No. 810,474.

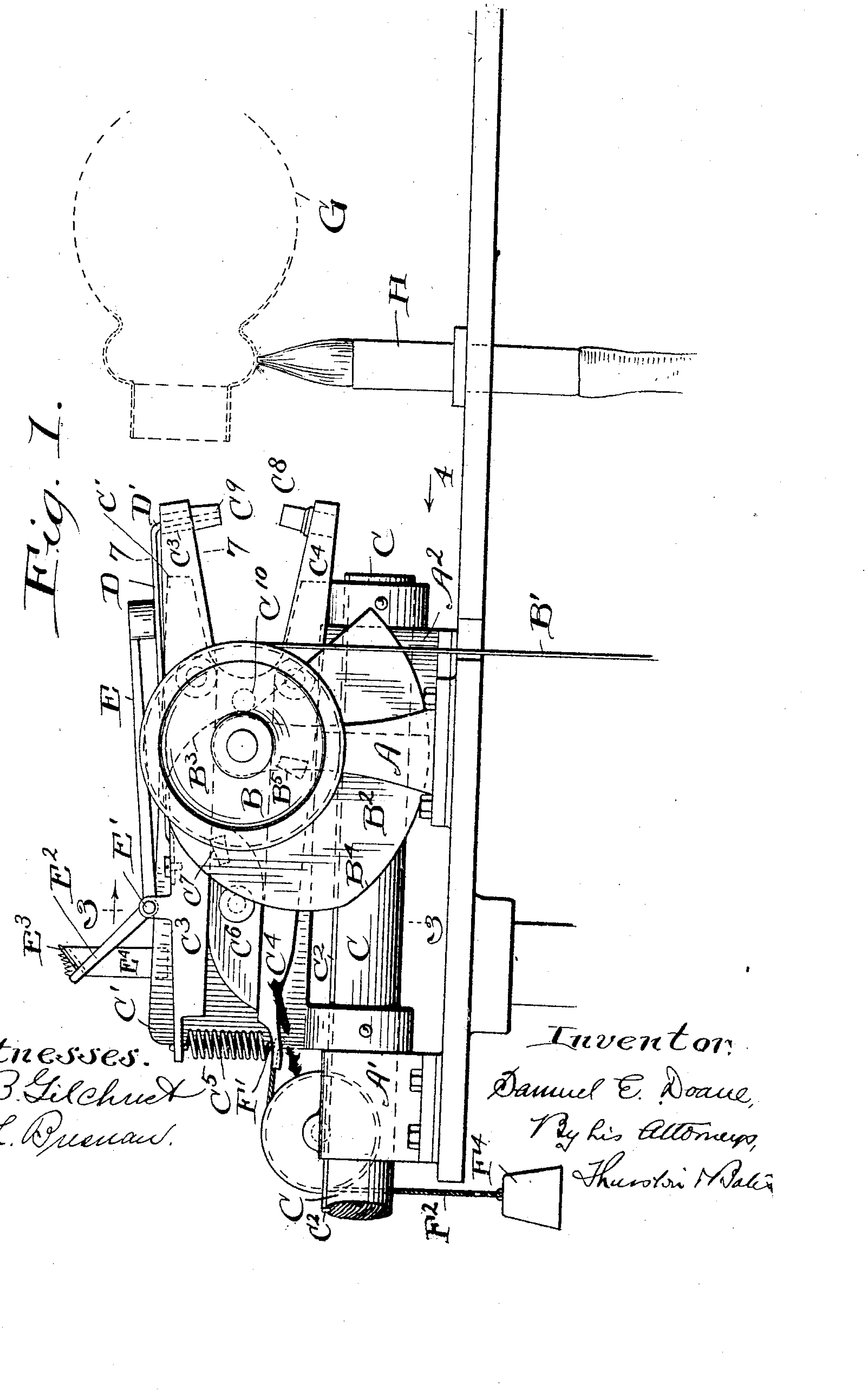
PATENTED JAN. 23, 1906.

S. E. DOANE.

MACHINE FOR PERFORATING GLASS.

APPLICATION FILED MAY 26, 1905.

4 SHEETS—SHEET 1.



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No. 810,474.

PATENTED JAN. 23, 1906.

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MACHINE FOR PERFORATING GLASS.

APPLICATION FILED MAY 22, 1905.

