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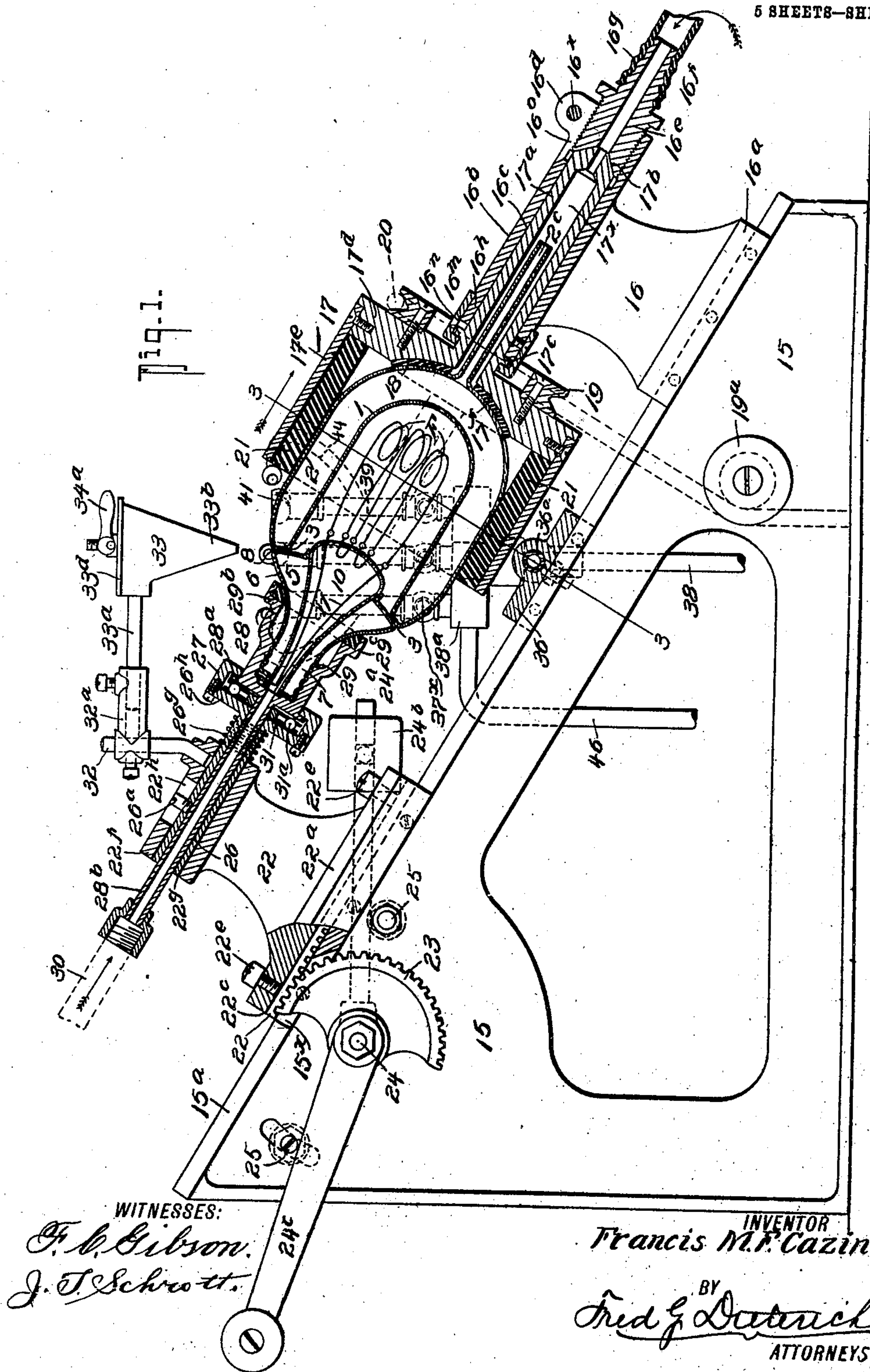
PATENTED MAR. 12, 1907.

F. M. F. CAZIN.

APPARATUS FOR AND METHOD OF UNITING VITREOUS PARTS.

APPLICATION FILED MAY 28, 1904. RENEWED AUG. 29, 1906.

