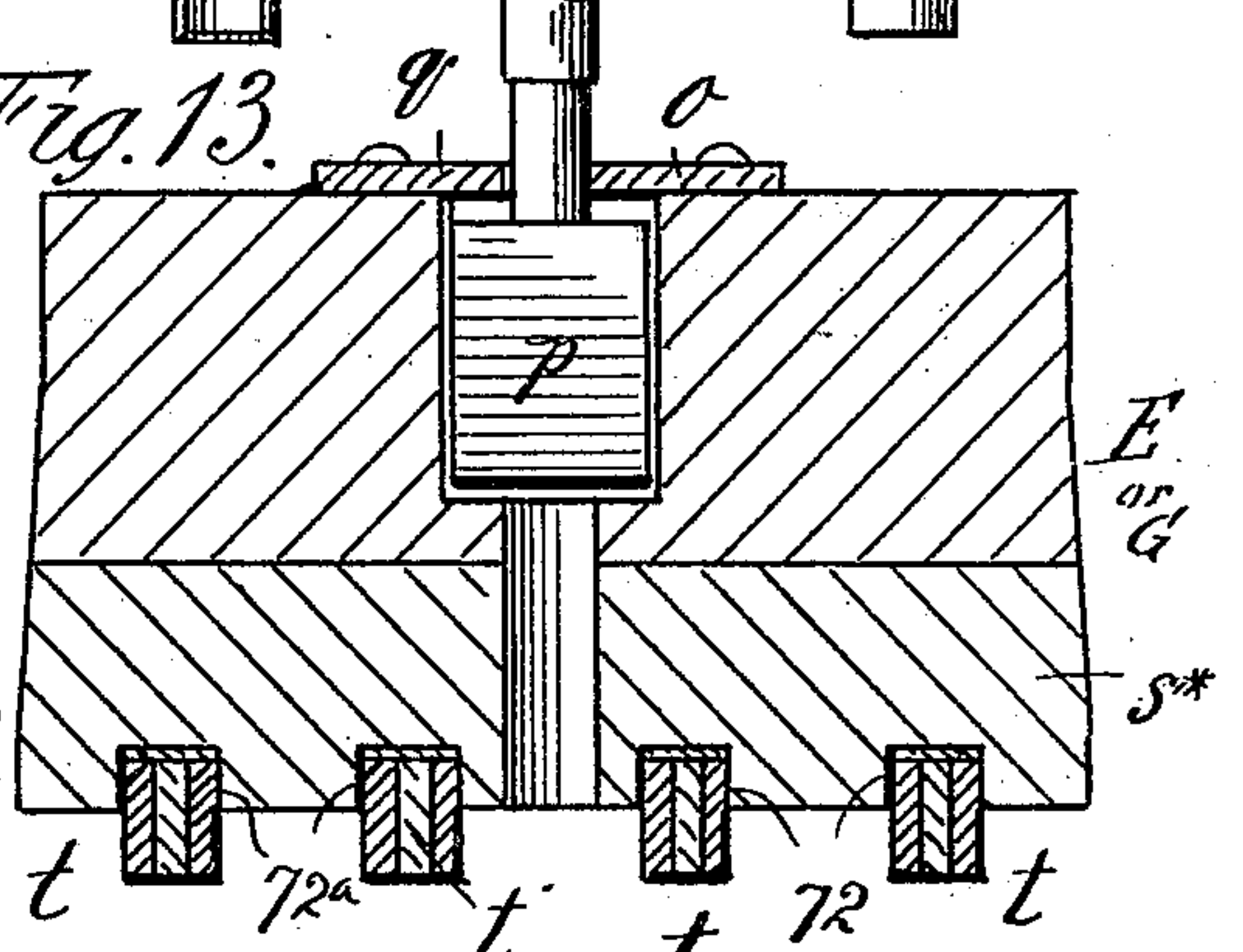
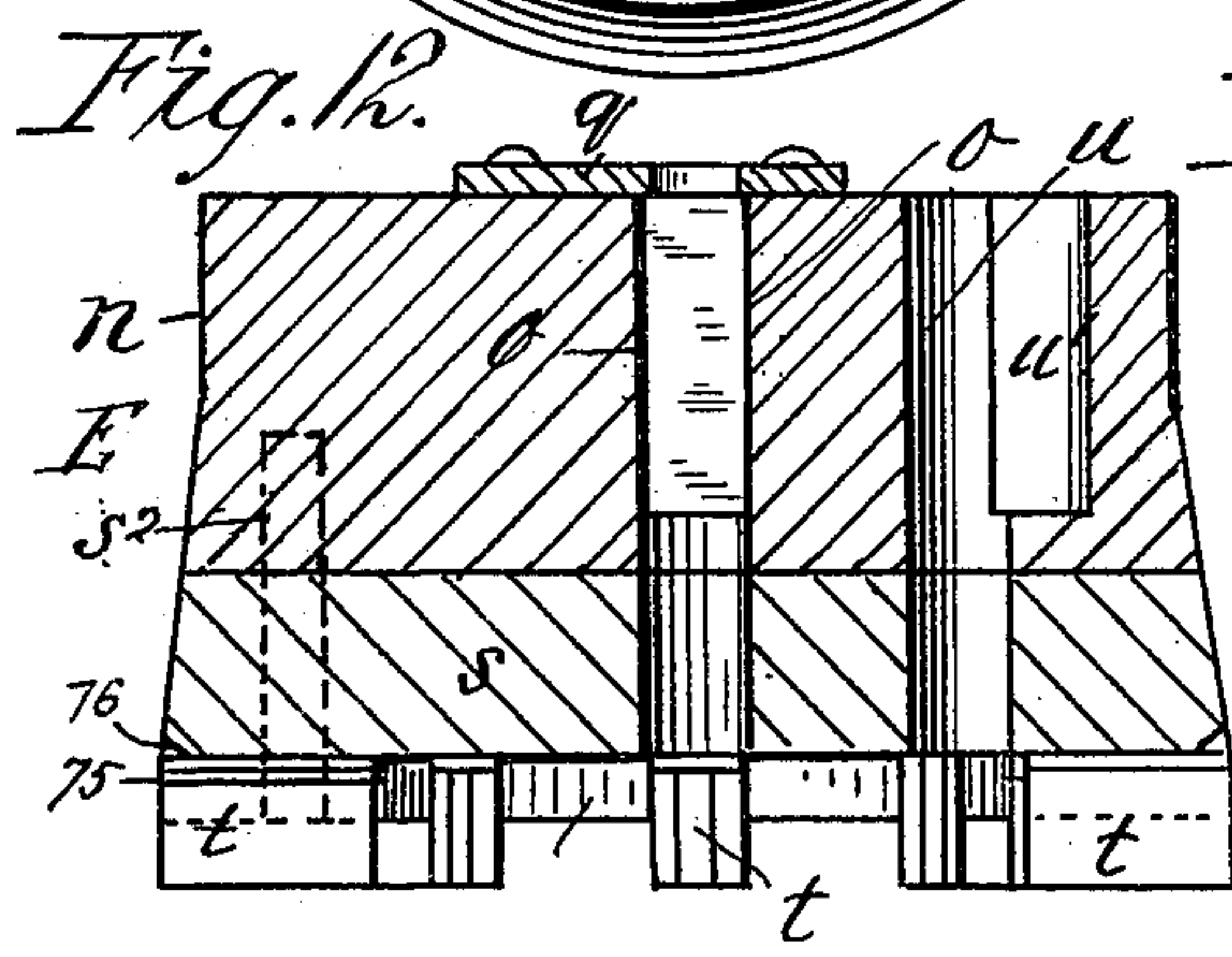
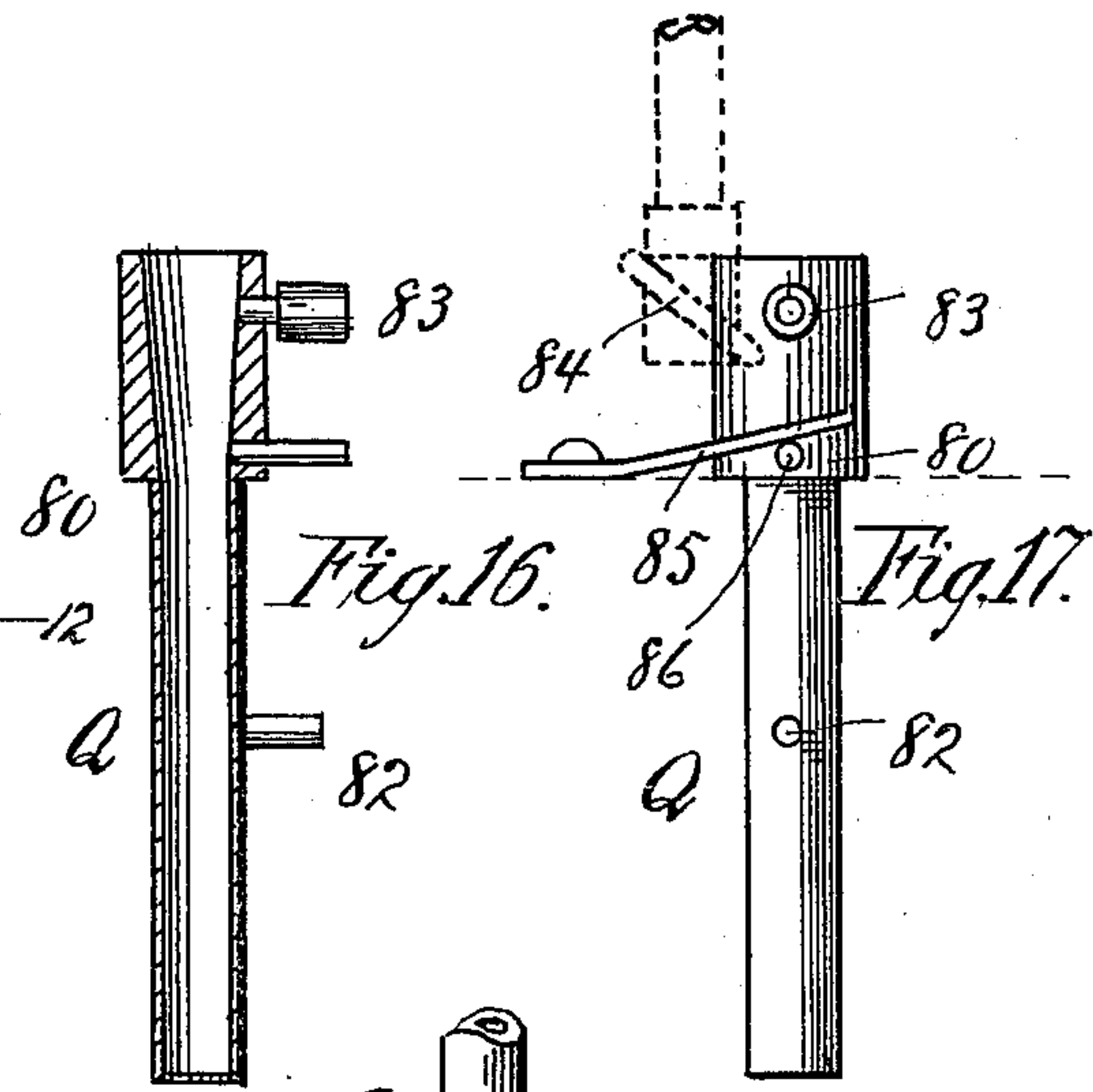
