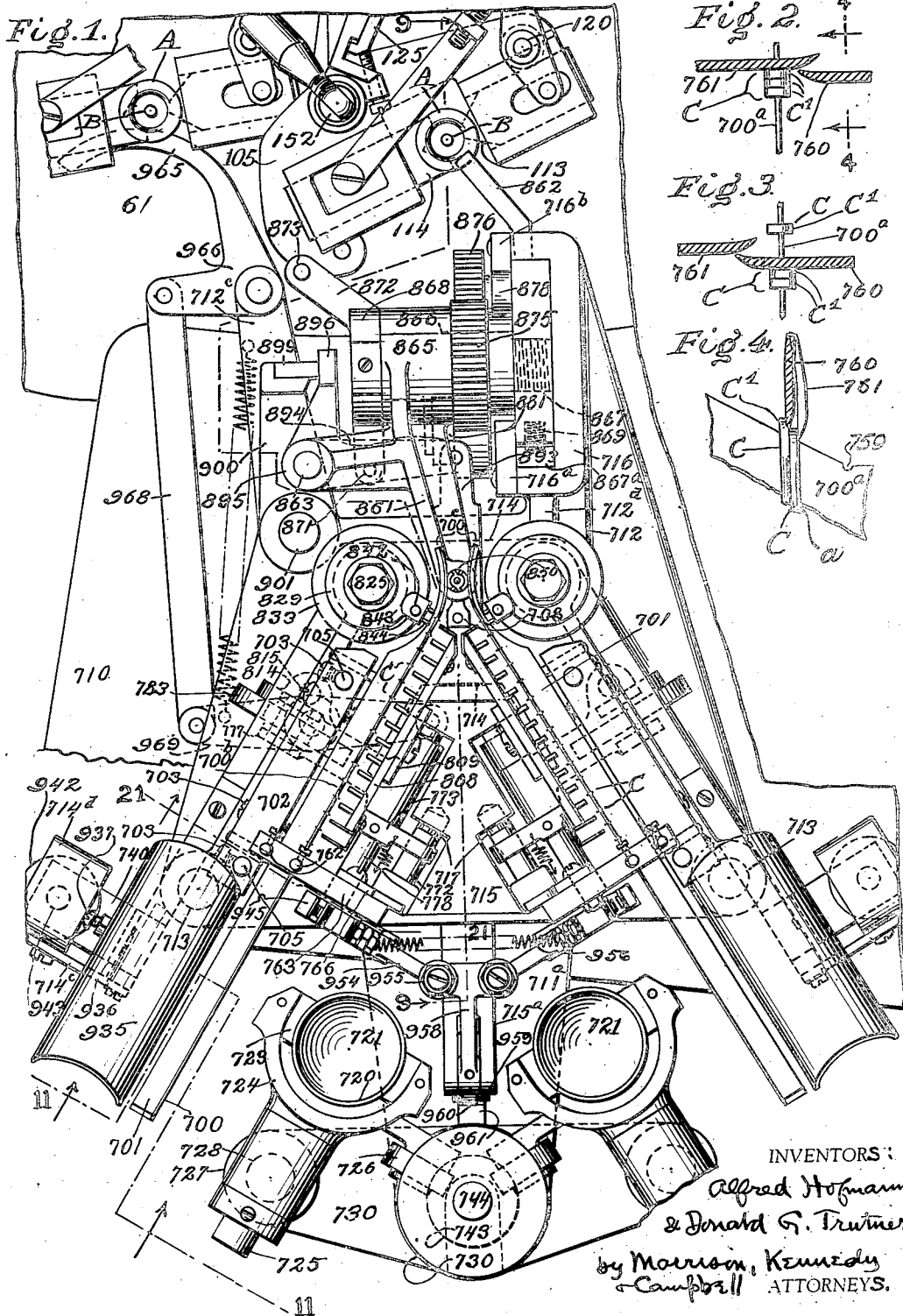


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9 Sheets-Sheet 1



Sept. 15, 1936.

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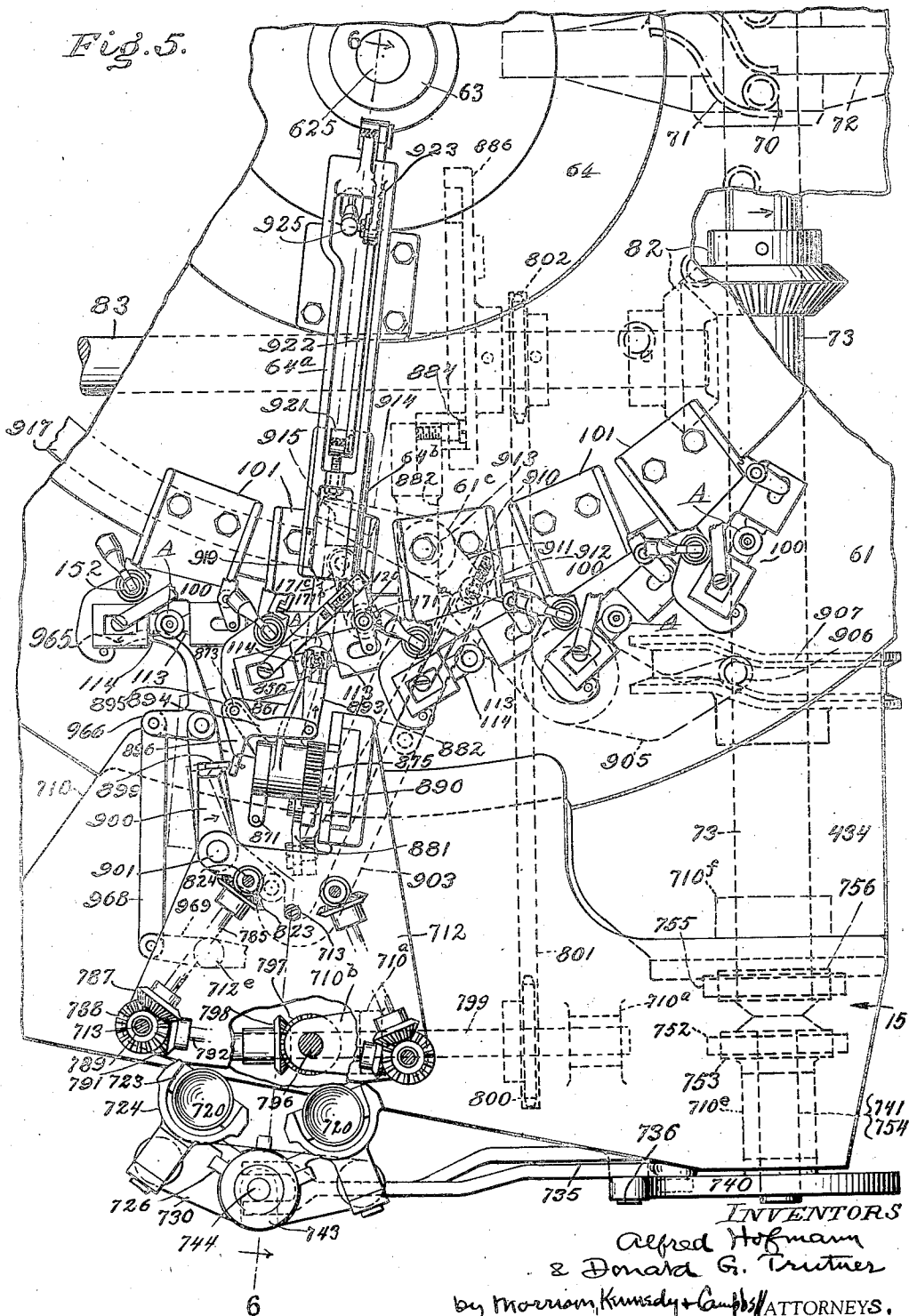
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MANUFACTURE OF LAMP STEMS

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Fig. 5.