5 SHEETS—SHEET 1.



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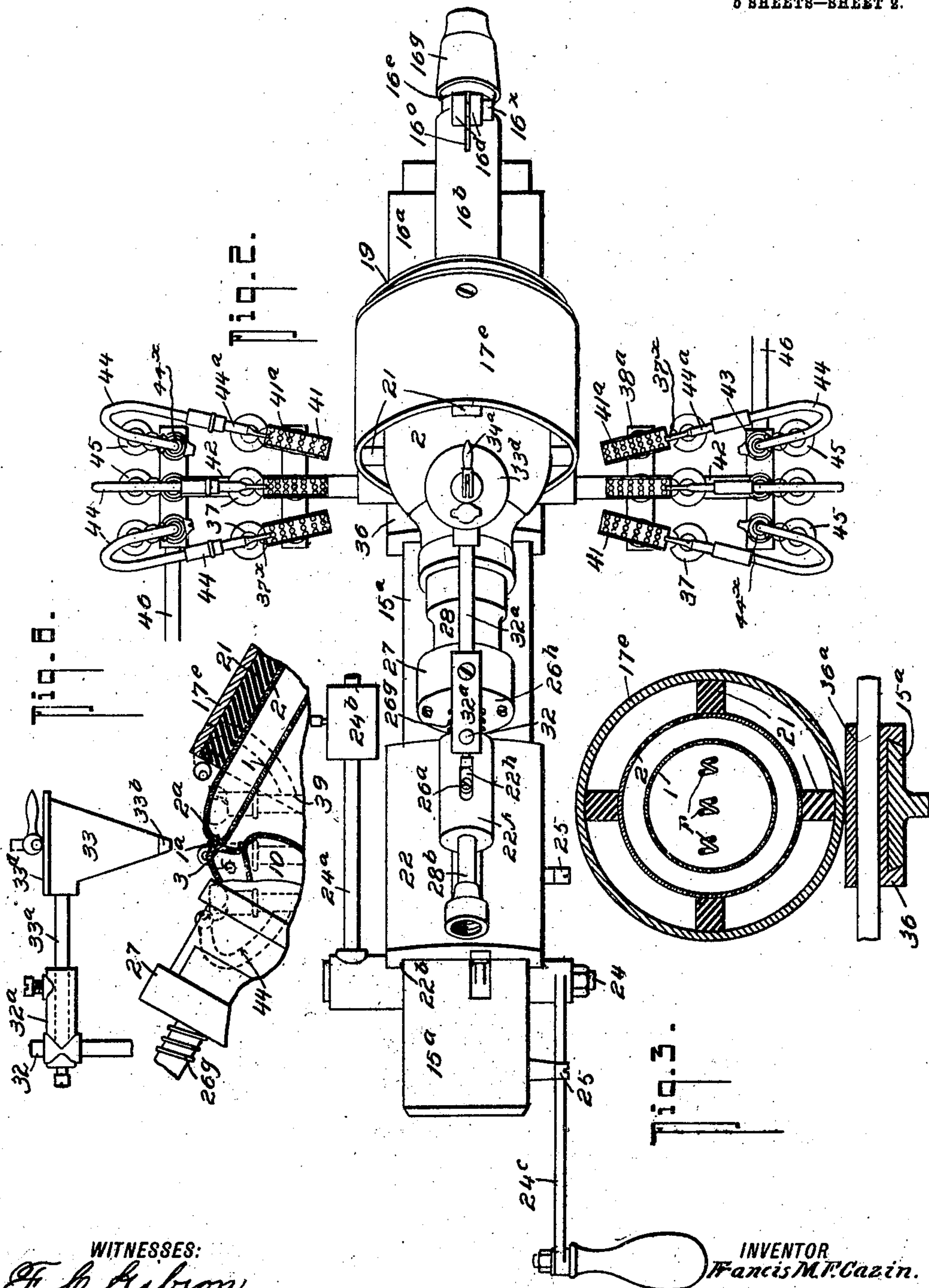
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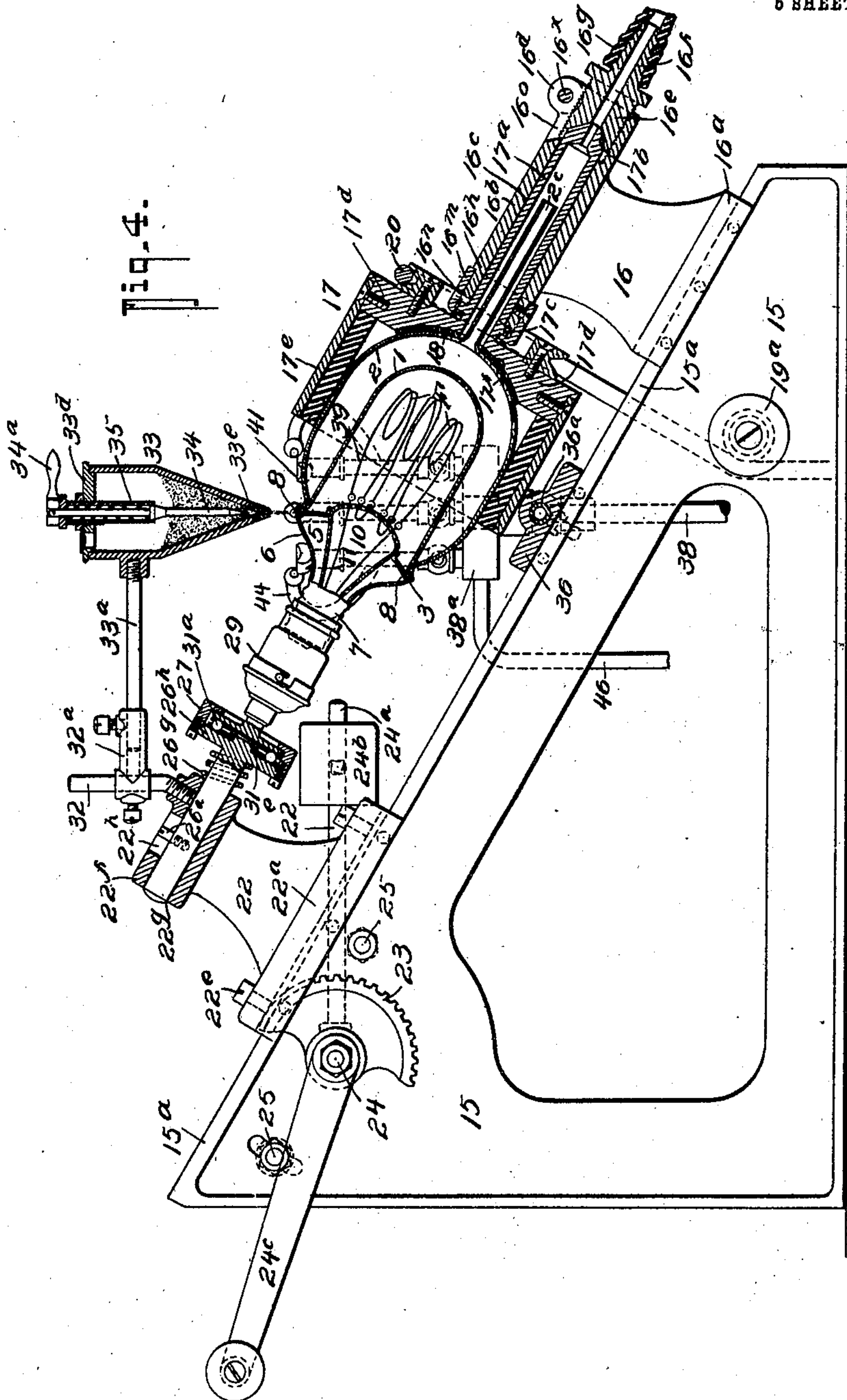
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5 SHEETS—SHEET 3.