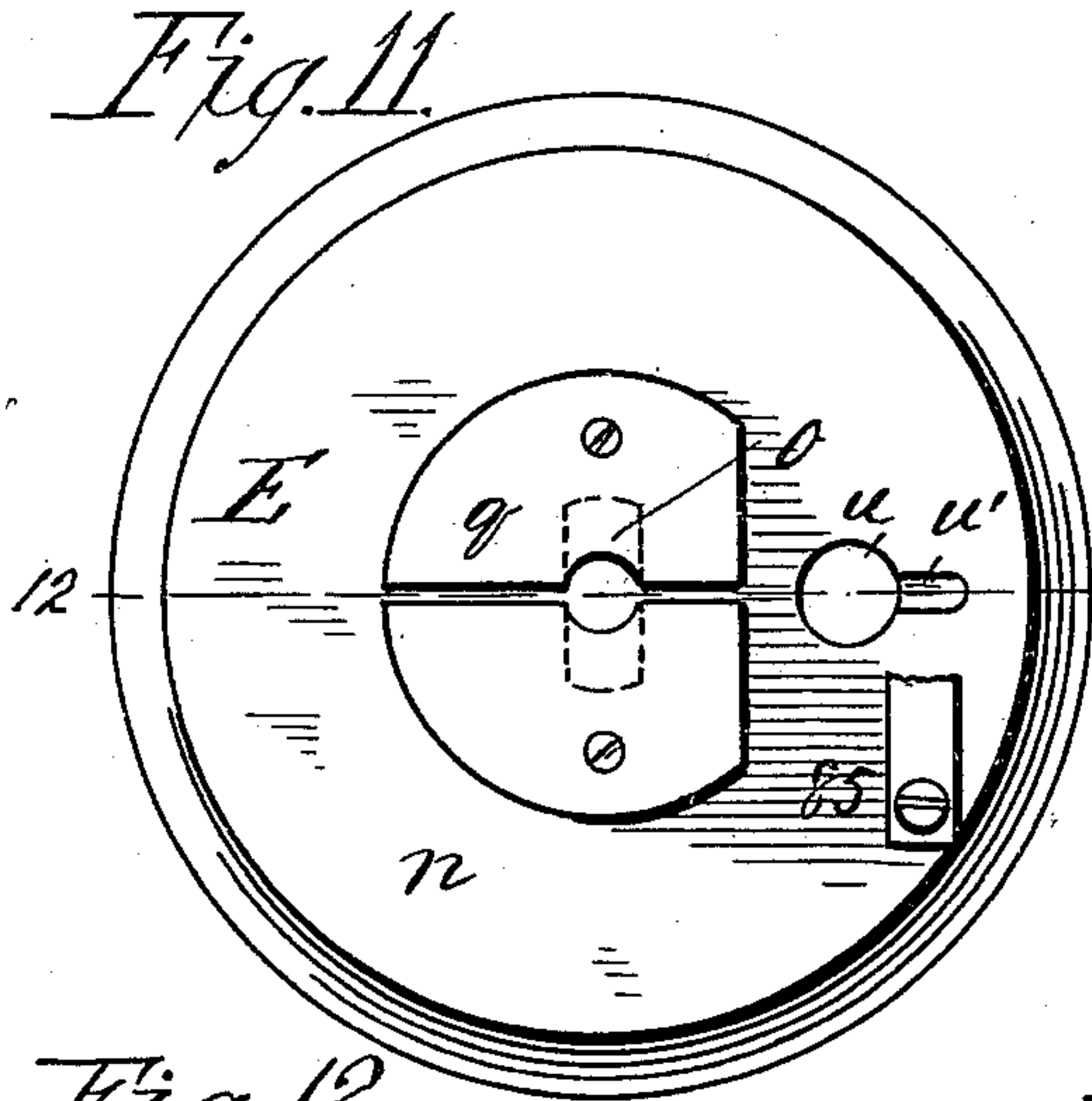
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6 Sheets—Sheet 5.