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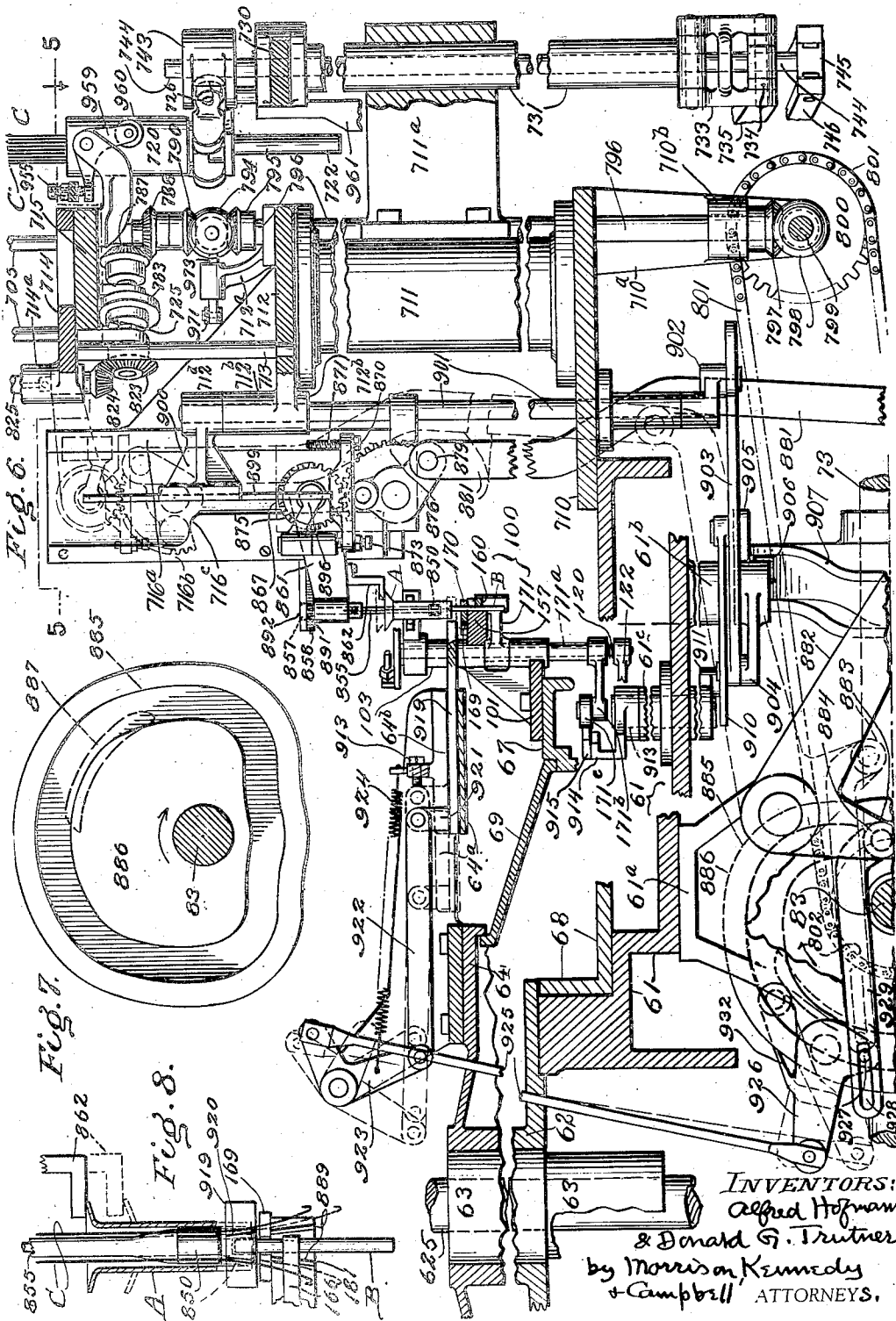
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MANUFACTURE OF LAMP STEMS

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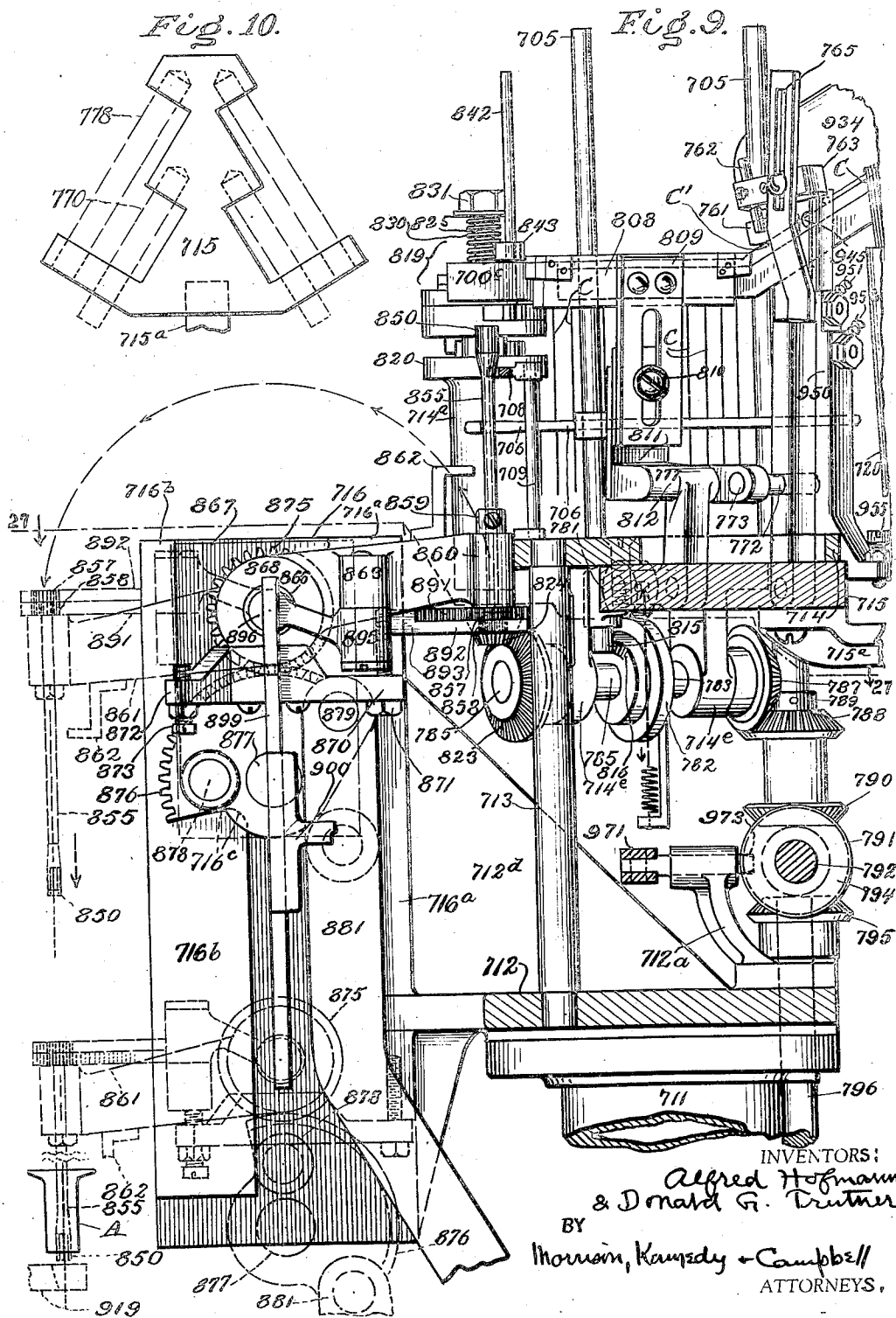
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MANUFACTURE OF LAMP STEMS