4 SHEETS—SHEET 2.

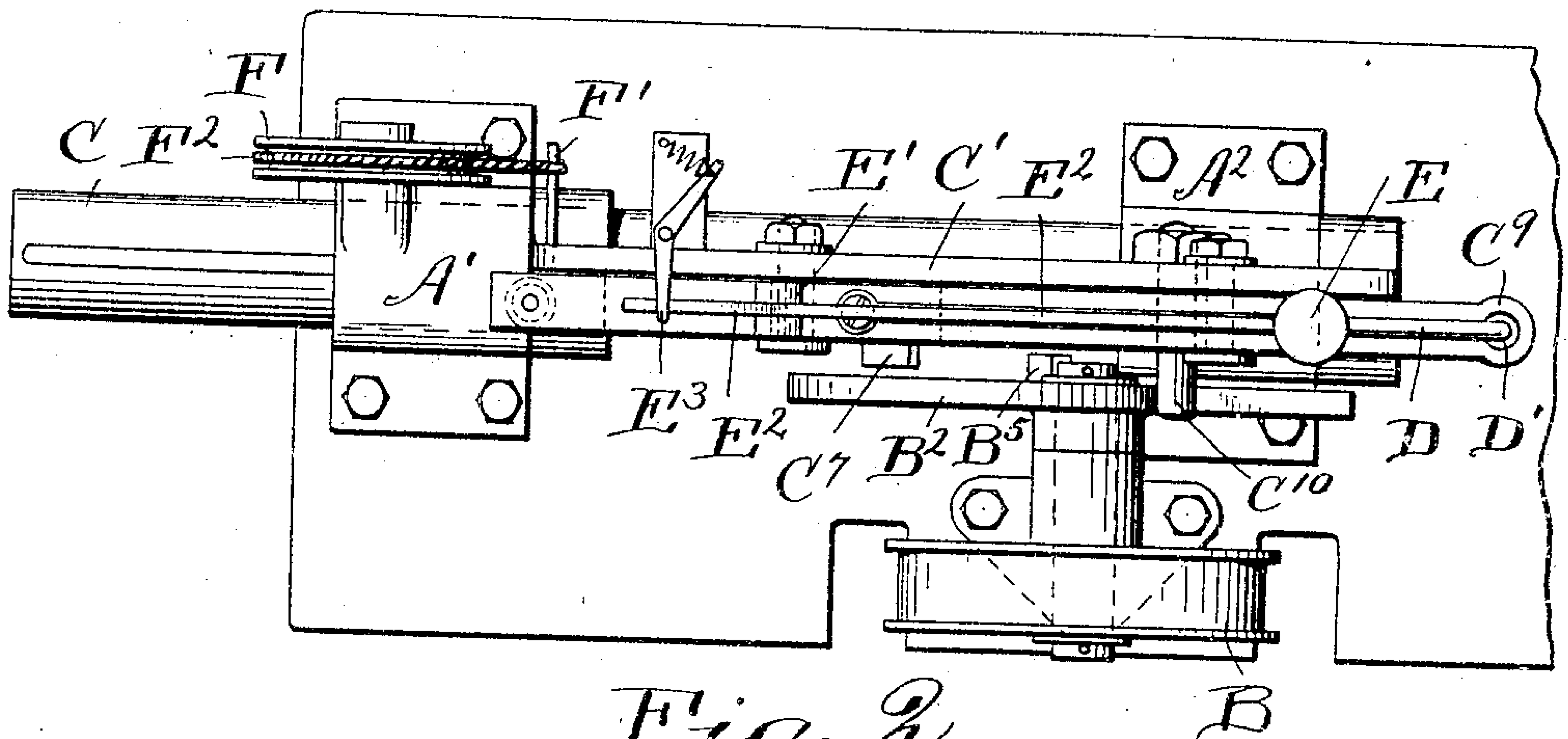

Fig. 2.