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Fig. 19.

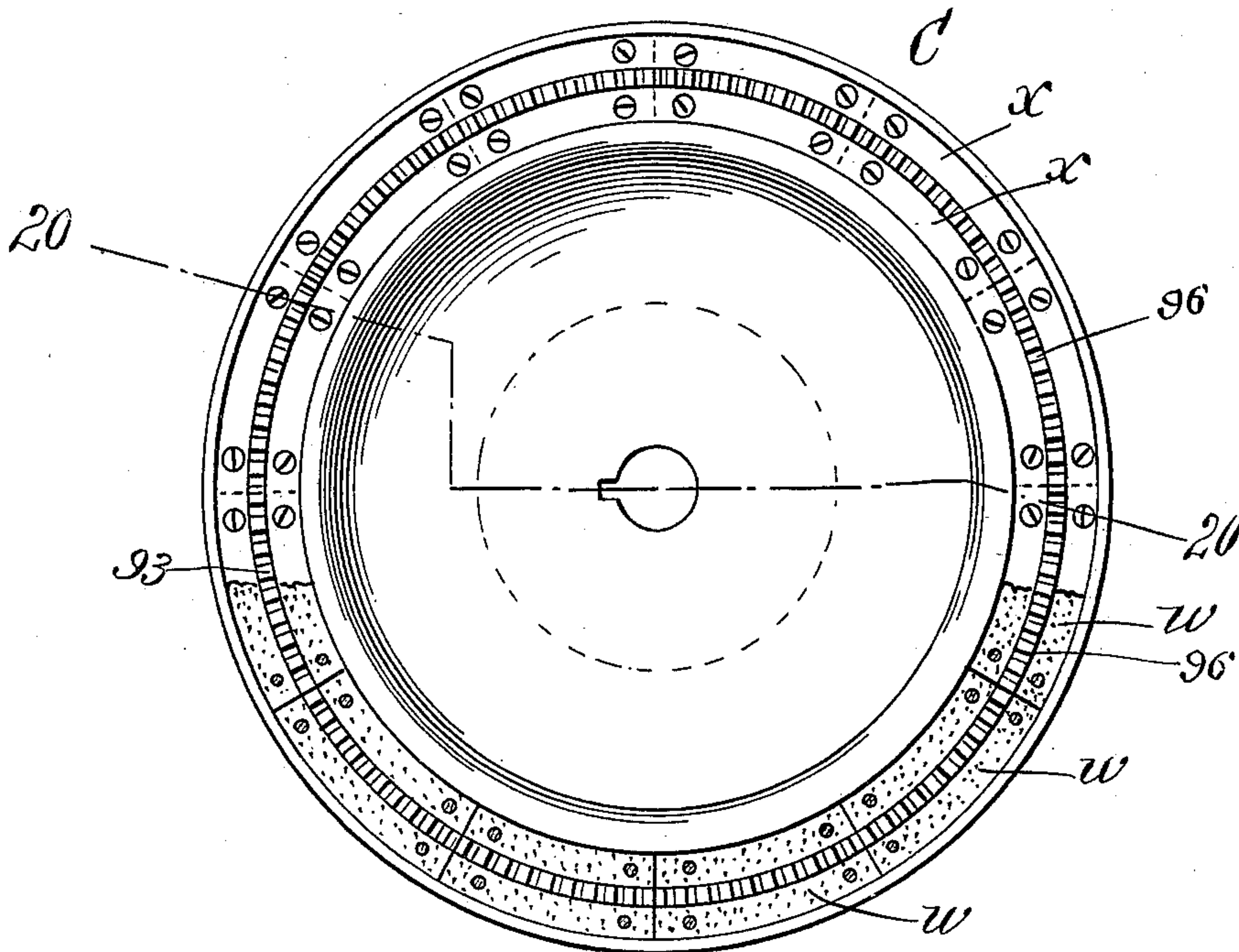


Fig. 20.

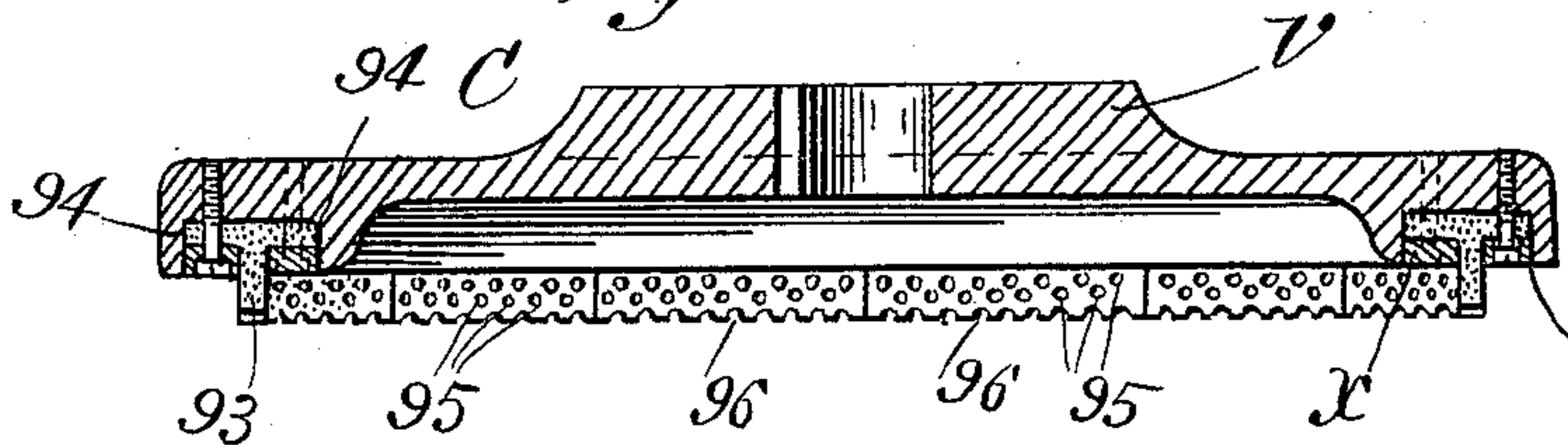
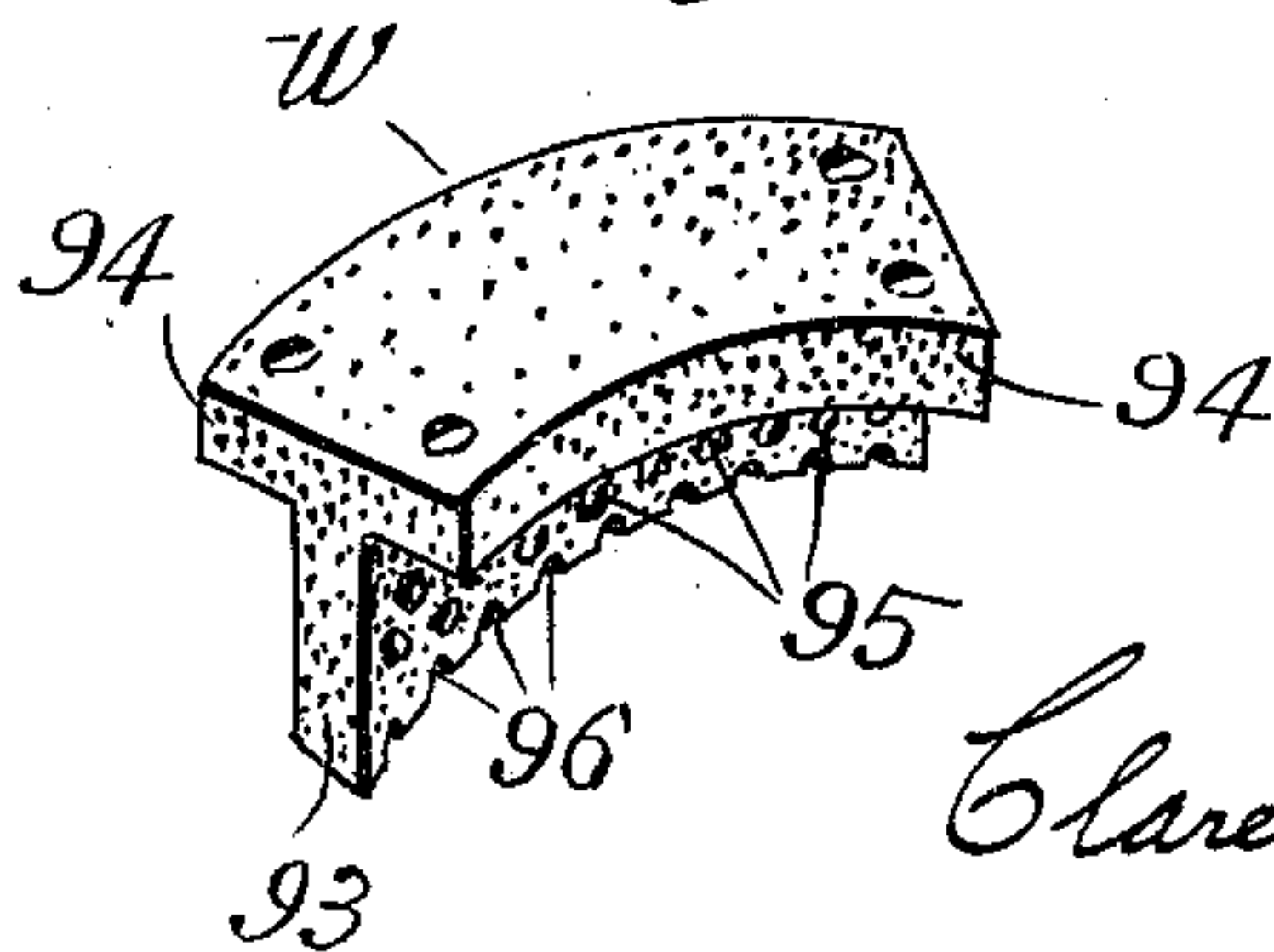