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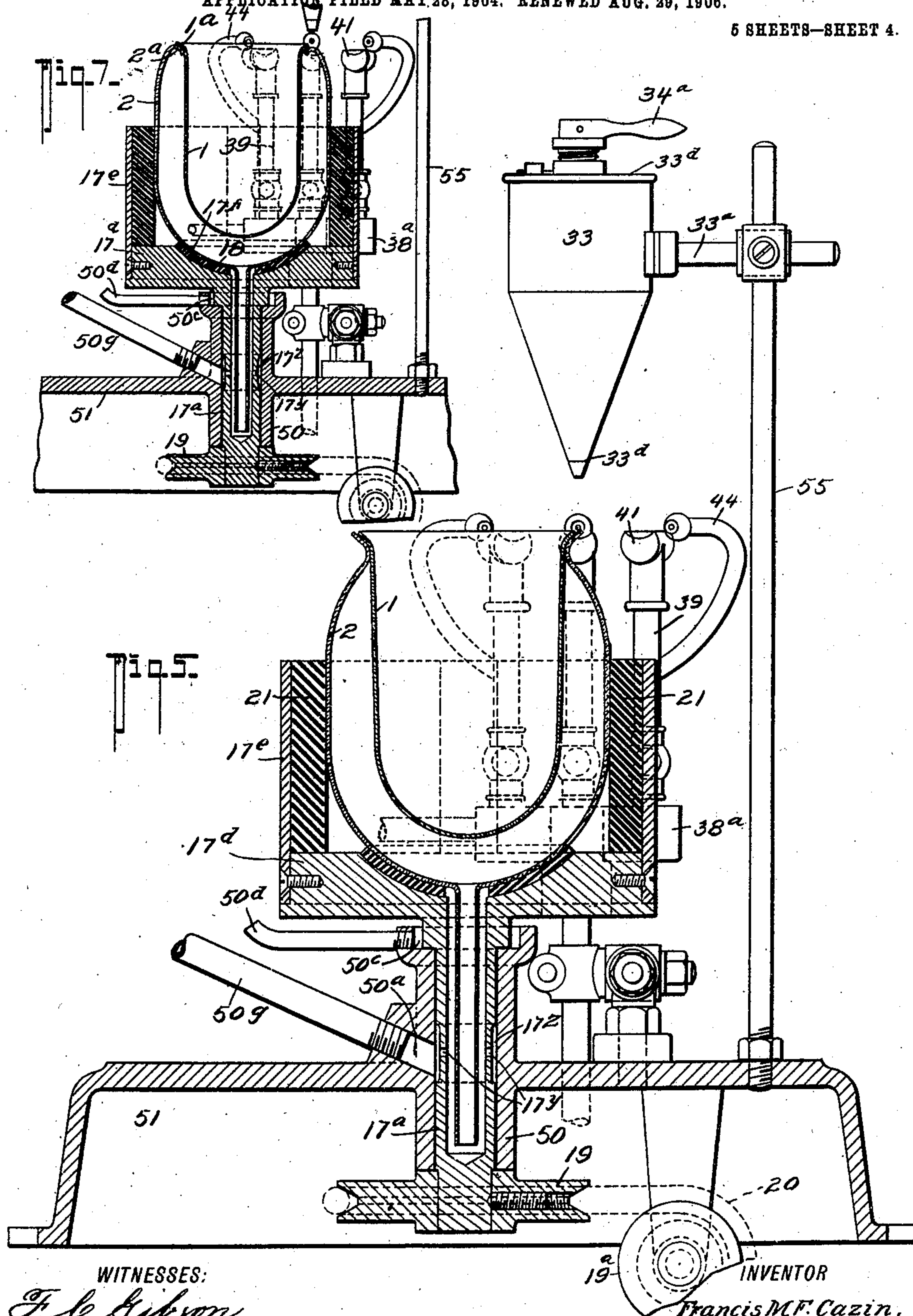
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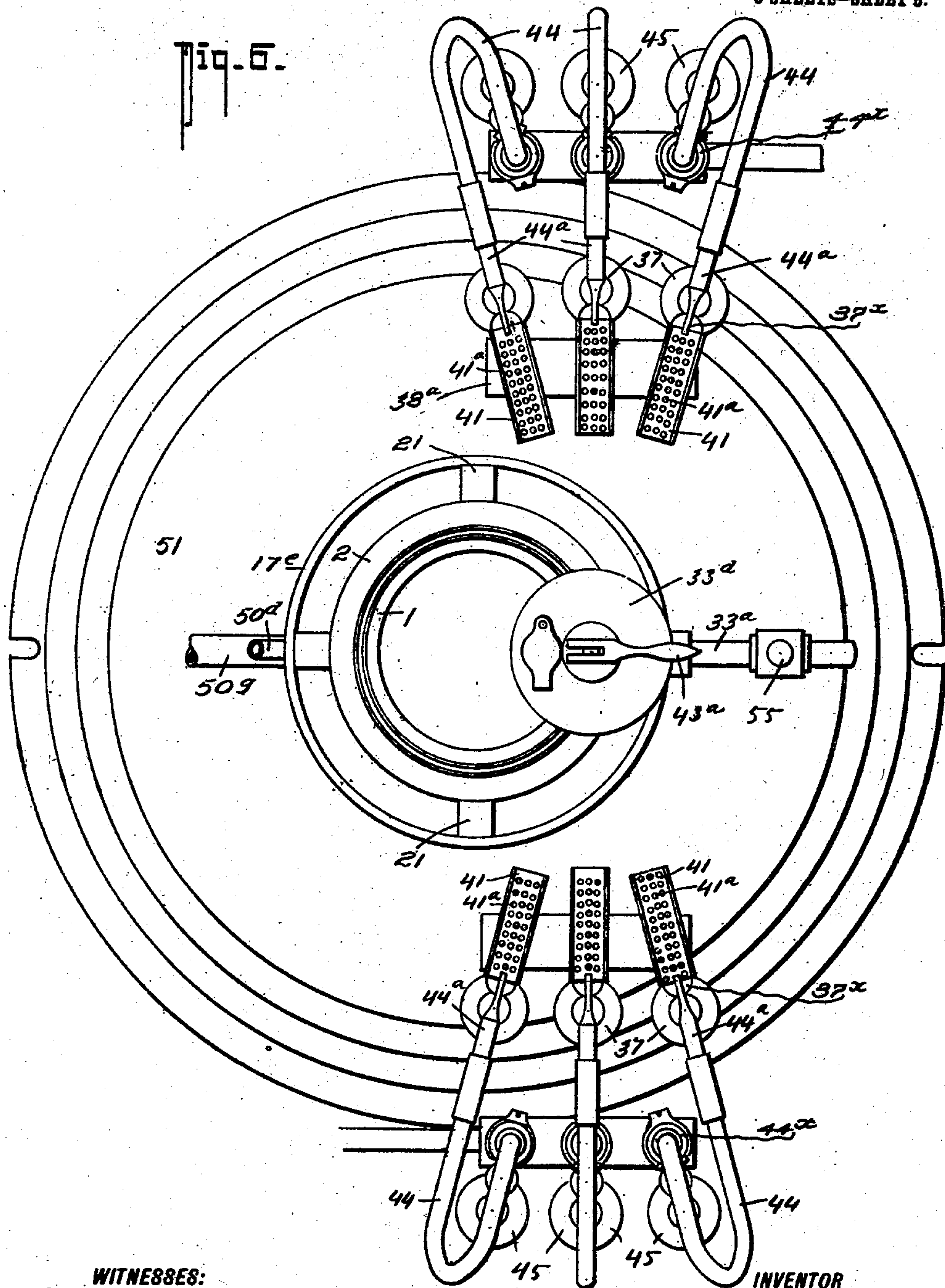
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5 SHEETS—SHEET 5.