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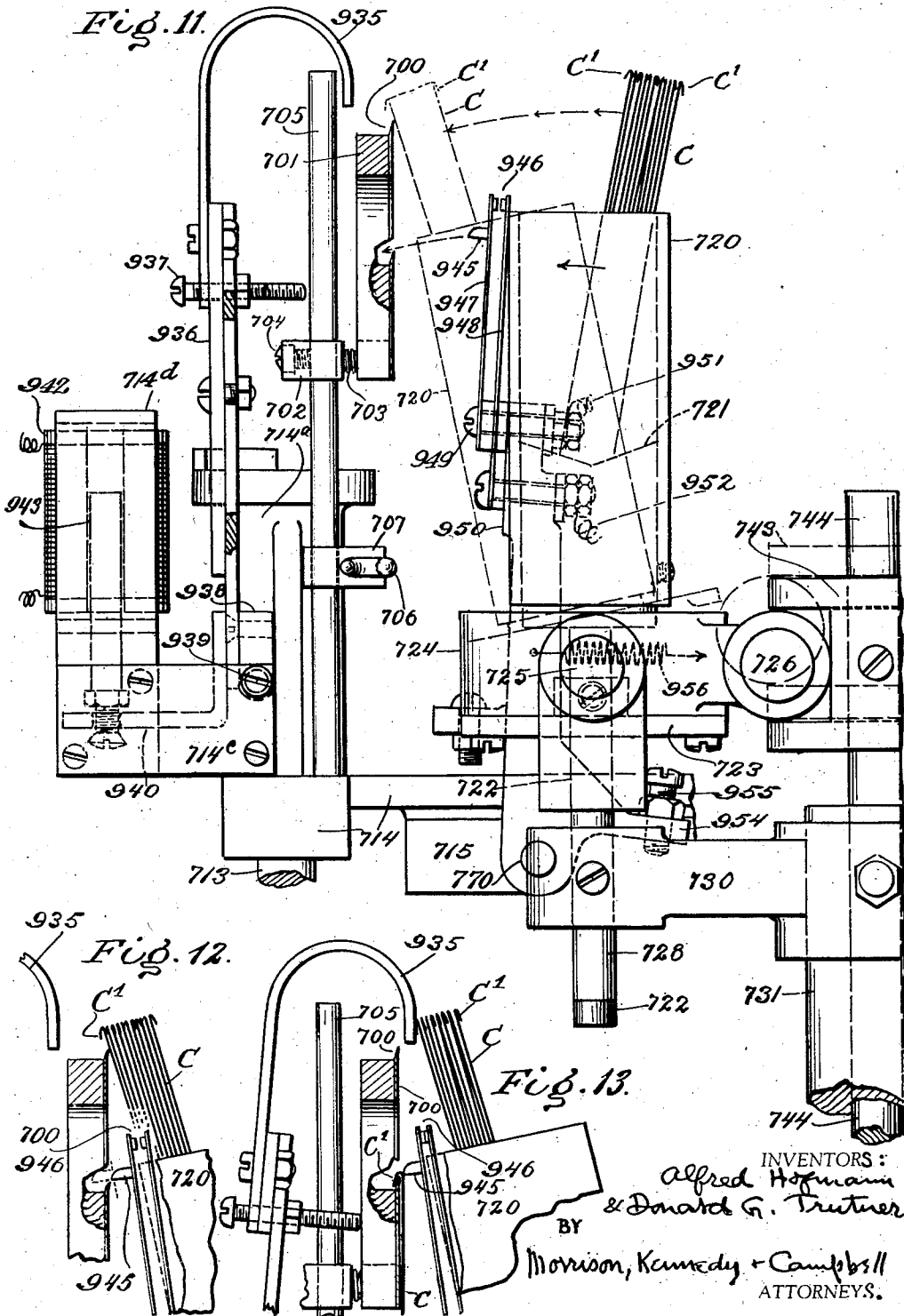
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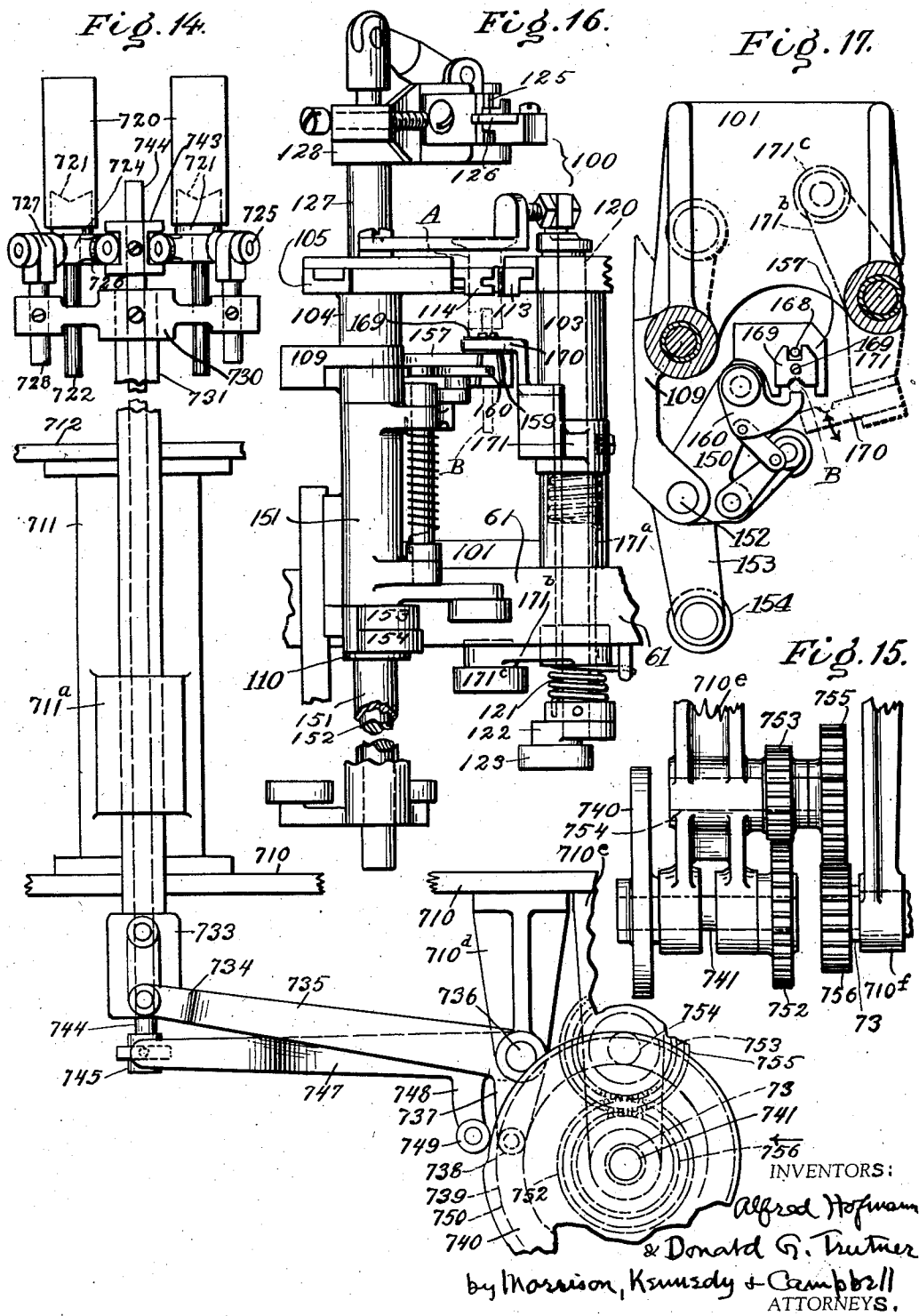