Fig. 21.



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# UNITED STATES PATENT OFFICE.

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## LITHOGRAPHIC-STONE-SURFACING MACHINE.

SPECIFICATION forming part of Letters Patent No. 639,953, dated December 26, 1899.

Application filed June 2, 1899. Serial No. 719,156. (No model.)

*To all whom it may concern:*

Be it known that I, CLARENDON G. WARNER, a citizen of the United States of America, and a resident of Holyoke, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Lithographic-Stone-Surfacing Machines, of which the following is a full, clear, and exact description.

10 This invention relates to machines for resurfacing lithographic stones which have been once used, so as to erase the engraving or transfer or drawings thereon and leave the working face or side thereof perfectly flat  
15 and smooth and in readiness for use for the next engraving, transfer, or drawing.

The invention consists in a machine comprising a carrier for the stone to be surfaced, reciprocating on a bed therefor, a roughing-wheel to the action of which the top of the stone is subjected, a further wheel or set of wheels of finer character, to the further action of which the stone is subjected, and in combination therewith a final polishing wheel  
25 or wheels reciprocating transversely and horizontally in a line transversely of the movement of the work on the bed.

The invention, furthermore, consists in novel means whereby the surfacing-wheels  
30 may be individually raised or lowered or all those of one set or series raised or lowered in unison; to means whereby the surfacing-wheels of the set may be, as desired, approached or separated, their axes being ever retained parallel to accord with the surfacing  
35 or narrower or wider stones to be worked upon.

The invention, furthermore, consists in the means for rotating the two or more surfacing-wheels of a set or series; to means for traversing such wheels bodily; to means for rendering the surfacing-wheel temporarily non-rotatable in conjunction with the means for rendering temporarily, as desired, the traversing mechanism inoperative.  
45

The invention, furthermore, consists in the means for supplying water to the working faces or portions of the surfacing-wheels, means for automatically supplying powdered  
50 pumice-stone or other polishing-powder on the face of the lithographic stone at the part thereof overlaid and being operated upon by

the surfacing, smoothing, or polishing wheels; and the invention, furthermore, consists in various constructions and combinations of parts, all substantially as hereinafter described, and set forth in the claims. 55

This improved machine is fully and clearly illustrated in the accompanying drawings, in which— 60

Figure 1 is a plan view of the complete machine. Fig. 2 is a side elevation, parts thereof being shown in central vertical section for clearer illustration. Fig. 3 is an elevation as seen transversely of the machine looking  
65 from an intermediate portion toward the left-hand end thereof. Fig. 4 is an elevation of parts or mechanism as taken at right angles to the view Fig. 3 looking at the right-hand end thereof. Fig. 5 is a plan and horizontal  
70 sectional view of the device which ships and unships the traversing mechanism for the surfacing-wheels. Fig. 6 is a plan and partial horizontal section of the traversing-wheel. Fig. 7 is a vertical partial sectional  
75 view and partial elevation of one of the surfacing-wheel shafts, the gearing therefor, and other devices to be hereinafter referred to. Fig. 8 is a side elevation in part and a vertical sectional view in part of the mechanism shown  
80 in Fig. 7, but taken at right angles thereto. Fig. 9 is a vertical sectional view on line 9 9, Fig. 7. Fig. 10 is a detail view in elevation of a device to be hereinafter referred to. Fig. 11 is a plan view of one of the surfacing-  
85 wheels. Fig. 12 is a vertical sectional view taken on line 12 12, Fig. 11. Fig. 13 is a view similar to Fig. 12, but taken at right angles thereto and showing at the bottom thereof the final polishing appliance. Fig. 14 is a  
90 plan view at the underside of the surfacing-wheel shown in Figs. 11 and 12. Fig. 15 is plan view of the under side of the final polishing-wheel, of which in this machine there are two or more. Figs. 16 and 17 are re-  
95 spectively central vertical sectional and side views of the receptacle which is carried by and agitated in relation to each of the surfacing-wheels for containing and discharging therefrom ground pumice-stone or other  
100 suitable polishing-powder. Fig. 18 is a view of a group of parts in detail hereinafter individually referred to. Fig. 19 is a plan view of the under side of the large roughing-wheel.



Fig. 20 is a cross-sectional view of the same as taken on the line 20 20. Fig. 21 is a perspective view of one of the abrading sections or segments, of which there are a series comprised in the said wheel.

Similar characters of reference indicate corresponding parts in all of the views.

In the drawings, A represents the bed of the machine, having longitudinal ways 25, along which is guided the carriage B, on which the lithographic stones to be surfaced are supported and confined. The bed has a longitudinal reciprocating motion, as ordinarily in planing-machines, engaging which bed is the feed-screw 26, having the reversing-gearing 27, which is of a well-known character not necessary to describe.

9 represents the driving-shaft of the machine.

At an intermediate part of the bed are the opposite standards 28 28 and a cross-tie beam 30 at the top, in which are bearings for the vertical hollow shaft 32, at the lower end of which is the rough-grinding or coarse-surfacing wheel C, arranged to rotate in a horizontal plane suitably above the bed, the same being rotated by the belt C<sup>3</sup>, which runs from the pulley 8 on the main shaft 9 around the pulley C<sup>2</sup> on the vertical grinding-wheel shaft 32. This grinding-wheel shaft and the wheel carried thereby are vertically adjustable, having adjusting means involving no novelty, but indicated partially at 33, and will be herein referred to in a general way only as comprising the horizontal shaft 34 at the top gearing into vertical shafts 35 35, which have screw or equivalent engagements with the vertically-adjustable support for the wheel C, a vertically-adjustable grinding-wheel whereby its horizontal working face may be disposed more or less nearly to the level of the carriage, being common and well known in various machines of this general character. Further endwise, beyond the roughing-wheel C, are opposite standards 36, supporting between them the transverse elevated horizontal girder-frame D, the opposite sides of which constitute ways for sliding movements of the carrier respectively provided for each of the two series of surfacing-wheels, the shafts on which they are supported, and the rotary driving means therefor.