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# UNITED STATES PATENT OFFICE.

FRANCIS M. F. CAZIN, OF HOBOKEN, NEW JERSEY.

## APPARATUS FOR AND METHOD OF UNITING VITREOUS PARTS.

No. 846,823.

Specification of Letters Patent.

Patented March 12, 1907.

Application filed May 28, 1904. Renewed August 29, 1906. Serial No. 332,483.

*To all whom it may concern:*

Be it known that I, FRANCIS M. F. CAZIN, residing at Hoboken, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Apparatus for and Methods of Uniting Vitreous Parts, of which the following is a specification.

My present invention primarily relates to certain new and useful improvements in apparatus for uniting vitreous articles; and it more particularly seeks to provide an apparatus for joining the bulb parts in an electric incandescent lamp, such as disclosed in my copending application filed, March 17, 1904, Serial No. 198,563.

The apparatus for use in securing the base to the bulb in its essential nature consists in means for holding the parts of the lamp in contact, for rotating them, and of means for applying a stream of glass to the joint between base and bulb parts, which stream of glass may be either molten, plastic, or granular. The invention also includes means for heating the parts adjacent to the joint and the applied glass, so that the glass fed to the joint will be fused and become adhered to the parts to be united, whereby to secure a tight joint.

Again, my invention also includes means for admitting or withdrawing air from either or both of the parts to be joined during said joining operation and also independent holders for the said parts to be joined, as well as means for withdrawing the completed lamp from the bulb-holder after the parts have become joined together.

This invention also includes a process of joining two or more vitreous parts, which consists generally in admitting compressed air to such parts while simultaneously rotating them and applying a stream of glass to the joint while heating the said joint.

In its detailed nature my invention consists in certain construction, arrangement, and combination of parts, all of which will be hereinafter first described and then specifically pointed out in the appended claims, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical section and part elevation of my improved apparatus. Fig. 2 is a top plan view thereof. Fig. 3 is a cross-section on the line 3-3 of Fig. 1. Fig. 4 is a vertical longitudinal section of a slightly-modified form of my apparatus. Fig. 5 is a

vertical longitudinal section of the auxiliary apparatus for joining the parts of a two-part bulb. Fig. 6 is a top plan view thereof. Fig. 7 shows in longitudinal section the apparatus disclosed in Fig. 5 as used to join a slightly-modified form of double bulb. Fig. 8 shows in longitudinal section a portion of the apparatus disclosed in Fig. 1 as used to join the modified form of bulb disclosed in Fig. 7 to its base.