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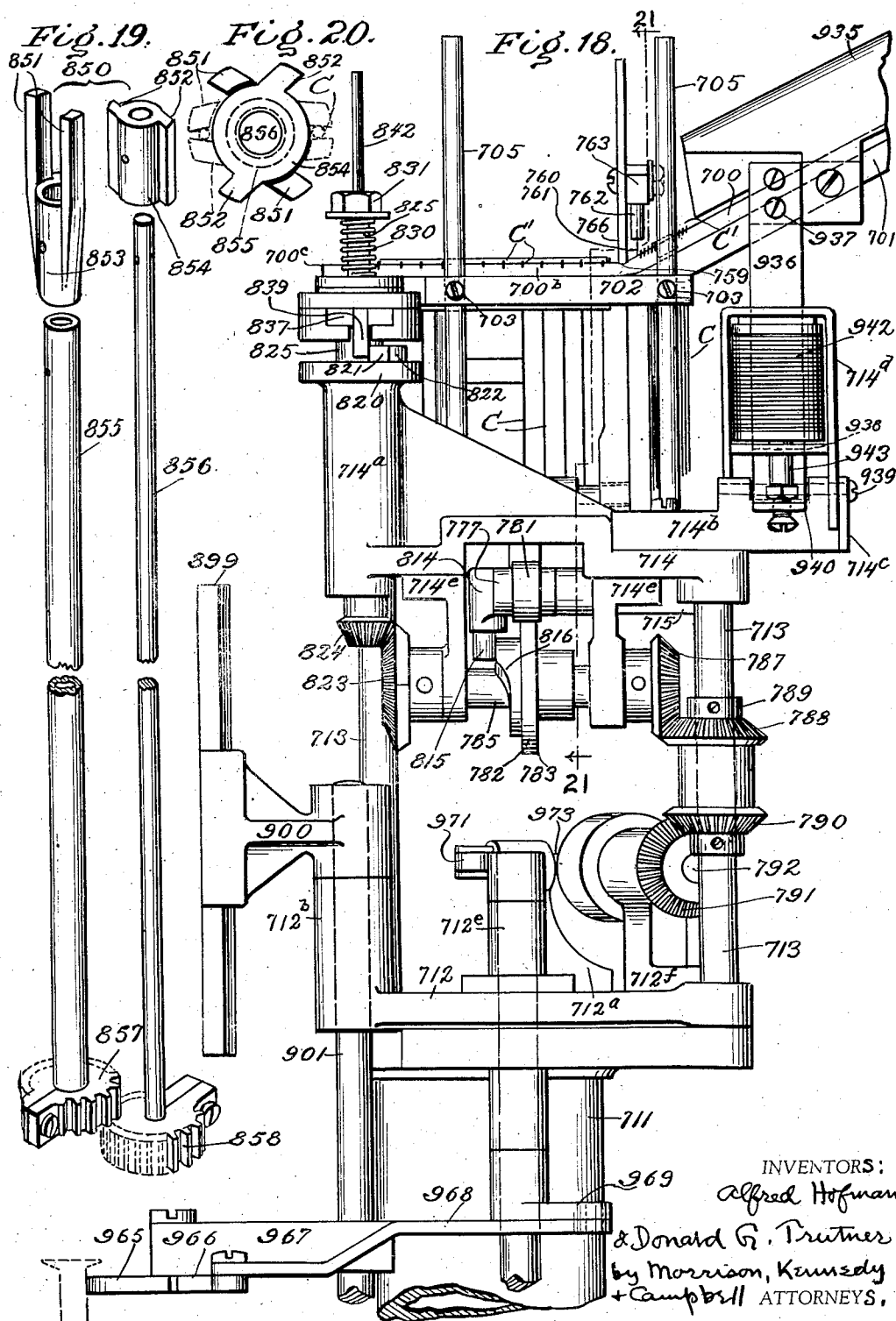
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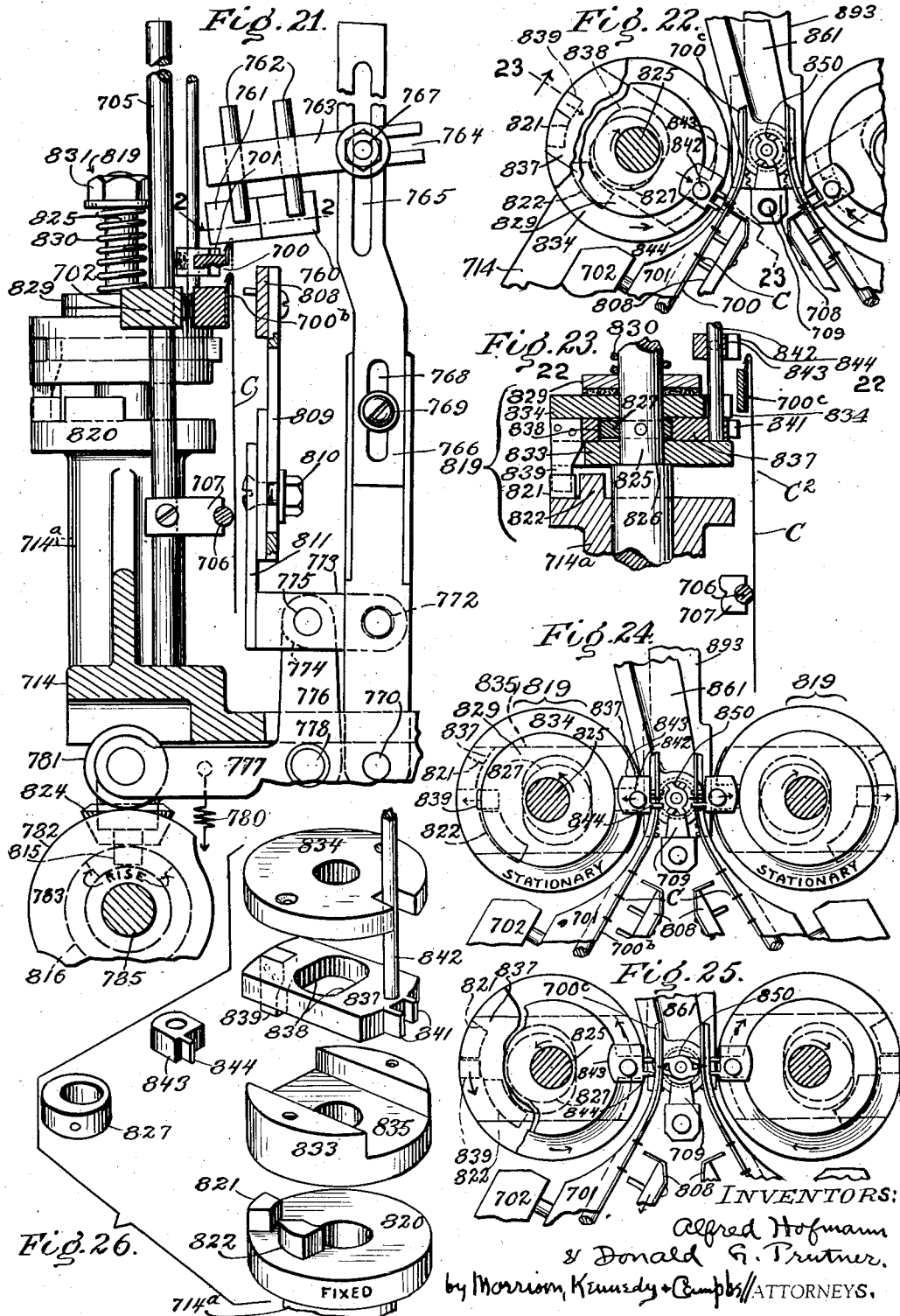