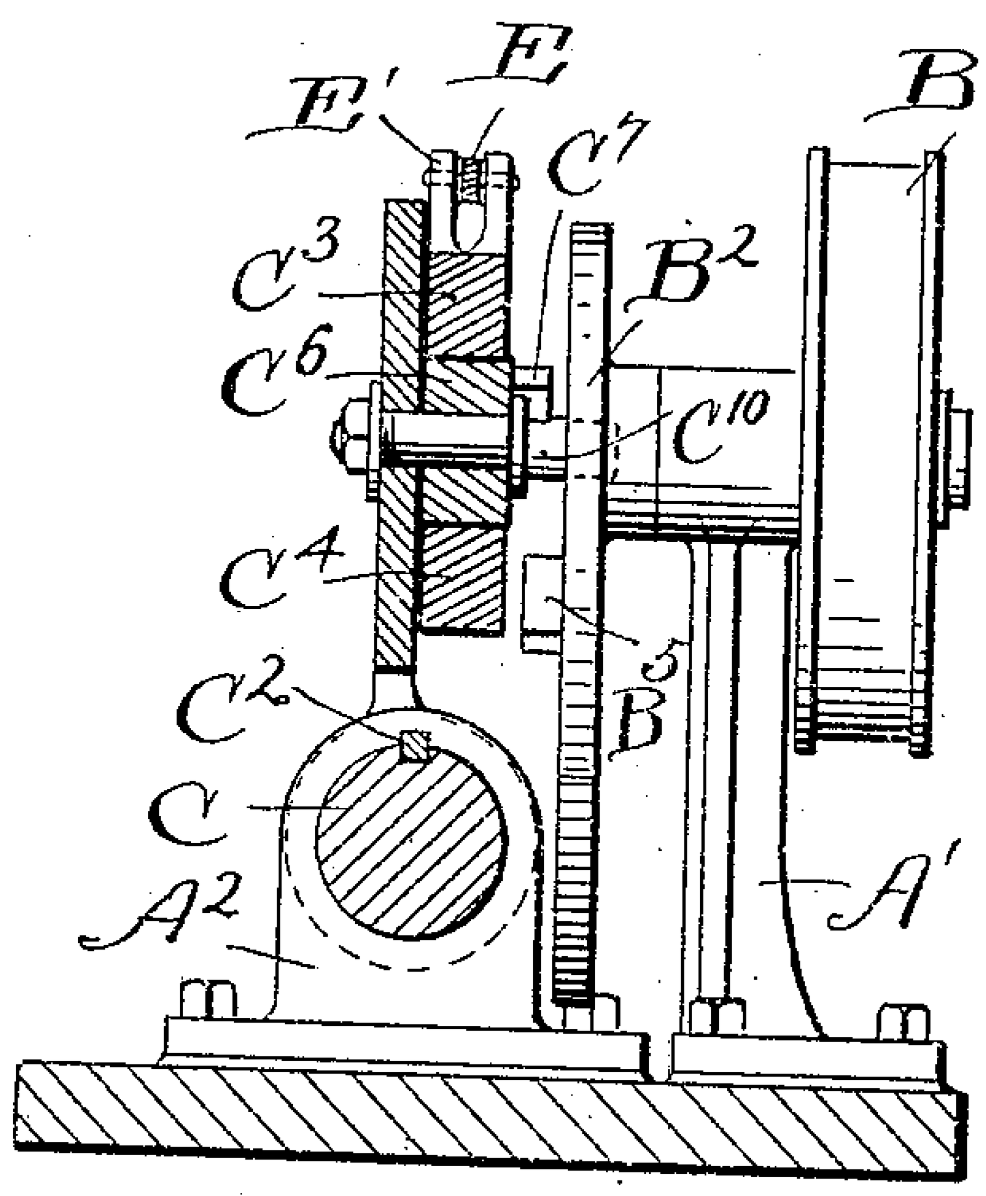

Fig. 3.

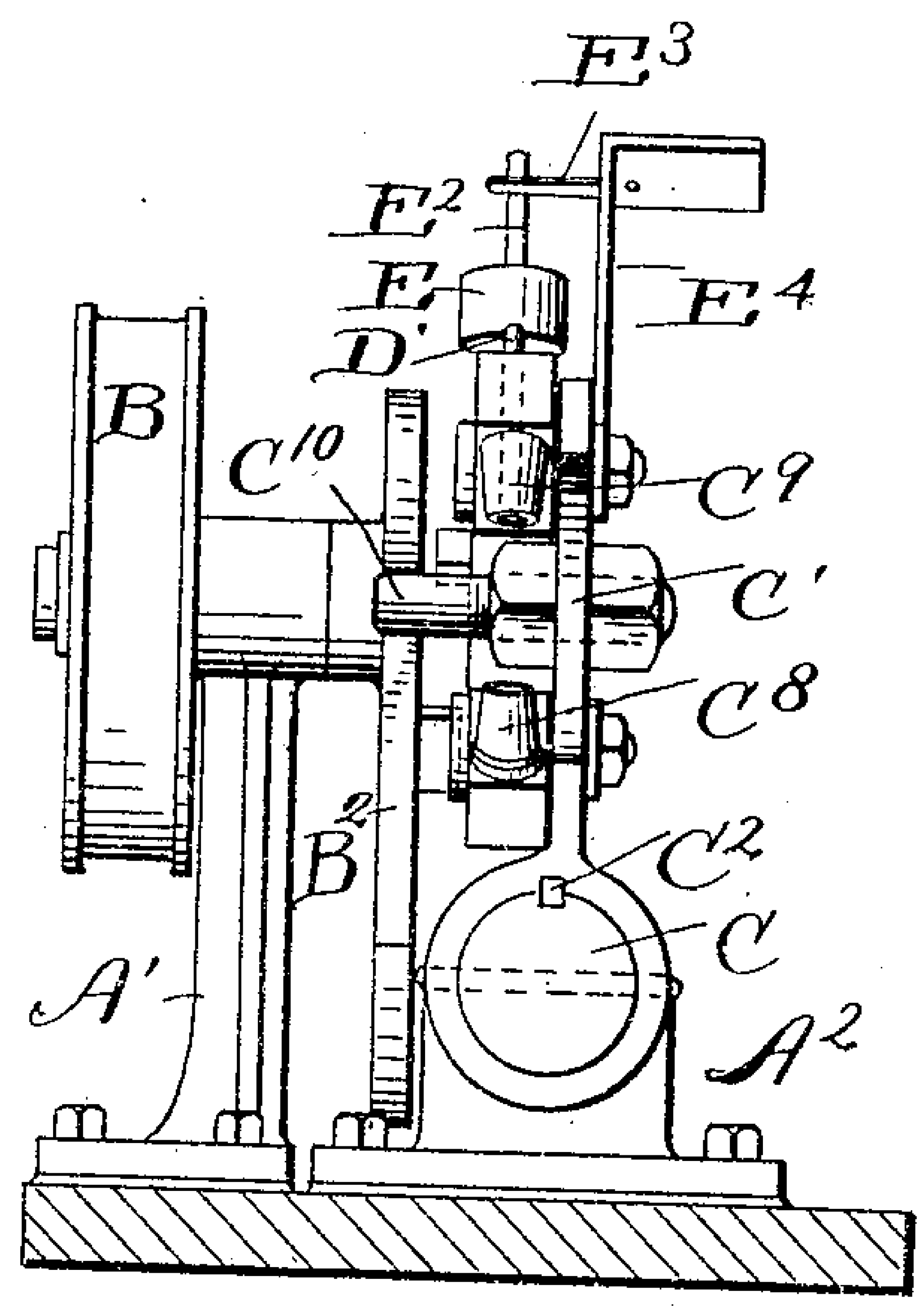

Fig. 4.