Referring now to the accompanying drawings, in which like numerals and letters of reference indicate like parts in all of the figures, to more clearly understand the use of my invention it will be necessary to first briefly describe the parts to be joined and then describe the method of joining the same and the apparatus used therefor. The bulb may consist of a single blown piece comprising the inner envelop 1 and the outer envelop 2, the two envelops being united at the base of the bulb, whereby the inner bulb closes the aperture, which would be otherwise formed in the outer bulb, a conical or flared seat 3 being formed at the mouth of the inner bulb. The base 5 of the lamp consists of a crown 6 and a stem 7, which by preference is threaded to provide a convenient means for mounting it in the socket, the crown part being surrounded by a conical shoulder 8 to snugly fit within the conical seat of the bulb, as shown. The base is also provided with a luminant-carrying member 10, through which the inleading wires 11 pass and to which inleading wires 11 and the said member 10 the filament or luminant F is connected in the usual manner. Again, for many purposes it may be desired that instead of constructing the bulb of a single blown piece, as shown in Fig. 1, the same may be constructed of two parts, as shown in Figs. 7 and 8, by reference to which it will be seen that the said bulb consists of the inner bulb 1 and the outer bulb 2, as above, the said bulbs having annular rims 1<sup>a</sup> 2<sup>a</sup>, which overlap each other to form the conical seat for cooperating with the conical seat 8 of the base. Such being the construction of the bulb parts themselves, I will now describe my improved apparatus and the manner in which it is used in securing the base and bulb together and also the apparatus as used in securing the two bulb-sections together when such form of bulb is used, and in doing so I will describe my invention with reference to the parts shown and described, although it



will be understood that in my invention, with respect thereof, is not restricted to such parts or even to uniting the parts of lamps, but it may be used in uniting parts otherwise constructed.

Generally speaking, the apparatus invented by me comprises one or more rotating or shaft parts having suitable bearings and means for imparting rotary motion to said parts and to the parts revolving therewith and also means for holding the parts with their edges in proper position to be joined. The means for heating and fusing in sealing or joining the parts together preferably consists of Bunsen flames or blowpipes directed to the proper place with respect to the parts to be joined.

15 15 designates a suitable base, which, as shown in the accompanying drawings, is of substantially triangular shape and which is formed with a bed-plate 15<sup>a</sup> of dovetailed shape in cross-section. Secured to the bed-plate 15<sup>a</sup> is a carriage 16, which includes the base or bed plate engaging portion 16<sup>a</sup> and the bearing portion 16<sup>b</sup>. This bearing 16<sup>b</sup> is longitudinally bored, as at 16<sup>c</sup>, on an axial line parallel with the bed-plate 15<sup>a</sup> to receive the tubular shaft section 17<sup>a</sup> of the bulb-chuck 17, hereinafter again referred to. The bearing portion 16<sup>b</sup> is split at one end, as at 16<sup>d</sup>, and is provided with a pair of ears 16<sup>d</sup> 16<sup>d</sup>, through which the bolt 16<sup>e</sup> passes to clamp the said split end together to firmly hold the plug 16<sup>e</sup>; to the nipple 16<sup>f</sup> of which the hose connection 16<sup>g</sup> from the air-pump mechanism (not shown) joins. The inner end of the plug 16<sup>e</sup> is countersunk to cooperate with the correspondingly-formed end 17<sup>b</sup> of the shaft-section 17<sup>a</sup> to form a practically airtight joint. The other end 16<sup>h</sup> of the bearing member 16 is adapted to receive a union-cap 16<sup>m</sup>, provided with an oiling-aperture 16<sup>n</sup>, and the said cap 16<sup>m</sup> cooperates with the annular rib 17<sup>c</sup> of the tubular shaft 17<sup>a</sup>. The bulb-chuck 17 also includes a body portion 17<sup>d</sup>, to which the tubular receiver 17<sup>e</sup> is secured, and this body portion or head 17<sup>d</sup> has a concaved portion 17<sup>f</sup> on its inner face concentrically arranged with respect to the bore 17<sup>x</sup> of the head and shaft section and is provided with a rubber gasket 18, as shown.

19 designates a pulley which is secured to the head 17<sup>d</sup> and around which and the guide or tightener pulleys 19<sup>a</sup> 19<sup>a</sup> the drive-belt 20 passes.

Held within the tubular receiver 17<sup>e</sup> and in parallel alinement with each other and the axis of the chuck are a plurality of rubber cushions 21 21, by means of which the outer bulb 2 is held in place with its neck 2<sup>c</sup> in the bore 17<sup>x</sup> and its end against the gasket 18 with its base-engaging portion projecting beyond the open end of the tubular receiver 17<sup>e</sup>.

22 designates a second carriage which includes a base 22<sup>a</sup>, having a dovetailed slot

22<sup>b</sup> in its lower face to cooperate with the bed-plate 15<sup>a</sup>, and the said carriage 22 also includes a longitudinal slot 22<sup>c</sup>, in which the rack-bar 22<sup>d</sup> is held by the bolts 22<sup>e</sup> 22<sup>e</sup> or otherwise, and with which the segmental pinion 23, projecting through a slot 15<sup>x</sup> of the bed-plate 15<sup>a</sup>, engages. The pinion 23 is secured to a shaft 24, mounted in the frame 15, to one end of which shaft the arm 24<sup>a</sup>, carrying a balance-weight 24<sup>b</sup>, is connected, a crank-arm 24<sup>c</sup> being connected to the other end of the said shaft 24, and its limit of movement is regulated by the stop-pin 25. The carriage 22 includes a bearing member 22<sup>f</sup> longitudinally bored, as at 22<sup>g</sup>, which bore 22<sup>g</sup> aligns with the bore 16<sup>c</sup> of the bearing 16<sup>b</sup>. A longitudinally-movable sleeve 26 is held in the bore 22<sup>g</sup> of the bearing member 22<sup>f</sup>, as shown, and this sleeve 26 has a stop-pin 26<sup>a</sup>, which projects into a longitudinal slot 22<sup>h</sup> in the bearing 22<sup>f</sup> to prevent turning of the sleeve. The sleeve 26 at its inner end carries an annular disk 26<sup>b</sup>, to which the union-cap 27 is secured.