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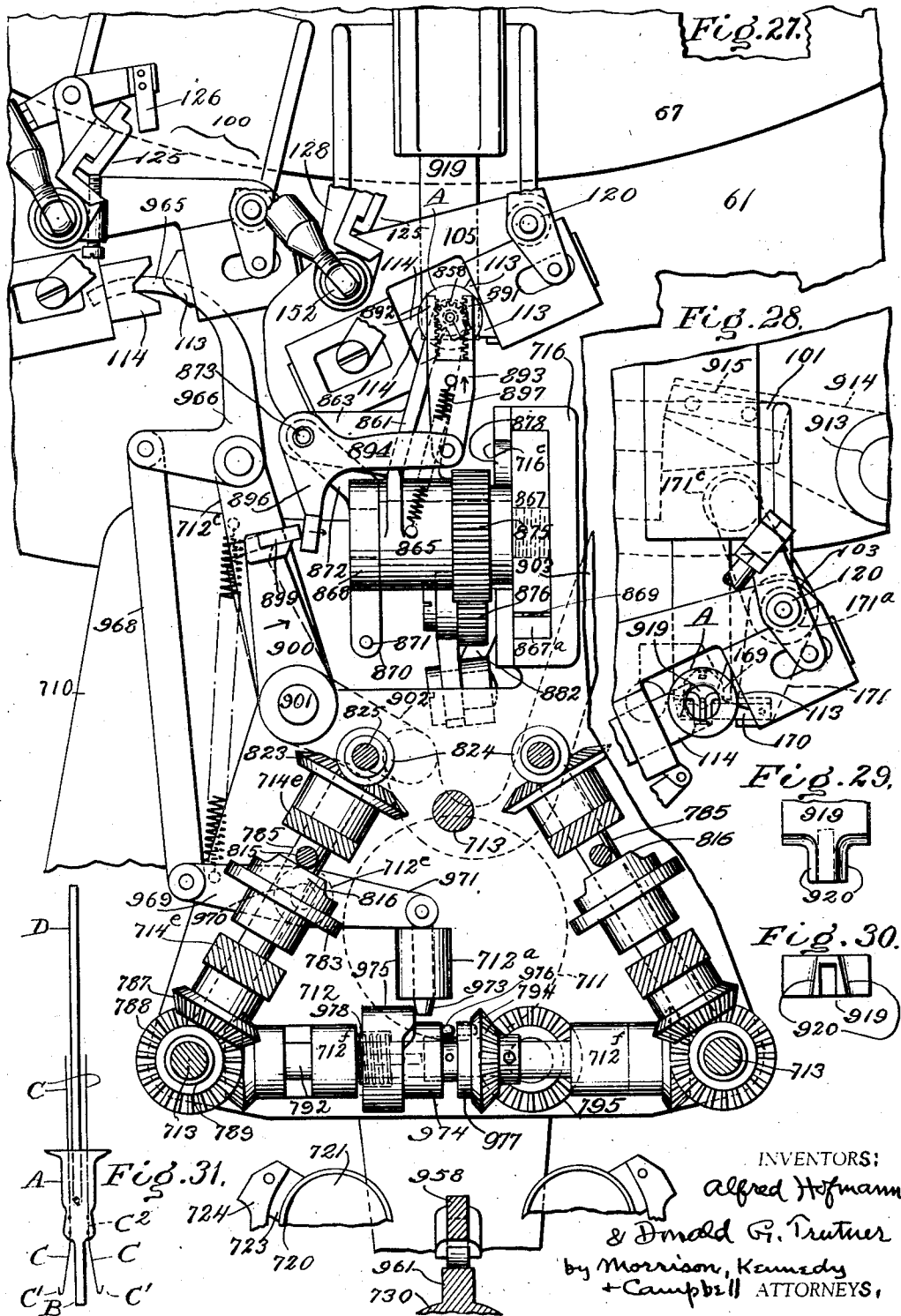
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UNITED STATES PATENT OFFICE