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4 SHEETS—SHEET 3.

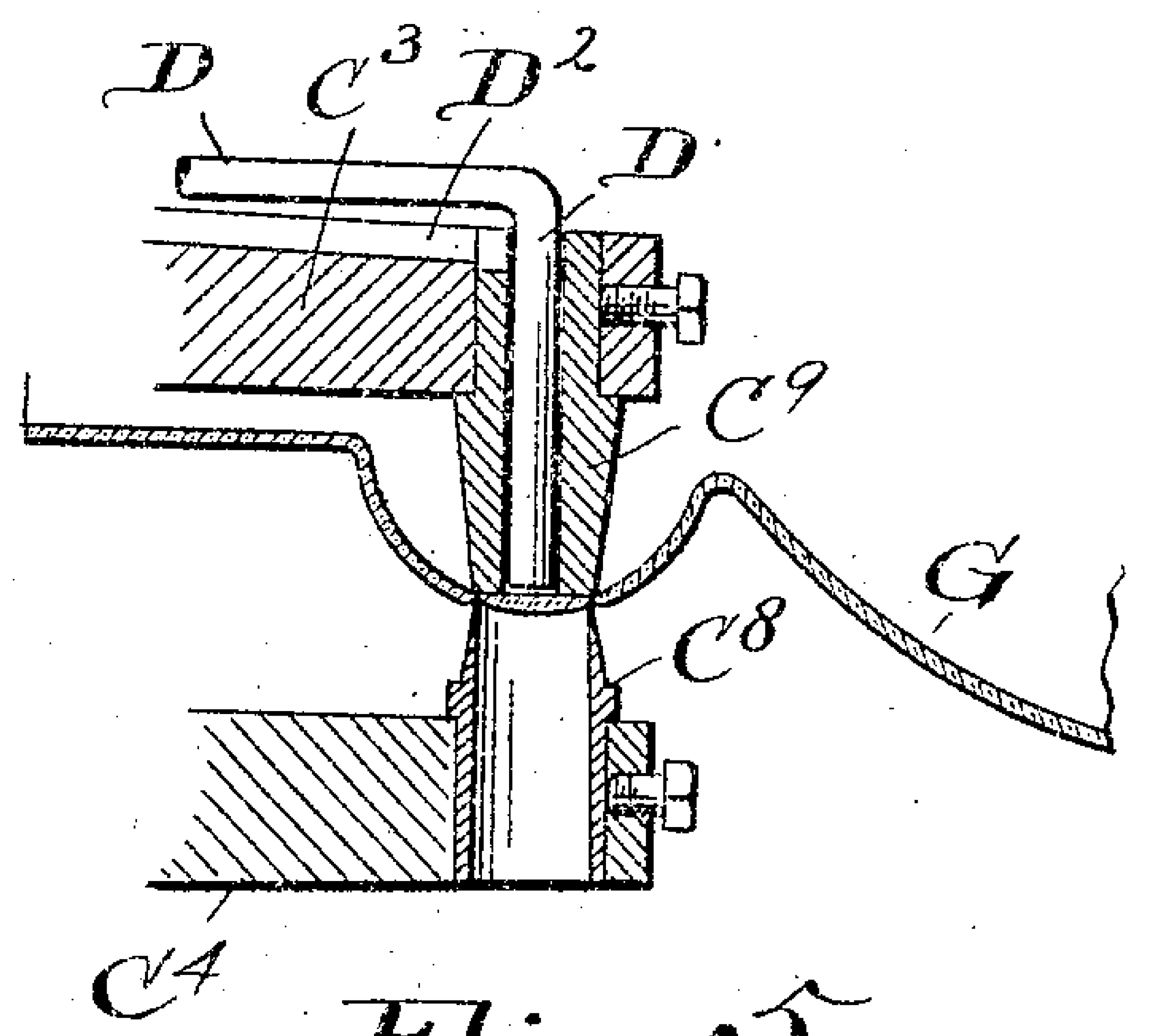

Fig. 5.

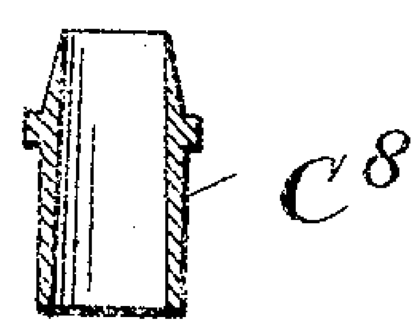

Fig. 6.

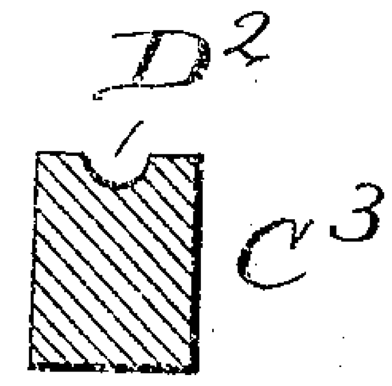

Fig. 7.