28 designates the base-holding chuck which includes a socket 29, which may be of the ordinary lamp-socket type, (see Fig. 4,) or which may be constructed on the lines indicated in Fig. 1, by reference to which it will be seen the socket 29 of the chuck 28 engages the threaded end of the lamp-base and an annular mouth 29<sup>b</sup>, which includes a rubber gasket or ring 29<sup>c</sup>, against which the lamp-base is held. The chuck 28 also includes an annular disk portion 28<sup>a</sup> to cooperate with the cap 27 and a tubular neck or spindle 28<sup>b</sup>, which passes through the sleeve 26 and joins with the tube 30 of the air-pumping mechanism. Disposed between the disk 28<sup>a</sup> and the disk 26<sup>b</sup> is a ball holder 31 to carry the bearing-balls 31<sup>a</sup>.

26<sup>g</sup> indicates a buffer-spring carried by the sleeve 26 between the disk 26<sup>b</sup> and the bearing 22<sup>f</sup> for a purpose readily apparent. Secured to the bearing 22<sup>f</sup> is a support 32, to which a socketed member 32<sup>a</sup> is adjustably connected and in which socketed member 32<sup>a</sup> the hopper-carrying rod 33<sup>a</sup> is adjustably held.

33 designates the hopper, which may be of any approved construction and which, as shown in the drawings, includes the conically-shaped end 33<sup>b</sup>, having an aperture 33<sup>c</sup>, controlled by the needle-valve 34, which is normally spring-pressed to its closed position and which passes through a tubular sleeve 35, carried by the closure-cap 33<sup>d</sup>, and the said valve 34 is held open at predetermined times by means of the lever 34<sup>a</sup>.

36 designates a third carriage disposed between the carriages 16 and 22 and likewise movable on the bed-plate 15<sup>a</sup>, and this carriage 36 has a transverse bore 36<sup>a</sup>, in which burner feed-pipes are held and with which the gas-feed pipes 38 join. Each of these



vertical feed-pipes have a cross-head 38<sup>a</sup>, to which the vertically-disposed burner-pipes 39 are turnably or pivotally joined, and these pipes 39 are turned on their vertical axis by means of the finger members 37<sup>a</sup>, as shown, to direct the burners 41, which are carried by the upper ends of the said pipes 39. These burners 41 are of elongated shape with a concaved upper surface and provided on said surface with apertures 41<sup>a</sup> to permit egress of the gas.

42 designates an extension from the head 38<sup>a</sup>, which carries a second hollow head 43, to which the blowpipes 44 are pivotally secured and are adjustable by means of the finger-piece 45. These blowpipes, as well as the burner-pipes 37, have stop-cocks 44<sup>x</sup> and 37<sup>x</sup>, respectively, to shut off the supply of air and gas, it being understood that the air-pipe 46 connects with the head 43. The blowpipes 44 have their nozzles 44<sup>a</sup> directed over the burners 40 to direct the flame to the desired point at the juncture of the bulb and base.

Referring to Fig. 1, it will be noticed that I hold the bed-plate on an angle of about thirty degrees to the horizontal, so as to maintain the hopper in a vertical position as well as the burner-pipes and to keep the line of juncture corresponding to the vertical axis of the hopper where the glass is deposited on the parts to be joined in a practically vertical position.

Having thus generally described the construction of the apparatus used in joining bulb and base, I shall now proceed to describe the construction of apparatus used in joining the two parts of the bulb together when the bulb is not made of a single piece.

By reference to Figs. 5 and 6 it will be seen that when used to join the outer and inner bulbs 2 and 1, respectively, together the bulb-chuck is held in a vertical position and is of substantially the same construction as that shown in Fig. 1, with the exception that the tubular shaft-section 17<sup>a</sup> in this form is closed at one end, to which end the drive-pulley 19 is connected instead of being connected to the head-piece 17<sup>d</sup>. Again, the tubular shaft-section 17<sup>a</sup> is provided with an external annular groove 17<sup>z</sup> and a series of apertures 17<sup>y</sup>, which communicate with the said groove 17<sup>z</sup> and the internal bore of the said sleeve. In this form also the bearing member 50 for the tubular shaft 17<sup>a</sup> is vertically disposed and forms a part of the base 51, and the said bearing 50 has an aperture 50<sup>a</sup> to receive the coupling-pipe 50<sup>z</sup>, to which the air-pumping-mechanism-connecting tube is connected, and the said bearing 50 at its upper end is provided with an oil-receiving groove 50<sup>c</sup>, with which the oil-admitting tube 50<sup>d</sup> communicates. In this case the burner mechanism, which is of the same construction as in Fig. 1, is vertically supported from

the base 51, as is also the hopper, which is vertically adjusted on the supporting-rod 55. The burner members are so arranged as to direct the flame at the point where the vertical axial line of the hopper intercepts the adjoining edges of the parts to be sealed together. (See Fig. 5.)

Having thus generally described the construction of the various apparatus used in the formation of my improved lamp-bulbs, I shall now briefly describe the method or manner in which the said bulbs are sealed. I shall first describe the manner of sealing the base to the bulb regardless of whether the bulb be formed of a single piece or of two pieces joined together. I first place the bulb in the bulb-chuck and the base in the base-chuck, it being understood that at this time the base-chuck carriage 22 has been moved up the inclined bed-plate by moving the handle downwardly. I then move the handle upwardly to bring the base and the lamp-bulb in proper correlative position, where they are then held by means of the balance-weight coöperating with the handle-shaft. I then adjust the hopper and the burners to direct the glass from the hopper and the burner-flames to the proper point and then set the chucks in motion by means of the drive-belt driven by any suitable power mechanism. (Not shown.) The pressure of the buffer-spring will serve to hold the base against the bulb with sufficient cohesion to permit the base and bulb to revolve together. After the stream of glass from the hopper is fused and sealed to the bulbs at their joint and the bulbs are securely sealed together the same may be removed and other parts placed into position for joining.