E E represent the first series of the surfacing-wheels next endwise beyond the roughing-wheel C, they being arranged axially with their vertical carrying-shafts E<sup>2</sup> in a common plane which is vertical and transverse in relation to the length of the bed. G G represent a similarly-arranged pair or series of surfacing-wheels next endwise beyond but comparatively close to the wheels E, being only at the opposite side of the supporting and guiding girder-frame D.

H represents one of the individual carriers for the surfacing-wheel shaft E<sup>2</sup>, the same having dovetail ways 39, which embrace for the transverse horizontal sliding motion the

cross girder-frame D. Each shaft E<sup>2</sup> is extended loosely through the supplemental or secondary carrier J, most clearly shown in Fig. 9, the shaft rotating freely therethrough; but the shaft is provided with a collar or shoulder 40, which engages the upper end of the secondary carrier J. Each carrier is constructed with rack-teeth 42.

Supported in suitable fixed bearings is the horizontal shaft L, ranging transversely relatively and in common to the series of secondary carriers J, this shaft being splined, as seen at 43, and a gear-wheel 44 has a spline engagement to rotate with and to move endwise along said shaft L. Each gear-wheel is located within a yoke or housing 45, which is projected at the front of the carrier H, the same straddling over and being free from the carrier J, said gear having the elongated hub 46, provided with the two annular grooves 47 and 48. One side of the housing 45 for the said gear-wheel 44 is recessed, as shown at 50, so that the said gear-wheel and its hub may be slid endwise along the shaft, whereby the gear-wheel may be in or out of mesh with the rack 42 of the secondary carrier.

52 represents a hinged retainer adapted to be swung down into engagement with either the groove 48 or the groove 47, so as to hold the gear in its proper transversely-arranged position to mesh or be out of mesh, as desired, with the rack.

L<sup>2</sup> represents a hand-wheel, by means of which to turn the shaft L for the purpose of raising and lowering through the gearing and secondary carriers, or all of those with which the gears 44 are in mesh, and through the carriers engaging the surfacing-wheel shafts E<sup>2</sup>, the raising of such shafts and the surfacing-wheel carried at the lower end thereof or permitting the lowering of such shafts by the weight thereof and of the wheels carried thereby. These arrangements last described permit, as indicated in Fig. 2, that one of the series of the wheels may be raised above the working level or that one or more of the series may be individually raised above such level, it being understood that such of the surfacing-wheels as have the gear-wheel 44 left in mesh with the racks provided on the secondary carriers corresponding respectively to the surfacing-wheels will on the turning of the shaft L be raised; but in order to insure that on the turning of said shaft L an individual one of the surfacing-wheels E will remain in its lowered working position it is only necessary to slide the gear-wheel 44 corresponding to such surfacing-wheel along the shaft L, whereupon the rotational movement imparted to such shaft will be without effect to change the position of the grinding or surfacing wheel.

At 52 in Fig. 9 is shown a snap-latch to engage the rack-teeth of the secondary carrier, so that when the latter has been elevated it will be retained in its elevated position, this device being readily withdrawn, when desired,



from its engagement to permit the secondary carrier and its shaft to be lowered.

Supported on the primary carrier H for each surfacing-wheel shaft  $E^2$  in a suitable journal-bearing 53 therefor is a bevel gear-wheel 54, the same having a spline engagement, as indicated at 55, Fig. 9, with the surfacing-wheel shaft  $E^2$ , whereby the latter may play vertically through the gear-wheel individually engaged therewith and through which such shaft is rotated.

Ranging transversely above the upper ends of the series of surfacing-wheel shafts  $E^2$  is the horizontal shaft M, splined on which are the several bevel gear-wheels 56. This shaft 56 is driven, primarily, from the main driving-shaft 9 of the machine through driving mechanism as follows: A gear-wheel 20 is mounted on the end portion of said shaft M, meshing with which is a gear-wheel on a short horizontal shaft 22, located at the rear side of the machine, this short shaft 22 having thereon the bevel gear-wheel 23, which is in mesh with bevel gear-wheel 24 on the vertical shaft 10, having thereon the pulley 19, (indicated by dotted lines in the plan view,) and driven by the belt 18, running from a pulley on the aforesaid main driving-shaft 9.

Each primary carrier H for a surfacing-wheel  $E^2$  has at its rear side, within the cored-out part of the transverse girder-frame D, the earpiece or projection 60, and through the several of these projections the single screw-shaft  $h$  engages, the same being provided with a hand-wheel  $h^2$  or other suitable means for turning it, so that the outer carriers H of the series of three for the surfacing-wheels  $E$   $E$   $E$  may be moved inwardly toward or outwardly from the middle one of these wheels, the threads at the opposite end portions of this screw-shaft being reversed—that is, the said shaft has thereon right and left hand screw-threads.

A traversing motion is imparted to the several primary carriers for the series of surfacing-wheels, which carriers, through the aforesaid screw-shaft which engages them, are united to move in unison transversely, and this traversing motion is imparted by the rotation of the wheel  $f^2$ , which has the eccentric-pin 62, connecting with which is the pitman or connecting-rod 63, which is secured to one of the carriers H. The gear-wheel  $f$  meshes into the gear-wheel  $f^2$ , this wheel being mounted on a short shaft 11, the line of which is longitudinally of the machine, and this shaft 11 has at its inner end the gear-wheel 12, which is in mesh with the bevel gear-wheel 13 at the lower end of the aforesaid vertical shaft 10, to which latter shaft the rotary motion is imparted by the belt and pulley, as aforementioned.

At the time the roughing-wheel is being used on the work (lithographic stone carried on the longitudinally-reciprocating bed B) it is not desired to rotate the surfacing-wheels  $E$  or to traverse them, and I have provided means

whereby the shaft M, having the gearing connections in common with the several surfacing-wheel shafts  $E^2$ , may cease its rotation and whereby the gear-wheels  $f$  and  $f^2$  may be stopped to insure a cessation of the traversing action.

$\alpha$  represents a push-rod ranging transversely of the machine, the same being supported for its horizontal sliding movements in an upper part of the cross girder-framing D, this carrying at its rear end the arm or yoke 61, which embraces the clutch member 64, which slides on the shaft M, it being understood that the clutch member 64 is splined on the shaft and that the gear-wheel 20 rotates independently of said shaft M. The rotation of said gear-wheel will not cause the turning of the shaft unless the clutch is in. Operating in conjunction with this clutch-actuating push-rod is a clutch-operating mechanism for throwing the gear-wheel  $f$  into and out of clutch engagement with the shaft 11, which has the continuous rotation, so that when the gear-wheel  $f$  is out of clutch the traversing motion will be stopped. Located below the push-rod suitably adjacent the shaft 11 is a slide-bar  $g$ , having an inclined end portion provided with a cam-slot  $c$ . Engaging in this cam-slot is a depending pin or stud  $b$ , which is affixed as a rigid part to the push-rod  $\alpha$ . Said bar  $g$  is constrained to move in a straight line because of the guide 51. (See Fig. 5.) This bar is connected to a clutch-operating lever or arm 65, the same being shown as pivoted at 66 to the short stud or fixture 67.