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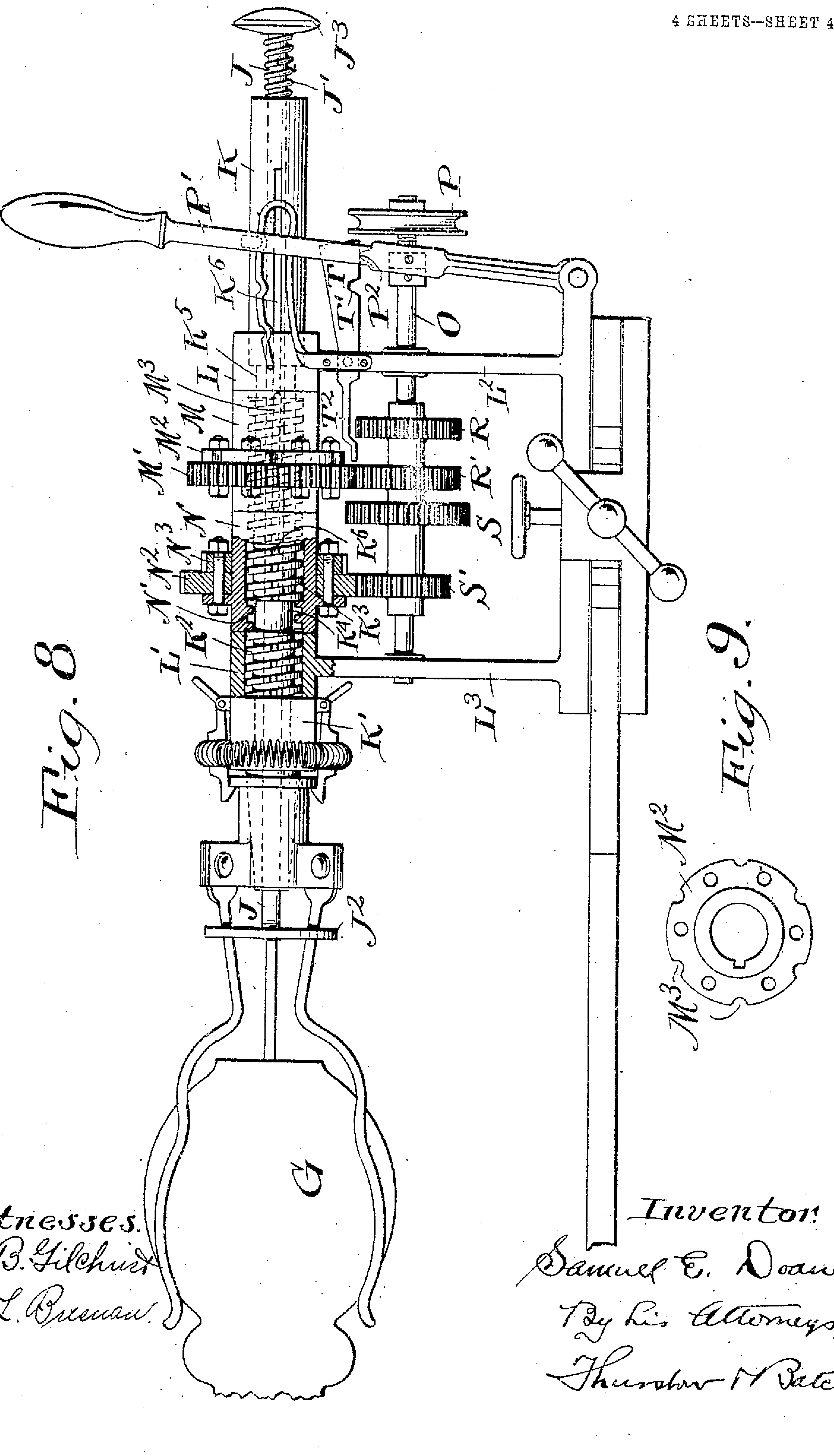
4 SHEETS—SHEET 4.



Witnesses.
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UNITED STATES PATENT OFFICE.

SAMUEL EVERETT DOANE, OF CLEVELAND, OHIO, ASSIGNOR TO THE NATIONAL ELECTRIC LAMP COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF NEW JERSEY.

MACHINE FOR PERFORATING GLASS

No. 810,474. Specification of Letters Patent. Patented Jan. 23, 1906.

Application filed May 22, 1905. Serial No. 261,528.

To all whom it may concern:

Be it known that I, SAMUEL EVERETT DOANE, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Machines for Perforating Glass, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

In the manufacture of perforated glassware, such as the exterior globes for incandescent lights, it is of course practically impossible to form the perforations while the glass is cold and brittle. Furthermore, great difficulty has been found in effecting a clean-cut perforation if the glass is operated on in a molten or plastic condition, as it has been found that the disk cut out of the glass does not readily drop away therefrom and draws after it strings of the plastic material, so as to form a rough edge about the perforation. Further, in the perforation of hollow ware it is necessary that the punch be advanced into the object operated upon with precision and operated with a certain degree of rapidity, and when this is attempted by hand the results are not uniformly satisfactory.