During the sealing and joining operation of the base and bulb I preferably force compressed air through the tubular shaft-sections into the base portion and between the outer and inner bulbs to exert pressure against the softened glass at the joint to weld the same together at the same time the sealing substance is being applied. In this case it should be understood that the chamber formed by the inner bulb has no connection with that formed between the inner and outer bulbs. Again, I may while the sealing process is taking place instead of forcing compressed air into the parts to be sealed, exhaust the bulbs to suck the sealing material into the joint between the parts, and when this is done the inner bulb-chamber is in communication with the chamber between the outer and inner bulbs by means of an aperture in the inner bulb.

My invention is also applicable for use in the process of manufacturing bulbs disclosed in my copending application filed March 15, 1904, Serial No. 198,340.

When it is desired to make the bulbs of two parts instead of a single part, I join the said



two parts by means of the apparatus shown in Fig. 5, by reference to which it will be seen that the outer bulb 2 is held in the bulb-chuck in a vertical position and the inner bulb rests with its flange upon the flange of the outer bulb, and the hopper and burners are so arranged that a stream of the sealing material will be deposited at the edges of the inner and outer bulbs while the said edges are heated by the burners and at the same time air is exhausted from between the two bulbs parts to suck such sealing material into the joint and also to weld the joint together by such heating of the parts during the suction or exhaustion thereof.

The sealing material which I may use may be of any approved kind; but I preferably use an all-glass solder having but one coefficient of contraction and expansion—a result directly impossible when a metallic solder is used. The importance and almost necessity of joining the all-glass parts by means of an all-glass solder will be readily apparent when luminants and filaments are adopted for use, which in view of other more important qualities secured dispense in part with flexibility and which would receive life-shortening cracks by being passed through narrow necks, and consequently demand wide necks to their bulbs, and which is not feasible or practicable under the method of glass-blowing now in common use.

It should be understood that the heating apparatus for melting the glass solder and for heating the joint at the point of application consists, essentially, of blowpipe-burners which are the equivalent of the Bunsen jet, ejecting simultaneously combustible air and gas or oxygen or a mixture thereof properly proportioned at the will of the operator to produce the oxidizing or reducing flame and having means whereby the total quantity of ejected mixed air and gas may be properly regulated to produce higher or lower temperatures.

In my improved apparatus I preferably use a plurality of such flames, regulating the function of the parts for the contributive purpose of obtaining the final effect of making an all-glass soldered joint between glass parts that strictly retain their former shape and dimension during the joining operation.

From the foregoing it will be seen that while my apparatus is practically adapted for use in connection with the joining of bulb and base while simultaneously forcing air into the same to weld the parts together, yet it will be seen it may be also used for exhausting the parts during the joining operation. It will be also seen that I have provided a very simple and effective means whereby to adjust the base and bulbs so as to fit as cone and collar and also mechanism for pulling the lamp out of the bulb-chucks and also at proper times to exercise a moderate

pressure to the parts to be joined to weld them together in proper position.

Any suitable motive power may be used for operating the driving-belt, as the same *per se* forms no part of my invention.

From the foregoing, taken in connection with the accompanying drawings, it is thought that the complete construction, operation, and advantages of my improved apparatus and the method in which it is used will be readily understood by those skilled in the art to which it appertains, as well as the many advantages of my invention, among which I desire to call attention to the following facts: First, that glass bulbs can be made without any change in form of the joined parts; second, joints of such length as could not be made by any apparatus now in use in the art can by this apparatus be made with the greatest degree of perfection and with better conditions for making the joint hermetical than in machines now in common use in the art; third, the action of joining the parts may be made controllable by coloring the solder glass powder in any approved manner and thereby render it distinguishable from the glass of the parts to be joined; fourth, joints made under the old art are as a rule to be disfigured, while under my improved method the form is not only preserved, but its beauty increased by the color ring or head covering the joint.

I desire it understood that I do not limit myself to the exact construction, arrangement, and operation of parts hereinbefore described, but I desire it understood that slight changes in the detailed construction, arrangement, and combination of parts may be made without departing from the invention or the scope of the appended claims.

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

1. In an apparatus for joining vitreous articles, means for heating the parts adjacent the joint, means for applying pressure to the said parts from within to cause the article to become welded and means for applying a sealing material to the joint.

2. In an apparatus for making joints between hollow vitreous parts, means for heating the parts adjacent to the joint, means for forcing air into the hollow articles while being heated to press the heated parts together to weld the same, means for applying the vitreous sealing material to the joint and means for simultaneously rotating said parts.

3. In an apparatus of the character stated, a base, a bearing mounted on said base, a bulb-chuck having a shaft rotatable in said bearing, said chuck including a head portion and a bulb-receiver carried thereby, substantially as shown and for the purposes described.



4. In an apparatus of the character stated, a base, a bearing mounted on said base, a bulb-chuck having a shaft rotatable in said bearing, said chuck including a head portion and a bulb-receiver carried thereby, and means for imparting rotary motion to said chuck and means for feeding vitreous material to the joint.

5. In an apparatus of the character stated, a base, a bearing mounted on said base, a bulb-chuck having a shaft rotatable in said bearing, said chuck including a head portion and a bulb-receiver carried thereby, cushions held in the said receiver to engage said bulb and hold it out of engagement with the receiver-walls, and means for rotating said chuck and means for feeding a vitreous material to the joint.

6. In an apparatus of the character stated, a base, a bearing mounted on said base, a bulb-chuck having a shaft rotatable in said bearing, said chuck including a head portion, and a bulb-receiver carried thereby, said chuck-shaft being hollow to receive the bulb-neck and communicate with the interior of the bulb, means for rotating said chuck and means for feeding vitreous material to the joint.