2,054,627

MANUFACTURE OF LAMP STEMS

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35 Claims. (Cl. 176—3)

This invention relates to lamp stem manufacturing apparatus, having reference to the quantity manufacture of the so-called stem parts of incandescent electric lamps of various classes; and pertains especially to the feeding of leadwires into assembled relation with the other components of the stem. A complete stem making machine is illustrated in Patent Number 1,990,258 of February 5, 1935, to which reference may be had for various details of construction and operation not herein fully disclosed. In the machine of said prior Patent 1,990,258 the leadwires are set into place manually in relation to the other or glass components of the stem, all held in a system of chucks constituting a head, and there being a series or procession of such heads arranged and operated to advance progressively around a designated path or orbit, from station to station, for the performing of the successive steps in the manufacture of the complete lamp stems, including the uniting of the components.

It has been heretofore attempted to infeed leadwires by automatic mechanism, one system being that shown in expired Patent 1,019,457 of March 5, 1912 wherein lengths of wire are drawn from reels and severed and the loose wires dropped into place in the heads. Other mechanisms have been tried or patented; but none have been entirely satisfactory as to efficiency, accuracy or reliability.

The general object of the present invention is to afford a mechanism for efficiently and accurately handling and feeding loose leadwire components and inserting them in proper location in the successive traveling heads, and there engaging each of them by its holder or chuck, in proper position to be combined and incorporated as a part of the final product. Particularly, an object is to handle mechanically a loose quantity of separate preformed leadwires of the kind having hooked ends, this being done, by engaging them by their hooks, so as to hang, and guiding and advancing them in single file while depending by their hooks, and then transferring them in succession to the leadwire chucks of the heads, preferably a pair of leadwires in each cycle, to a chuck adapted to hold the pair, and preferably setting or adjusting the leadwires of each pair vertically or longitudinally to their correct height or location before the closing of their chuck.

A further object is automatically to control the posture of each leadwire, that is the disposition or direction of facing of its hook, for example outwardly or from the center of the lamp stem, so as to stand ready for the subsequent reception of

the coiled or other filament without the usual need of manual twisting of the hooks into the proper facing direction; this object being rendered possible by reason of the mode of supplying and supporting the wires by their hooks and advancing and transferring them accordingly. A further object is to simplify the heads by eliminating therefrom the usual positioning means or stops for the leadwires which determine the vertical location of the wires in the stem, and the consequent troublesome adjustment of a large number of heads for a change in lamp size or kind; this being accomplished by transferring each wire to the head and holding it there at the correct height and position until engaged by the wire chuck in the head.

Further and more detailed statements of object and advantage will be explained in the hereinafter following description of an illustrative embodiment of the present invention or will be understood by those conversant with the subject; the invention consisting in the novel features of method, operation, combination, arrangement and construction disclosed by drawing or description.

In the accompanying drawings Figure 1 is a top plan view of a portion of a lamp stem manufacturing machine or apparatus embodying the present invention, with certain head parts corresponding with the disclosure in said prior Patent No. 1,990,258.

Fig. 2 is a top view of the leadwire escapement device in horizontal section on the line 2—2 of Fig. 21. Fig. 3 is similar to Fig. 2 with the parts in a subsequent position. Fig. 4 is a right elevation of the parts shown in Figs. 2 and 3 partly in section on the line 4—4 of Fig. 2.

Fig. 5, on a smaller scale than Fig. 1, is a top plan view of a greater extent of the machine, and with the leadwire infeeding mechanism partly in horizontal section on the broken line 5—5 of Fig. 6.

Fig. 6 is a left elevation taken partly in section on the broken line 6—6 of Fig. 5, and on the same scale. Fig. 7 is a right elevation of a certain cam seen in Fig. 6.

Fig. 8 is a front elevation on larger scale than Fig. 1 showing the relation of the flare, cane, and leadwire elements of the stem during their assembling.

Fig. 9 is a left elevation taken partly in section on the section line 9—9 of Fig. 1, and on the same scale. Fig. 10 is a top plan view of a fixed bracket member giving support to several movable parts.

Fig. 11 is a substantially front elevation showing the left leadwire supply container and receiving track and cooperating parts, partly in section on the section line 11—11 of Fig. 1, but on larger scale. Figs. 12 and 13 in diagram are partial views similar to the upper part of Fig. 11 showing the same parts in different stages of operation.

Fig. 14, on the same scale as Fig. 5, is a front elevation of the supply container and its operating connections. Fig. 15 is a right elevation showing certain details of the connections of Fig. 14, looking in the direction of the arrow 15 on Figs. 5 and 14.

Fig. 16 is a front elevation of one of the heads of the turret showing especially the leadwire chuck and cooperating parts. Fig. 17 is a top plan view of the mechanism of Fig. 16.

Fig. 18 is a left elevation of the left hand receiving track, escapement device, intermittent advancing device and rotary delivering device, on the same scale as Figs. 1 and 9, with certain operating connections therefor.

Fig. 19 is an exploded view of the transferring leadwire gripper. Fig. 20 on an enlarged scale is a top plan view of the assembled gripper showing the jaws open in full lines and closed in dotted lines.

Fig. 21 is an elevation in substantially front view, partly in section taken generally on the line 21—21 of Fig. 1, and more particularly on the broken line 21—21 of Fig. 18.

Fig. 22 is a top plan view, similar to a part of Fig. 1, on a larger scale, but partly in section on the line 22—22 of Fig. 23, especially showing the rotary delivering device by which the successive leadwires on the track are brought into gripping relation to the gripper. Fig. 23 is a sectional view taken on the line 23—23 of Fig. 22. Figs. 24 and 25 are views similar to Fig. 22 showing the parts in different stages of position. Fig. 26 is an exploded view of the parts making up the rotary delivery device.

Fig. 27 is a top plan view, partly in section on the line 27—27 of Fig. 9, on the same scale as Fig. 1 but with the transfer device shown as swung over rearwardly and in its inverted position, and with certain of the upper parts omitted to disclose better the construction of the lower parts which are not seen in Fig. 1 and are only partly seen in Fig. 5.

Fig. 28 is a plan view like a part of Fig. 27 with certain upper parts omitted to show certain lower parts.

Fig. 29 is a top plan view of the front end of the retractable leadwire-guiding or steering member operating near the turret head to assist proper descent of the leadwires into their chuck. Fig. 30 is a front elevation of the member shown in Fig. 29.

Fig. 31 is a side elevation of the completed lamp stem according to said Patent 1,990,258.

The finished product or lamp stem may be built up from the following components: the flare A or main tubular part of the product, the cane or rod component B serving later to give support to a filament, the leadwire or leadwires C extending through the flare from above to below, and an exhaust pipe or tube D, Fig. 31. After the assembly of these components by means of the several chucks in each of the heads they are to be united by heating and accompanying operations, the lower end of the flare being thereby collapsed and closed, forming a fused connection with which the cane is combined and in which the leadwires are embedded, and the exhaust pipe

being later united with the flare by a fused connection, as shown, at which a perforation is blown so that the exhaust pipe may subsequently be in communication with the interior of the lamp, for exhausting or gas-filling the same; all generally as shown in said Patent 1,990,258.

The present invention deals with a certain well known type of leadwire C wherein at one end is a small hook C' that subsequently facilitates the connecting of the filament to the leadwires. Said leadwire also preferably has a short section C² composed of a special kind of wire welded to the sections above and below it, the special wire section C² being the part that becomes embedded in the fused connection and having a coefficient of thermal expansion substantially equaling that of glass.

The present invention utilizes and takes advantage of the small hook C' at one end of each leadwire, namely by the provision of a receiving and feeding device or chute, shown in the nature of a track, strip or edged bar over which the wire hook engages and along which the wire is advanced from the supply point to the means for transferring successive wires into the traveling heads of the machine. The entire mechanism for handling each one of the two wires usually arranged in a lamp may be symmetrically duplicated for the other wire, so that at each cycle two wires are transferred and inserted in proper position inside of the flare in the advancing head and into engagement with the chuck or holder which holds the leadwires in their proper relative position until the heat-softening and uniting actions have taken place. In each of the twin feed mechanisms the wires are advanced in single file, and the transfer mechanism takes one from each side as stated; but this arrangement may be varied according to circumstances, and one feed mechanism may advance two wires in tandem to the transferring gripper.

A particular advantage of the described arrangements is that the positions of the wire hooks are taken into account, that is, the directions at which they extend from the wires, so that after the wires have been assembled and thereafter united in the finished product the hooks will stand in the desired positions, usually outwardly from the axis of the lamp stem, whereas with any prior system with which applicants are familiar the wires have been inserted haphazard and the hooks therefore have been required regularly to be repositioned prior to the attachment of the filaments thereto.