To overcome the difficulties here presented and to achieve the desired results, I have designed a mechanism which forms the subject of the following specification and claims and in which certain new principles of operation and action are for the first time brought into play in this art.

Referring to the accompanying drawings, Figure 1 is a side elevation of the apparatus which I have designed for effecting the perforation of the glassware, showing a piece of hollow ware in position to be perforated. Fig. 2 is a plan view of the perforating mechanism. Fig. 3 is a sectional view taken on the line 3 3 of Fig. 1. Fig. 4 is an end elevation of the perforating mechanism. Fig. 5 is a detail section showing the action of the perforators on the molten ware. Fig. 6 is a central vertical section of the cutting-punch. Fig. 7 is a transverse section on the line 7 7 of Fig. 1. Fig. 8 is a side elevation, partly in section, of apparatus which I have designed for the purpose of feeding the hollow ware into perforating position. Fig. 9 is a detail of the feeding mechanism.

In the various figures of the drawings, A represents a fixed standard supporting the mechanism for advancing the perforator to operative position.

A′ and A² are bearing-boxes in which reciprocates the carriage bearing the perforating mechanism.

Journaled on the standard A is a pulley-wheel B, adapted to be operated by a strap B′, secured to a treadle (not shown) or other movable part. Rigidly secured to the pulley B and oscillatory therewith is a cam B², having a gradually-increasing cam-surface B³, merging into a concentric surface B⁴. From the inner face of the cam projects a lug B⁵, which lug is suitably positioned radially in order to come into action in a manner to be described below. The carriage C, sliding in the boxes A′ A², has pinned thereto the plate C′, which carries the perforating mechanism.

C² represents the spline between the bearing-boxes and the carriage. Pivotally secured to the forward end of the plate and on the side thereof nearest the cam are two jaws C³ and C⁴, connected at their rear ends by a tension-spring C⁵, which normally draws the rear ends together and holds the forward or perforating ends of the jaws apart. Interposed between the rear portions of the jaws C³ and C⁴ and likewise pivotally secured to the plate C′ is a double cam C⁶, carrying a lug C⁷, designed to be acted on by the lug B⁵ when the carriage is moved to its forward position, the effect of this action being to swing the cam C⁶ about its pivot in such manner as to spread the rear ends of the jaws apart against the action of the spring C⁵ and bring the perforating devices C⁸ and C⁹ on the forward end of said jaws toward each other.

C⁸ is a hollow cylindrical steel cutter secured within the end of the jaw C⁴. This cutting-cylinder C⁸ is conically tapered at its cutting edge both exteriorly and interiorly.

C⁹ represents the coacting member for the cutter C⁸ and is provided with a central cylindrical opening and is preferably somewhat tapered exteriorly, providing an annular bearing against which the cutter edge of C⁸ thrusts. The member C⁹ is of any suitable soft metal which will not wear the cutter C⁸ and which has a melting-point above that temperature to which it is subjected in perforating the molten glass, and in practice I prefer to use copper.

Secured to the forward end of the plate C′ is a pin C^{10}, projecting into the path of the cam-surface B^3. When the pulley-wheel B is rotated, the cam-surface B^3 will operate against the pin C^{10} to thrust the same forward and carry the plate C′, together with the perforating-jaws, into operative position. When the concentric surface B^4 rides into contact with the pin C^{10}, this forward movement ceases and simultaneously therewith the lug B^5 comes in contact with the upper surface of the lug C^7, which latter is now well forward of the center of the pulley B, and depresses said lug C^7, thereby oscillating the double cam C^6, so as to close the jaws C^3 and C^4 and bring the perforating members against the glassware G at the point where it has been heated to a molten or plastic condition by the flame from a burner H, properly located. This action is in itself sometimes sufficient to effect a perforation of the glass; but the results are not to be relied on, since it frequently happens that the excised disk adheres to the punching apparatus or is not entirely separated from the body of the glass. In order to make the perforation clean cut, it is necessary that the disk be entirely removed from and maintained out of contact with the body portion, since any subsequent contact therewith will result in its becoming welded thereto. I have tried several means for effecting this result, such as the use of compressed air or by suction; but the preferable device is one which will deliver a quick sharp blow adjacent to the chilled attenuated portion of the glass.

Secured to the upper jaw is a spring-rod D, bent at its forward end to form a striking-head D′, which enters the hollow punch member C^9. The spring-rod D is normally held somewhat elevated above the jaw C^3, so that the lower end of the head D′ does not come flush with the end of the hollow member C^9. A groove D^2 on the upper side of the jaw C^3, however, allows the rod D and the head D′ to be forced down when struck by the hammer E. The hammer E is itself pivoted between the ears E′, projecting from the rear end of the jaw C^3, and is provided with a tail E^2, extending upwardly and rearwardly in such manner as to be caught by a spring-trigger E^3, supported on a bracket E^4, fixed to the plate C′. When now the perforating mechanism has been moved forward by the cam B, as above described, and the perforating-jaws are brought together by the cam C^6, it will be seen that the movement of the jaw C^3 to whith the hammer E is pivoted, will cause the hammer to be raised by reason of the fact that the tail E^2 is caught by the trigger E^3. When, however, the motion of the jaw C^3 has progressod to the point where the perforating members are brought together, the end of the tail E^2 slides off the trigger E^3, permitting the hammer E to fall and deliver a sharp quick blow to the rod D, which blow is transmitted to the glass disk formed by the cutter C^8