7. In an apparatus of the character stated, a base, a bearing mounted on said base, a bulb-chuck having a shaft rotatable in said bearing, said chuck including a head portion and a bulb-receiver, cushions held within said receiver to hold the bulb out of engagement with the receiver-walls, said chuck-head having a concaved portion, a gasket seated in said concaved portion, said chuck-shaft being hollow to communicate with the interior of the bulb, and means for causing a differential air-pressure between the outside and inside of the bulb while in such chuck and means for applying a vitreous material to the joint, substantially as shown and for the purposes described.

8. In an apparatus of the class described, a base including a bed-plate, a carriage having a bearing mounted thereon, a bulb-chuck having a shaft rotatably mounted in said bearing to receive the bulb, a second carriage mounted on said bed-plate, a base-chuck carried thereby to receive the lamp-base, means for moving said second carriage to or from the first carriage and means for sealing the lamp-bulb and lamp-base together.

9. In an apparatus of the class described, a base including a bed-plate, a carriage having a bearing mounted thereon, a bulb-chuck having a shaft rotatably mounted in said bearing to receive the bulb, a second carriage mounted on said bed-plate, a base-chuck carried thereby to receive the lamp-base, and means for moving said second carriage to or from the first carriage, means for normally forcing said second carriage to-

ward said first carriage to hold the base part against the bulb part and means for sealing the lamp base and bulb together substantially as shown and for the purposes described.

10. In an apparatus of the character stated, a base including a bed-plate, a carriage having a bearing mounted thereon, a bulb-chuck including a shaft rotatably mounted in said bearing to receive the bulb, a second carriage mounted on said bed-plate, a base-chuck carried thereby to receive the lamp-base, means for moving said second carriage to or from the first carriage, said means including a gear mounted on said base, and a rack carried by said second carriage for co-operating therewith and means for sealing the lamp base and bulb together, substantially as shown and for the purposes described.

11. In an apparatus of the character stated, a base including a bed-plate, a carriage having a bearing mounted thereon, a bulb-chuck including a shaft rotatably mounted in said bearing to receive the bulb, a second carriage mounted on said bed-plate, a base-chuck carried thereby to receive the lamp-base, means for moving said second carriage to or from the first carriage, said means including a gear mounted on said base, and a rack carried by said second carriage for co-operating therewith, means for normally moving said second carriage toward said first carriage and means for sealing the lamp base and bulb together substantially as shown and for the purposes described.

12. In an apparatus of the character stated, a base including a bed-plate, a carriage having a bearing mounted thereon, a bulb-chuck having a shaft rotatably mounted in said bearing to receive the bulb, a second carriage mounted on said bed-plate, a base-chuck carried thereby to receive the lamp-base, means for normally moving said second carriage toward said first carriage to hold the base and bulb parts together, means for limiting such normal movement and means for applying a sealing material to the joint between the base and bulb parts of the lamp.

13. In an apparatus of the character stated, a base including a bed-plate, a carriage mounted thereon, a bulb-chuck carried by said carriage, a second carriage mounted on the bed-plate, a base-chuck carried by said second carriage, means for moving one of said carriages toward the other to hold said base and bulb parts together, means for rotating said chucks, a hopper carried by said second carriage, and means for applying a vitreous material to the joint between the lamp and base bulbs, substantially as shown and for the purposes described.

14. In an apparatus of the character stated, a base including a bed-plate, a car-



riage mounted thereon, a bulb-chuck carried by said carriage, a second carriage mounted on the bed-plate, a base-chuck carried by said second carriage, means for moving one of said carriages toward the other to hold said base and bulb parts together, means for rotating said chucks, a hopper carried by said second carriage, burners mounted on the base and means for feeding a vitreous material to the joint between the lamp base and bulb, substantially as shown and for the purposes described.

15. In an apparatus of the character stated, a base including a bed-plate, a carriage mounted thereon, a bulb-chuck carried by said carriage, a second carriage mounted on the bed-plate, a base-chuck carried by said second carriage, means for moving one of said carriages toward the other to hold the base and bulb parts together, means for rotating said chucks, a hopper carried by said second carriage, a third carriage adjustably mounted on the base between said first and second carriages, burner members carried by said third carriage and means for feeding a vitreous material to the joint substantially as shown and for the purposes described.

16. In an apparatus of the character stated, a base including a bed-plate, a carriage mounted thereon, a bulb-chuck carried by said carriage, a second carriage mounted on the bed-plate, a base-chuck carried by said second carriage, means for moving one of said carriages toward the other to hold the base and bulb parts together, means for rotating said chucks, a hopper carried by said second carriage, a third carriage adjustably mounted on the base between said first and second carriages, burner members carried by said third carriage, means for moving one of

said carriages away from the other to withdraw the joined base and bulb from the bulb-chuck and means for applying a vitreous material to the joint substantially as shown and for the purposes described.

17. In an apparatus of the character stated, a base, a bearing carried thereby, a bulb-chuck rotatably mounted in said bearing to receive the lamp-bulbs, a hopper arranged above said chuck to feed sealing material to the joint between the bulb parts, burners carried by the base for heating the joint between the parts to be sealed substantially as shown and for the purposes described.

18. The method of joining hollow vitreous articles, consisting in heating the parts adjacent the joint, and applying pressure to such parts from within each article to cause the articles to become welded together and in simultaneously applying a sealing material to the joint.

19. The method of joining hollow vitreous articles, consisting in heating the parts adjacent the joint and applying pressure to such parts from within the joint to cause the joint to become welded together and simultaneously feeding vitreous material to the joint.

20. A method of making joints between hollow vitreous parts consisting in heating the parts adjacent the joint and in forcing air into each of said hollow articles while being heated to press the heated parts together to weld the same and in simultaneously feeding vitreous material to the joint.

FRANCIS M. F. CAZIN.

Witnesses:

MINNA E. CAZIN,  
CHAS. C. WASHBURN.