68 represents the clutch proper, having a spline engagement on the shaft 11, around which the gear  $f$  turns, said gear not being affixed to the shaft, but having an independent journal-bearing.

By throwing the clutch 68 out of engagement with the hub of the gear  $f$  the rotation of the shaft 11 will be without effect to turn said gear, and consequently to drive the traversing-gear  $f^2$ , and hence at the same time the driving-gear 20 is out of clutch with the shaft M the shaft  $f$  will also be out of clutch with the shaft 11, driven as aforesaid, which said gear  $f$  when driven drives the traversing-gear  $f^2$ .

The set of surfacing-wheels G, two of which are shown in the plan view, Fig. 1, at the side of the upright framing of the machine toward the left-hand end of the latter, are respectively provided with carrying-shafts  $G^2$ , having combined therewith the secondary carriers  $J^2$ , mounted on primary carriers  $H^2$ , which slide on the transverse girder-frame D in precisely the same manner as the carriers H, already described, and each of these secondary carriers  $J^2$  has the rack-teeth 42, meshing with each of which is a gear-wheel 44, arranged on the horizontal shaft  $L^2$  and adapted to be slid in and out of mesh with the adjacent rack-teeth on the supplemental carrier, so that these shafts and surfacing-



wheels may be both or either of them elevated above the working level.

The right and left hand screw-shaft  $h^2$  is understood as applied in the same manner as the one  $h$  for bringing the surfacing-wheels and their shafts in axial proximity or greater separation, as may be desired, and the bevel-gearing 53 54 is duplicated and arranged at the upper ends of each of the shafts  $G^2$ , so that whether the shafts are approached or arranged in greater distention their driving engagements remain intact, and in conjunction with the shaft  $M^2$ , arranged similarly to the one  $M$ , is the gear-wheel  $20^a$ , combined with which is the clutch  $64^a$ , operated by duplication of the same clutching and unclutching mechanism as described in conjunction with the gear-wheel  $20$ , and the traversing-gear  $f^{20}$  is suitably arranged opposite the one  $f^2$  and has combined therewith the connecting-rod  $63^a$ , which also has connection with the two primary carriers  $H^2$ , connected by the screw-shaft, as aforesaid, so that the surfacing-wheels  $G$   $G$  are traversed relatively to the longitudinally horizontally reciprocating work the same as the wheels  $E$   $E$ , and in conjunction with the traversing-gear  $f^{20}$  and a gear  $f'$ , like the aforesaid gear  $f$ , is the clutch  $68^a$ , the push-rod  $a^2$ , stud  $b^2$ , and clutch-operating device  $g^2$ , which is a counterpart of that shown in Fig. 5 and already described.

All of the shafts  $E^2$  and  $G^2$  are constructed hollow or tubular from end to end, and extending down within each is a vertical water-pipe  $i$ , terminating at or near the bottom of the annular surfacing-wheel, these pipes being respectively supported by brackets  $i^2$ , as shown in Fig. 2 only. The upper ends of these water-pipes are provided with funnels  $i^3$ , leading into which are flexible sections of hose-pipe  $i^4$ , extended from the main supply-pipe  $k$ , which is suitably supported from the overhead flooring or any available supporting structure, and cocks  $k^2$  are provided for the individual conduits, so that the water may be turned onto or off from each tubular conductor for the respective vertical surfacing-wheel-carrying shafts. The roughing-wheel  $C$  has its vertical hollow shaft  $12$  also internally provided with a water-supply pipe  $m$ , the same being supported adjustably as to height by the set-screw  $m^2$ , which screws through the bracket  $m^3$  at the top of the supporting-frame or carrier for the shaft of the roughing-wheel. The said water-pipe  $m$  has at its upper end the flexible conduit-section  $m^4$ , which is coupled to the overhead supply-pipe  $k$ . The lower end of the pipe  $m$  has radial horizontal branches  $m^5$ , which connect the pipe  $m$ , in the manner of the spokes of a wheel, with the annular pipe  $m^6$ , which is thereby supported within the grinding or abrading sections which constitute the annular surfacing medium of the roughing-wheel  $C$ . This annular pipe  $m^6$  has the series of jet-holes  $m^7$ , whereby the water may be expressed at all

points around the circular working edge of the roughing-wheel.

Each of the surfacing-wheels  $E$  is constructed with a circular carrier or body  $n$ , which may advantageously be made of cast-iron, and this body is so engaged on the lower end of the vertical shaft  $E$ , therefore, that it may have a slight degree of lost motion or play relatively to its shaft, so as to conform to the level surface of the stone being worked upon and yet so that the rotary motion of the shaft will rotate the surfacing-wheel and also so that the lifting motion in any considerable extent imparted to the shaft by the means hereinbefore described will elevate the surfacing-wheel clear from its work. This connection is constituted by forming the body of the surfacing-wheel with a squared mortise  $o$ , extending vertically and centrally from its top, while the lower end of the carrying-shaft  $E^2$  (or  $G^2$ , for both sets of wheels  $E$  and  $G$  are mounted at the lower ends of the carrying-shafts  $E^2$  and  $G^2$  in similar manner) is constructed with a solidly-formed or rigidly-connected tenon  $t$ , which is sunk within the mortise and is overlaid by the retaining-cap  $q$ .

Detachably connected with the surfacing-wheel body is the annular carrier  $s$  for the series of surfacing-sections of abrading material with which said carrier is provided at its under side. Said carrier has dowel and socket engagements with the body, as indicated at  $s^2$ , retaining or set screws  $s^3$  engaging the dowels, the same being provided to penetrate the body of the carrier from its periphery.

The carrier of the surfacing-wheels  $E$  is constructed with the depending annular flange  $70$ , formed with a series of radial recesses or pockets  $72$ , opening at the bottom of said flange, and in these pockets, which also open radially at the outer periphery of the flange, are the blocks or sections  $t$   $t$ , of rectangular form, and which may be of any material or combinations of materials to constitute an abrading medium having fitness to the purpose. These blocks may advantageously be made of layers  $73$  of wood or leather or wood and leather or other material of fine grain or texture, having their adjoining faces surfaced with glue, which glue before the so-surfaced layers are placed together and clamped is liberally sprinkled with emery, so that the finished block  $t$  is constituted with strata of ground emery or like gritty material, which in use exerts a very good surfacing action on a lithographic stone. This block retains its good surfacing capability even after having been considerably worn away, always presenting at its working face the combination of the comparatively smooth grained and more gritty substances. These blocks are crowded into place tightly within the radial recesses therefor and are held against displacement by reason of their crowding fit, which is materially increased by the expand-



ing effect of the water copiously applied in the surfacing operations of the machine.

Inasmuch as the abrading sections or blocks, the lower edges of which protrude beyond the base of the flange 70, become finally uniformly reduced and worn away, they are downwardly crowded to compensate for the wear by inserting thin strips 75, of wood or other suitable material, in the top walls of the recesses 72, and in order to render this easy the outer corners of the recesses are beveled, as shown at 76, and the said strips are formed with their entering ends beveled or chisel-shaped, whereby they may be entered to their crowding action above the blocks *t*.

The pair or set of wheels *G G*, which are designed to operate on the face of the surface lithographic stone after the same has previously been reduced by the roughing-wheel and the surfacing-wheels *E E*, is shown as having a body *n*<sup>2</sup>, the same as and mounted on its shaft in the same manner as the body of the surfacing-wheel *E*, and the holder *s*<sup>\*</sup>, which has the dowel-and-socket engagement and set-screw confinement, as before described, is here made in the form of a disk with a small central opening for the disposition therein of the water-pipe, and recesses 72<sup>a</sup> extend from edge to edge of the holder, and in these recesses are fitted bars or sections of the abrading material, (indicated by *t*<sup>2</sup>), these being rubber in any of its elastic compounds or combinations of rubber and cloth or felt or other polishing material.