Referring now to Fig. 5, it will be seen that the cutter C^8 as it approaches the member C^9 pinches and attenuates the hot plastic glass at the points where the cutting edges bear. By reason of the contact with the metallic surfaces the plastic glass becomes chilled in the immediate vicinity of the cutting zone and is brittle in this portion, although it remains hot and plastic adjacent to this zone. By virtue of the fact that the glass is thus made brittle about the periphery of the disk the sharp quick blow of the rod D is sufficient to cause said disk to break away with a clean-cut edge free from prongs of any kind. Thus it would be seen that while the cutter C^8 is the principal element in effecting the excision of the disk from the glass and by reason of its interior conical taper an effective retaining means after the disk has been excised, nevertheless the striking-head D′ coöperates to make the line of excision a clean-cut edge and to insure that the disk shall enter the interior tapered conical portion of the cutter C^8, the several parts thus forming a unitary means adapted to excise the disk and maintain it out of contact with the body of the glass. After the perforating operation has been completed and it is desired to rotate the article operated upon so that another portion may be heated and perforated the apparatus is withdrawn by releasing the pulley-strap B′, whereupon the plate C′ and the carriage C are retracted by means of a weight F^4, connected with a pin F′ on the plate C′ by means of a cord F^2, passing over a pulley-wheel F, journaled on the fixed support A′. Thus the mechanism is reciprocated back and forth whenever the glass becomes properly heated for the purpose of being operated upon. In order to properly feed the ware G into position over the flame H and rotate the same to present successive portions to the heating-flame and perforator, I employ a threaded holding-shaft provided with gripping-arms. This shaft is adapted to be rotated at a uniform speed within a rotating nut, which nut is adapted to be rotated at will at two different speeds, one greater and one less than that of the shaft. By this arrangement I am enabled to advance or retract the shaft and its gripping-arms, as desired, by merely changing the rate of rotation of the nut.

Referring to Fig. 8, K is a shaft freely rotating in bearings L and L′, between which bearings fit the nut N and the key-sleeve M. The shaft K is provided at one end with a retaining-cap K′, provided with a conical end, on which is secured the holding or gripping arms for the ware under treatment. The gripping-arms are controlled by means of a rod J, passing through the shaft K, provided at one end with a spider J^2 for holding said gripping-arms and at the other end with a knob J^3 and a spring J', bearing thereagainst for the purpose of maintaining the rod J in a retracted position, so as to hold the gripping-arms closed. When it is desired to release the object held by the arms it is only necessary to press the rod J forward against the spring J', whereupon the spider J^2 will expand the arms and allow the operator to remove the article held. As will be seen, the shaft K is provided with a long key-slot K^6, in which the key M^4 of the sleeve M fits. This is for the purpose of securing a rotation of the shaft whenever the sleeve M is rotated regardless of any longitudinal movement which the shaft may undergo. On the sleeve M is a gear M', to which is bolted a positioning-disk M^2, provided with detent-notches M^3 at intervals on its periphery. On the nut N is a gear N^2, to which is bolted a second gear N^3 of smaller size. Internally the nut N is provided for a short space with a female thread N', through which the thread on the shaft K is adapted to pass. The thread on the shaft K is, as shown, broken at one portion, so as to make two threaded sections K^2 and K^3 and an open reduced section K^4, which latter is of the same width as the threaded portion N' of the nut N. The thread K^2 has no function save that of affording a bearing-surface for the shaft in the bearing L' and facilitating assembling. The thread K^3 feeds backward and forward through the female thread N' according to the relative speeds of the nut and the shaft, as stated above. At the end of the thread K^3 is a second reduced portion K^5, which is of the same width as the female thread N'. In the supporting-standards L^2 and L^3 is journaled a longitudinally-movable shaft O, having at one end an operating-pulley P and provided with a shifting-lever P', adapted to throw different gears S S' and R R' into mesh, respectively, with the gears N^2, N^3, and M'. The lever P' is provided with a lug P^2, bearing on the under side of a stop-lever T, adapted to ride into a notch T' when the aforesaid gears are out of mesh, and thereby allow the finger T^2 to rise into the notches M^3 of the disk M^2 and maintain the shaft against accidental movement.

From the above arrangement it will be seen that when the lever P' is shifted to the position shown in the drawings and the gears S' and R' are in mesh, respectively, with the gears N^2 and M' the key-sleeve M will be rotated at a rate greater than that of the nut N, owing to the proportionate sizes of the several gears. Inasmuch as the shaft K is engaged by the sleeve M by means of the key M^3 and the key-slot K^6, it follows that the shaft will itself be rotated at a rate greater than that of the thread N', and assuming the direction of rotation to be from left to right the thread K^3 will enter the thread N' and the shaft will be advanced until the reduced portion K^5 passes into the thread N', whereupon the advance will obviously be automatically stopped. If at this point the lever P' be shifted to its middle position, the gears S' and R' will pass out of mesh with the nut and the sleeve, respectively, and the stop T will be allowed to drop, so that the finger T^2 will pass into a notch M^3 and hold the sleeve M and the shaft K against further or accidental rotation. While the holding mechanism is in this position, the glass is perforated, the shaft being rotated by hand, as desired, to shift successive portions into perforating position. When now it is desired to retract the shaft K, the lever P' is shifted still farther until the gears S and R come into mesh with the gears N^3 and M', respectively. The proportionate sizes of these gears are such as to cause the nut N to rotate at a greater speed than the sleeve M, with the effect that the thread K^3 will be fed backward through the thread N', and this action will continue until the cut-away portion K^4 of the shaft is reached, at which point the backward feed will stop.