The described type of hooked wire receiving device is simple and lends itself to the effective and accurate handling of this small component of the lamp stem. Thus the individual hooked leadwires are not required to be placed by hand upon the receiver, chute or track, but may be supplied thereto automatically by means of an open wire container or supply cup which in each operation is shifted or swung toward the chute, causing the body of wires therein to flop across to overlie the top edge of the receiver or track, a relatively lowering movement of the supply thereupon causing an indeterminate but substantial number of leadwires, on the average, to be hooked and caught upon the top edge of the receiving member ready for the subsequent advancing, spacing and transferring operations. The repeated movements of the supply group of leadwires is in the nature of a brushing action, the track pulling the leadwires by their hooks out of the cup. Broadly viewed, the receiver or track for the hooked wires might

be of a movable or rotary character to advance the wires, but a fixed track is preferably set at an incline so that the wires are moved along by gravity.

5 The described form of fixed chute or track also is well adapted to the single or spaced feeding of the supplied leadwires, by means first of certain separating or escapment means, and means for further feeding or advancing them beyond the
10 escapment, bringing eventually each of the successive wires to the delivery point, whereat the transferring device takes charge of the wire, or two or more wires, transferring them to a position adjacent to the traveling head and preferably in-
15 verting them during such transfer, so that each hook will be at the lower end as is customary, and thereupon lowering the leadwires into their assembled position in the head. The leadwire chuck in the head is coordinated with the wire gripping
20 device of the transfer mechanism so that the former closes upon the wire to hold it before the latter opens for its return movement.

Referring first to some of the general machine parts, corresponding generally with said Patent 1,990,258 and shown in Figs. 5, 6, 27 and others herein, there is a horizontal frame member or
25 table 61 of generally circular form, to the central part of which is attached a flanged sleeve 62 giving support to a fixed interior vertical sleeve 63 within which is guided a vertically reciprocable
30 rod 625 communicating certain motions as described in Patent 1,990,258. At the top of the sleeve 63 is a fixed closing disk or cap 64 upon which certain parts are mounted. The rotary
35 turret or carrier 67 is in the nature of a ring of large diameter, having a depending flange upstanding from a web 68 turning on a portion of the frame table, resting upon a shoulder thereof, and held down by the flange of the sleeve 62. In
40 Fig. 6 these parts are broken away for condensation of illustration. The outer or higher part of the turret 67 gives support to the series of heads to be described and a cover piece or cap 69 over-
45 lies a portion of the turret and extends inwardly adjacent to the fixed cap disk 64.

The turret is preferably advanced in step by step manner, pausing at certain stations for an appreciable time for the successive operations, but some operations being effected during advancing
50 travel. An intermittent drive means is indicated, corresponding to Patent 1,990,258 comprising depending studs or rollers 70 at the underside of the turret web 68, see Fig. 5. These studs are engaged successively by a cam 71 advancing the heads by
55 one space in each cycle, this cam being at the periphery of a cam wheel 72 mounted on a drive shaft 73, which may be turned at a low speed, such as one turn in five seconds by a speed reduction drive from a power shaft, not shown.
60 Through bevel gears 82 a second drive shaft 83 is driven from the drive shaft 73.

Around the turret may be mounted twenty-five, or more or less, heads 100 each having chucks or holders to receive the flare and other components
65 and hold them during the various operations until the product is completed. Each head has a rearwardly projecting base 101 mounted upon the outer part of the turret and each head is formed with certain fixed parts rigid with the base, including right and left hollow columns 103 and 104,
70 see also Figs. 1, 16, 17 and 27. Connecting the columns is a top piece 105. This relatively fixed head frame gives support to the several holding or chuck devices and their operating connections,
75 which will not be herein fully described except

as to the leadwire chuck. Each of the chucks is not only openable and closable but, with the exception of the flare chuck, having a permanent axial position, each may be swingable to and
5 from the vertical axis or center of the head. The flare chuck comprises right and left jaws 113 and 114. Included in the connections for opening and closing the flare jaws is a vertical rock shaft 120
10 turning in the hollow column 103 and constantly pressed toward closed position by surrounding spring 121. This shaft 120 is herein utilized, contrary to said Patent 1,990,258 as an axle or bearing for a sleeve 171^a carrying one of the jaws
15 of the reconstructed leadwire chuck as will be further described.

The exhaust pipe chuck comprises a relatively fixed holding jaw 125 and a relatively movable jaw 126 carried at the top of a rock sleeve 127 by a swinging carriage 128.

At its front side the head 100 carries a swing-
20 ing or rocking carriage 150 which, as in said Patent 1,990,258 carries the chuck for the cane, comprising fixed and movable jaws 159 and 160, the carriage swinging the chuck frontwardly for
25 the infeed of the cane, and rearwardly to bring the cane to the central axis, and finally frontwardly for delivery of the completed product. The carriage 150 is mounted at the top end of a rock sleeve 151 taking its bearing on a vertical
30 rod 152 turning in upper and lower brackets 109 and 110 in the head. The sleeve 151 carries a rock arm 153 with a cam roll 154 by which the bodily movements of the carriage 150 are effected as described in said Patent 1,990,258. The con-
35 nections for these movements need not be described, since the functioning of the carriage 150 for the purposes of the present improvement takes place only when in its rearward or centrally swung position, the frontward and return swinging
40 movements having no relation to the handling of the leadwires.

In said Patent 1,990,258 the carriage 150 supports not only the cane chuck but both jaws of the leadwire chuck. In the present application the carriage 150 supports only the first or rela-
45 tively fixed jaw 169 for the leadwires, the other or movable jaw 170 being independently mounted. At the free extremity of the carriage 150 it is formed with an enlargement or block 157, see Fig. 17, which supports the fixed jaw 159 for the
50 cane and the fixed jaw 169 for the leadwire.

As disclosed herein the relatively fixed leadwire jaw 169 is swivelled on a pin or pivot 169^a, to permit a slight rocking movement for equaliza-
55 tion during the closing of the chuck, the rear part of the jaw member being recessed to receive loosely a limiting pin 168. The other or relatively movable leadwire jaw 170 is herein shown mounted on a rock lever 171, the hub of which is secured on a vertical rock sleeve 171^a sur-
60 rounding the lower part of the vertical shaft 120 rocking in the right column 103, which column is interrupted to receive the hub of the rock lever, as seen in Fig. 16. The rock sleeve 171^a at its lower end carries a rock arm 171^b with a cam roll
65 171^c at its extremity by which the sleeve is rocked, by cam connections to be described, to bring about the closing of the movable jaw 170 immediately after the leadwires have been positioned in the chuck. In the present application the leadwire
70 channel members and stop means shown in said Patent 1,990,258 are dispensed with and instead, as will be described, the leadwires are set and held in their proper positions in the head by the leadwire feeding mechanism so that when the
75

jaws close the leadwires are in proper relative position for the uniting operations. Fig. 17 shows jaw 170 in nearly closed position; when fully open it is swung far to the right to clear the swinging movements of jaw 169 with carriage 150.