Each of the surfacing-wheels *E* and *G* is provided with a receptacle containing ground pumice, which receptacle is carried bodily with the stone and is adapted to be agitated for the purpose of discharging a portion of the pumice down through an opening therefor terminating at the bottom of the stone to facilitate the surfacing and polishing effects. Therefore it will be pointed out that each surfacing or polishing wheel body is constructed with a socket *u*, which extends from top to bottom of the body, being also continued through the carrier or holder *s* or *s*<sup>\*</sup>, the lateral recess *u'* leading radially from the socket and having its base within the thickness of the body.

*Q* represents a tubular receptacle for the polishing-powder, the same having its bottom constructed as a sprinkler by being perforated or composed of gauze. This receptacle at its upper end portion is shouldered, as shown at 80, so that as it is periodically elevated by means to be shortly described and permitted to fall it will in its descent, by reason of the abutment of its shoulder 80 against the body of the wheel, receive a shock or become agitated, causing a sifting out of the polishing-powder at the bottom.

The holder *Q* for the polishing-powder is provided with lateral projection 82, which engages in the lateral aperture *u'* to prevent rotational movement of the device *Q*, permitting freely, however, its vertical play.

The receptacle *Q*, near its top, has a projection or cam-roller 83, which of course revolves bodily with the surfacing-wheel, and in the path of this cam-roller is the cam or incline 84, so that every time the projection 83 reaches and impinges against the cam it must necessarily ride up thereon, elevating the receptacle, and immediately thereafter as the projection 83 in its continued revoluble movement passes clear of the cam it is allowed to descend. The descent is insured forcibly and positively by the application of the spring 85, which is fastened on the top of the surfacing-wheel body and has by its free end a downward reaction against the stud 86, projected from the side of the upper end portion of receptacle *Q*.

In order that the cam may have its proper relative position to the projection 83 on receptacle *Q* always the same, such cam is so arranged as to have rising and falling movements in unison with the rising and falling movements of the surfacing-wheel-carrying shaft in conjunction with which it is arranged, and, as most clearly shown in Fig. 8, the radial arm 87 is provided to extend from the surfacing-wheel shaft *E*<sup>2</sup>, the circularly-apertured end of this arm being fitted about the shaft, so that the shaft may turn freely independently of the arm. Collars 88 88 are fastened on the surfacing-wheel shaft closely above and below the arm. This insures that the arm will be carried bodily vertically in unison with the shaft; but the arm may have no revoluble motion, because the vertical rod 89, fastened at the outer end thereof and at the lower end of which the cam 84 is provided and supported, has its upper end playing vertically through the socket 90 in a part of the primary carrier *H*.

The primary or roughing wheel *C*, as more particularly shown in Figs. 19, 20, and 21, will be now described. The said wheel is constructed with a cast-iron body *v*, having a circular form, with a depending external flange *v*<sup>2</sup> and a depending internal flange *v*<sup>3</sup>, leaving the annular groove, which is downwardly opening between such flanges. The roughing or abrading medium consists of a series of sections *w* of **T** form in cross-section and extending as to their length in an arc. These sections are made of granulated or pulverized emery, corundum, or equivalent abrading material molded to the form shown—that is, having the depending central portion 93 and head-flanges 94 94. The depending central portion 93 is constructed with a multiplicity of perforations or rendered porous, as indicated at 95, and the lower edge is formed serrated, as indicated at 96, by preference, although not of necessity. These arc-formed and cross-sectionally **T**-shaped abrading-sections *w* are held in place by the annular clamping-rings *x x*, which lie within the aforesaid annular groove of the roughing-wheel body *w* with a retaining engagement against the portions 94 94 of said sections, said clamping-rings being



confined by set screws or bolts which pass through and with a screw engagement into the solid top of the body *v*. The depending middle part 93 of the sections *w w* projects quite a little below the body *v* of the roughing-wheel. By making the sections *w w* with the interstices or pores substantially as shown such rough grinding or abrading mediums are relieved of the tendency to become glass-like or smooth at their working edges after a short time of use and present after continued employment always a fresh and suitably-rough working edge, and, furthermore, as the wheel becomes worn away by reason of the aforesaid perforations the edge successively becomes edgewise-recessed, permitting the water supplied within the wheel to flow under the working edge.

When the depending rib-like parts of the abrading-sections *w w* have been worn up closely to the bottom of the iron body *v* of the surfacing-wheel, the clamping-rings *x x* are removed and new sections *w w* are replaced and confined, as before.

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

1. In a lithographic-stone-surfacing machine, in combination, the bed, the carriage for the stone to be surfaced reciprocating thereon, a roughing-wheel to the action of which the top of the stone is subjected, a further wheel or wheels of finer character to the rotary action of which the stone is subjected, means for rotating the roughing and secondary surfacing-wheels, separate means for elevating and retaining raised both the roughing-wheel and the surfacing wheel or wheels, driving connections from a common driving-shaft for said wheels, and means for unshipping at pleasure the connection for the secondary wheels.

2. In a lithographic-stone-surfacing machine, the combination with the reciprocatory bed, of a series of surfacing-wheels, and carrying-shafts therefor, means for rotating the shafts and means arranged in common to the several shafts and having detachable connections or engagements individually therewith whereby they may be, as desired, all elevated in unison or individually elevated, for the purpose set forth.

3. In a lithographic-stone-surfacing machine, the combination with the reciprocatory bed, of a series of surfacing-wheels and shafts therefor, means for rotating the shafts, and means for traversing the several shafts and surfacing-wheels thereof.

4. In a lithographic-stone-surfacing machine, the combination with the bed, of two or more surfacing-wheels, and upright shafts therefor, means for rotating said shafts, and means for causing approached or distended relations of said shafts, for the purpose set forth.

5. In a lithographic-stone-surfacing machine, the combination with the bed, of two

or more surfacing-wheels, and upright shafts therefor, means for rotating said shafts, means for traversing said shafts bodily in unison, and means for causing approached or distended relations of said shafts, for the purpose set forth.

6. In a lithographic-stone-surfacing machine, the combination with the bed and an elevated transverse supporting part or framing, of the primary carriers *H* horizontally movable on said transverse supporting part, secondary carriers vertically movable on the carriers *H*, the surfacing-wheel shaft vertically journaled for rotation and also vertically movable and engaged to be moved by said secondary carrier, mechanism for imparting vertical elevating motions to said secondary carriers, a right and left hand threaded screw-shaft, screw engaging the primary carriers, and serving as connecting means therefor and also as means for causing approached and distended relations thereof, and means for traversing said screw-shaft-united carriers *H*, for the purposes set forth.

7. In a lithographic-stone-surfacing machine, in combination, the bed and carriage movable thereon, a primary carrier transversely movable on the stationary elevated horizontally-ranging part of the machine, the secondary carrier mounted for a vertical sliding movement on said primary carrier, and provided with the rack-teeth, the vertical shaft journaled for rotation in the primary carrier, and axially movable relatively thereto provided with an engagement-shoulder 40, the shaft *L* having the gear-wheel 44 splined thereon and axially movable along said shaft, and adapted to be placed at will in mesh with and disengaged from the said rack, substantially as and for the purposes set forth.

8. In a lithographic-stone-surfacing machine, in combination, the bed and carriage movable thereon, a primary carrier transversely movable on the stationary elevated horizontally-ranging part of the machine, the secondary carrier mounted for a vertical sliding movement on said primary carrier, and provided with the rack-teeth, the vertical shaft journaled for rotation in the primary carrier, and axially movable relatively thereto provided with an engagement-shoulder 40, the shaft *L* having the gear-wheel 44 thereon in mesh with the rack-teeth of the secondary carrier, means for rotating the surfacing-wheel shaft and a detent for temporarily holding the secondary carrier after having been elevated by the rotation of said shaft *L* and gear in its raised position.