By the mechanism above described it will be seen that I have provided means for automatically feeding the glassware into the heating-flame, means for automatically stopping it in position, means for advancing a suitable perforator to the ware, and automatic means for effecting the perforating action in a manner more efficient than has heretofore been possible, and it will be obvious that many alterations and changes may be made in the details of my mechanism without materially affecting the nature or character of the machine or altering the scope of the invention.

Having described my invention, I claim—

1. A process of perforating glass consisting in locally heating the same to a point of plasticity, attenuating and chilling a zone of the plastic glass, and striking a portion of the glass adjacent to said zone.

2. A process of perforating glass consisting in rendering it plastic, forming an attenuated annular zone and chilling the glass adjacent thereto and delivering a blow within the chilled attenuated zone.

3. A glass-perforating apparatus comprising means adapted to attenuate and chill the plastic glass, and means adapted to deliver a blow adjacent to the attenuated and chilled portion.

4. A machine for perforating glassware provided with perforating-jaws adapted to be advanced to operative position, means for causing each of said jaws to be advanced and means for automatically bringing the perforating-jaws together when so advanced.

5. A machine for perforating glass comprising two perforating members, one of which is equipped with a cutting edge, the other of which is provided with a face against which the cutting edge is adapted to bear;

and a striking member adapted to deliver a blow to the glass.

6. A glass-perforating apparatus comprising two coöperative members, one of which is provided with an annular cutting edge, the other of which is provided with an annular surface against which the cutting edge is adapted to bear, a striking member within the annular bearing-surface and adapted to deliver a blow to the glass.

7. Mechanism for perforating glass, comprising means for holding the glass within a heating-flame, means for advancing a pair of perforating-jaws, and means for automatically bringing said jaws together as soon as they come within operative radius of the heated glass.

8. Mechanism for perforating glass comprising feeding means adapted to advance the glass to a heating-flame, means for automatically stopping said advancing movement, perforating-jaws adapted to be advanced toward the glass, and means for automatically bringing the jaws together when their advancing movement ceases.

9. Mechanism for perforating glass comprising jaws pivoted to a plate mounted on a reciprocative carriage, one of said jaws being provided with a cutting-annulus having an interior taper, the other of said jaws being provided with an annular bearing-surface for said cutting edge, and a striking member positioned within said annular bearing, and means for delivering a blow to said striking member.

10. A glass-perforating apparatus comprising jaws bearing perforating-annuli, means for causing said annuli to approach each other, and means for automatically delivering a blow to the glass inclosed by said annuli when they are brought together.

11. Glass-perforating mechanism comprising a frame-plate carrying a pair of pivoted perforating-jaws held apart at their perforating ends by spring means secured to their opposite ends, a double cam interposed between said jaws in such manner to bring the perforating ends of the jaws together when it is rotated, means for advancing the frame carrying the jaws, said advancing means being adapted to rotate the said cam.

12. A machine for perforating glass provided with two coöperating annuli adapted to outline a disk in the plastic glass, and means for automatically delivering a blow to the glass when said disk is outlined.

13. Means for perforating glass comprising a burner adapted to locally soften the glass, means adapted to advance the glass to said burner, means for automatically stopping said advance, means for advancing the perforating-jaws toward the glass and bringing them together, and means for automatically delivering a blow to the glass when said jaws are closed.

14. In a glass-perforating apparatus, a pair of perforating-jaws, means for holding the glass while being perforated, said latter means comprising a threaded shaft rotatable within a partially-threaded rotatable nut, and differential gears whereby the speed of the nut relatively to the shaft may be varied so as to be either greater or less than that of the shaft.

15. A machine for perforating glass comprising a carriage bearing perforating elements, means for retaining the carriage in a retracted position, means for retaining the perforating elements apart while the carriage is in such retracted position, means for advancing the carriage, and means for automatically bringing said perforating elements together on the termination of the advancing movement.

16. A machine for perforating glass comprising means adapted to form a thin chilled line in the glass when plastic, and means for automatically delivering a blow adjacent to said line upon the formation thereof.

17. A machine for perforating glass comprising unitary means adapted to excise a portion from the body of the glass and maintain all of said excised portion out of contact with the body of the glass.

18. A machine for perforating glass comprising means for excising a portion therefrom when in a plastic state and automatic means for removing all of the excised portion clear of the body of the glass.

19. A process of perforating glass consisting in locally heating the same to a point of plasticity, attenuating and chilling a zone of the plastic glass and delivering a blow within the chilled attenuated zone of sufficient force to effect excision and drive the excised portion clear of the body of the glass.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

SAMUEL EVERETT DOANE.

Witnesses:
E. B. Gilchrist,
J. M. Woodward