9. In a lithographic-stone-surfacing machine, in combination, the bed and carriage movable thereon, and an elevated transversely-arranged supporting part of the framing thereabove, two or more primary carriers *H* transversely movable along said elevated support, secondary carriers mounted for vertical movements on the primary carriers and provided with rack-teeth, the vertical sur-



facing-wheel shafts journaled for rotation in the primary carriers and axially movable relatively thereto, and means for rotating them, the horizontal shaft having the gear-wheels 44 splined thereon and adapted to individually engage or be placed out of engagement with said rack-teeth, and means of engagement whereby the secondary carriers in their vertical movements insure the elevation of the surfacing-wheel shafts, substantially as described.

10. In a lithographic-stone-surfacing machine, in combination, the bed and carriage movable thereon, and an elevated transversely-arranged supporting part of the framing thereabove, two or more primary carriers H transversely movable along said elevated support, secondary carriers mounted for vertical movements on the primary carriers and provided with rack-teeth, the vertical surfacing-wheel shafts journaled for rotation in the primary carriers and axially movable relatively thereto, and having shoulders 40, the horizontal shaft having the gear-wheels 44 splined thereon and adapted to individually engage or be placed out of engagement with said rack-teeth, gear-wheels 54 mounted to rotate on vertical axes in said carriers H, and through which the upper extremities of the surfacing-wheel shafts are passed with a spline engagement, and means for rotating said gear-wheels 54, substantially as and for the purposes described.

11. In a lithographic-stone-surfacing machine, in combination, the bed and carriage movable thereon, and an elevated transversely-arranged supporting part of the framing thereabove, two or more primary carriers H transversely movable along said elevated support, secondary carriers mounted for vertical movements on the primary carriers and provided with rack-teeth, the vertical surfacing-wheel shafts journaled for rotation in the primary carriers and axially movable relatively thereto, and having shoulders 40, the horizontal shaft L having the gear-wheels 44 splined thereon and adapted to individually engage or be placed out of engagement with said rack-teeth, gear-wheels 54 mounted to rotate on vertical axes in said carriers H, and through which the upper extremities of the surfacing-wheel shafts are passed with a spline engagement, the shaft M having thereon several gears 56 in mesh with the gear-wheels 54, and means for rotating said shaft M, for the purposes set forth.

12. In a lithographic-stone-surfacing machine, in combination, the bed, and carriage movable thereon, and an elevated transversely-arranged supporting part of the framing thereabove, two or more primary carriers H transversely movable along said elevated support, the vertical surfacing-wheel shafts journaled for rotation in the primary carriers and axially movable relatively thereto, bevel gear-wheels 54 mounted to rotate on vertical axes in said carriers H, and through which

the upper extremities of the surfacing-wheel shafts are passed with spline engagements, the horizontal shaft M having splined thereon the several bevel-gears 56 in mesh with the bevel gear-wheels 54, means for rotating said shaft M, and the right and left threaded screw-shaft engaging the carriers H, substantially as and for the purposes described.

13. In a lithographic-stone-surfacing machine, a set or series of two or more surfacing-wheels, means for rotating said wheels, means for traversing said wheels bodily in unison, and a mechanism for rendering the surfacing-wheels temporarily non-rotatable and for temporarily rendering the traversing means inoperative.

14. In a lithographic-stone-surfacing machine, the combination with the reciprocatory work-carriage, of the vertical rotatable shaft squared or tenon-provided at its lower end, the surfacing-wheel having in the upper part of its body the vertically-opening mortise into which said tenon is fitted and adapted for a slight vertical play, and a retaining cap or plate *q* secured on the top of the surfacing-wheel body, substantially as described.

15. In a lithographic-stone-surfacing machine, the combination with the rotatable surfacing-wheel having a downwardly-opening passage therein, a receptacle for the polishing-powder mounted on said surfacing-wheel having a sifting-bottom, and means for automatically agitating said receptacle, for the purpose set forth.

16. In a lithographic-stone-surfacing machine, the combination with the surfacing-wheel, and a hollow rotatable shaft at the lower end of which said wheel is provided, a water-delivering pipe provided interiorly in said shaft and delivering the liquid to the bottom of the wheel, a receptacle movably mounted on the wheel and having a sifting-bottom, and means for automatically agitating said receptacle, for the purpose set forth.

17. In a lithographic-stone-surfacing machine, the combination with the surfacing-wheel having therein a seat or socket *u* and a passage downwardly continued therefrom to the bottom of the wheel, a cylindrical receptacle having an apertured bottom vertically movable in said socket, and provided with a projection, a cam mounted in the path of revolution of said projection, and adapted to be successively impinged against by the latter, and the spring 85 for downwardly forcing the said receptacle immediately the cam is disengaged, for the purpose set forth.

18. In a lithographic-stone-surfacing machine, the combination with the vertically-movable and rotatable surfacing-wheel shaft, and means for rotating said shaft, means for elevating the same, and the surfacing-wheels provided at the bottom thereof having a passage or socket *u* leading vertically there-through, the shouldered receptacle Q having a sifter-bottom fitted in said socket and provided with a cam-engagement projection and



a downwardly-reacting spring, the arm 87 loosely engaged with and radially extended from the shaft, non-rotatable relatively to but vertically movable in conjunction with said shaft, a vertical supporting rod or bar 89 carried by said arm and provided at its lower portion adjacent the surfacing-wheel with the cam 84, substantially as and for the purposes set forth.

10 19. In a lithographic-stone-surfacing machine, a horizontal reciprocatory carriage, a roughing-wheel having an annular depending working face rotatably supported above the carriage, and means for rotating said wheel, 15 and a secondary set of surfacing-wheels also rotatably mounted above the bed at a point beyond the said roughing-wheel each having the working bottom thereof provided with a surfacing medium of finer character than the 20 roughing-wheel, and means for traversing said surfacing-wheel.

20. In a lithographic-stone-surfacing machine, a horizontal reciprocatory carriage, a roughing-wheel having an annular depending 25 working face supported above the carriage, and means for rotating said roughing-wheel, one or more secondary surfacing-wheels rotatably mounted above the bed beyond the said roughing-wheel, each having a working 30 bottom of finer character than that of the roughing-wheel, means for traversing said surfacing-wheels, and means for elevating them, for the purposes set forth.

21. In a lithographic-stone-surfacing machine, a bed and reciprocating carriage, a roughing-wheel rotatable thereover, second-

ary or surfacing wheels having their working bottoms of finer character than the roughing-wheel arranged beyond such wheel, and one or more polishing or final-surfacing wheels 40 beyond the secondary wheel, means for rotating all of said wheels, means for elevating each of said wheels or sets thereof, and means for traversing the secondary surfacing and the final-polishing wheels horizontally, for the 45 purposes set forth.

22. In a lithographic-stone-surfacing machine, a bed and reciprocating carriage, a roughing-wheel rotatable thereover, secondary or surfacing wheels having their working 50 bottoms of finer character than the roughing-wheel arranged beyond such wheel, and movable individually horizontally toward and away from each other, polishing or final-surfacing wheels beyond the secondary wheels 55 movable horizontally toward and away from each other, means for rotating all of said wheels, means for elevating each of said wheels or sets thereof, means for traversing the secondary surfacing and the final-polish- 60 ing wheels horizontally, and means for distending or approaching the wheels of the secondary and final sets and for holding them in their given relations, for the purposes set 65 forth.

Signed by me at Springfield, Massachusetts, this 25th day of May, 1899.

CLARENDON G. WARNER.

Witnesses:

WM. S. BELLOWS,  
M. A. CAMPBELL.