Said prior Patent 1,990,258 recites in detail the various cams for causing the swinging and opening and closing movements of the several chucks, all of which it is deemed unnecessary to describe further herein, except as to the means herein disclosed for the timed operation of the movable leadwire jaw, arranged to be closed immediately after the leadwires have been properly positioned, as already stated. In the prior Patent 1,990,258 the consecutive stations for the heads are lettered *a, b, c* etc. for the identification of the positions; the flare being infed at position *a*, the cane at position *c*, the leadwires in the neighborhood of position *e* and the exhaust pipe at position *g*. Herein the leadwire infeeding mechanism may be located at the same relative position in the travel of the heads, the leadwires preferably not being introduced and chucked in the head until after the flare and cane have been positioned and chucked, although the present invention is not limited to the precise position or order of infeeding of the several components. Suffice it to say at this point that when each head reaches the leadwire infeeding position the flare and the cane have preferably already been infed and chucked, the operation of the leadwire infeeding mechanism being to feed and introduce one or more leadwires, set them in position spaced from the axis and at the proper vertical height, and release them there only after the leadwire chuck has closed upon the leadwires, so that as each head moves away from this position it carries these components in their proper relative positions subject to a relative vertical readjustment, preferably of the flare, as described in said Patent 1,990,258; the exhaust pipe being preferably introduced at a later station and adjusted vertically into proper relation to the other three components before the application of heat and the uniting of the components.

As stated in Patent 1,990,258 the flare is infed first, preferably laterally from the front, and the cane then laterally from the front beneath the flare, followed by the lateral infeed of the wires above the flare and their lowering into the flare and finally the infeed of the exhaust pipe above the flare and its lowering into position. The chucks including the leadwire chuck are preferably timed to close during a pause of the head, by an active cam, the several chucks opening again before or at the delivery position.

The leadwire infeeding mechanism will next be described in substantially the following order. A characteristic element is what will be termed a track, in the nature of a support or chute for holding the leadwires by their hooks *C'*, the leadwires at this stage being in a relatively inverted position, with their hooks uppermost. Next will be described a supply means or device in the nature of a container operated to supply leadwires to the track or support 700. The first part of the track is preferably inclined for gravity feed or advance of the wires, which however then come under definite control and are advanced by parts of the feed mechanism comprising preferably first an escapement device releasing the leadwires one by one, followed by a feeding or advancing device spacing the leadwires and forwarding them in single file, this followed in turn

by a delivery device preferably rotary in character delivering the successive leadwires to the transfer mechanism. The entire construction thus described is preferably provided in duplicate, twin tracks being shown converging from the supply points to the delivery and transfer point, thus to feed two leadwires simultaneously to each head. These parts will be described in the order stated, and then will be described the transfer mechanism including a transfer member or gripper adapted to take hold of each leadwire, or each pair thereof, transfer them rearwardly to a position above the head, preferably inverting them during transfer so that the leadwire hooks will then extend downward, and finally lower them to a predetermined position in the head, holding them there until the leadwire chuck of the head closes upon the leadwires. Additionally will be described the timed connections or cam mechanism for operating the infeeding mechanism and for closing the leadwire chuck in harmony therewith; also a means properly to guide the leadwires into the chuck and certain detector devices for controlling the actions of the mechanism.

The leadwire track or receiving support 700, at its initial or receiving part, is inclined downwardly in a rearward or advancing direction, as shown in Figs. 9, 18 and elsewhere, leadwires being shown with their hooks *C'* engaging over the track. Gravity is thus used to advance the leadwires along the first part of the track, although another force might be substituted.

At the foot of its incline the track is shown as extended in a continuation 700^b toward the rear, preferably horizontally, along which section the leadwire travel is continued, preferably in spaced relation; and beyond the track portion 700^b is a curved track extension 700^c around which the successive leadwires are further advanced to the delivering and transferring point. As seen in Fig. 1, this arrangement permits the two opposite tracks to be convergently arranged, with their curved extensions 700^c facing each other in closely spaced relation, this spacing representing substantially the spacing of leadwires in the completed product, and each pair of leadwires being removed from the curved track extensions by the transferring gripper as will be more fully described. The horizontal track 700^b is non-essential as the track may slant from the receiving point to the delivery point.

The three-section leadwire track is shown as a preferably fixed and vertical plate, with the described contour, and with a thin upper edge over which the hooks may engage. For supporting the track member there is provided a bracket bar 701 stiffening and holding the track plate, and having the same contour, inclined, then horizontal, then curved. The bracket bar in turn is shown mounted on a supporting block or head 702, with screws 703 attaching the bar to the head and screws 704 attaching the head adjustably to a pair of vertical posts 705, this arrangement permitting the track to be set to the exact required height in the machine. Lower down on the posts 705 is a rod or rail 706 having sliding mountings 707 on the posts 705, this rail, as seen in Fig. 21, serving as a frictional or sliding contact for the depending leadwires *C*, damping the tendency of the latter to swing, and possibly be dislodged, by reason of their intermittent advancing travel. By way of describing the fixed mounting of the vertical posts 705 the description will now pass to

the underlying or frame parts supporting the entire leadwire infeeding mechanism.

As best seen in Fig. 6 the fixed frame table 61 has a frontward extension 710 supporting the mechanism. Above the extension table is shown a round column 711, at the top of which is attached a horizontal shelf 712. Extending rigidly upwardly from the shelf 712 are fixed posts 713, at the top of which is secured an upper shelf 714 from which directly rise the posts 705 on which the track member 700 is adjustably mounted as described. The frame members 710 to 714 have various fixed extensions bearing the same numbers, with exponents; while the shelf 714 carries under it a fixed bracket member or plate 715, shown separately in Fig. 10, and above it a bracket 716 in the nature of a vertical slideway for the down and up movements of the transfer device carriage and with overlying guide plates 716^a and 716^b confining the carriage; all of which will be more fully described.

The leadwire supply device comprises primarily, for each track 700, a container or cup 720, its cylindrical portion being attached to an interior bottom or base 721. The cylinder 720 is shown screw-attached to the base for vertical adjustment according to the length of the leadwires, and the top surface of the base is shown as concave so that the leadwires, standing loosely in the cup, with their hooks up, will tend to take a position with their lower ends central within the cup and their top ends slanting outwardly somewhat to overhang the cup. See Fig. 11, also Figs. 1, 5, 6 and 14.

The action of the leadwire container, as already indicated, is to shift, tilt or oscillate toward the track 700, as indicated by the dotted lines in Fig. 11, giving the supply of leadwires a flopping movement, so that by chance some of the hooks will overlie the track, the cup being then bodily lowered so far as to remove it and the remaining leadwires below the hooked leadwires, which latter thus become engaged upon the track, the cup then shifting or oscillating back to vertical position and rising for repetition of action. The loose batch of wires is thus given a brushing movement against the track edge, the movements relative to the track causing the track to pick up and lift relatively from the cup several wires at each action; and while the action might be manual it is preferably automatic as next described.

Convenient mountings for the leadwire cup movements are illustratively shown, the cup base member having a depending shank 722 passing through and secured by a screw in the upstanding boss of a cross plate or bridge 723 mounted at the lower side of a yoke 724, as well shown in Fig. 1. The yoke has a horizontal stem 725 mounted to permit tilting of the yoke and cup, and it has also an extension or arm 726 with a contact or roll, through which the cup tilting or oscillation is effected. The stem 725 of the yoke is mounted to rock in a head 727 supported at the top of a depending shank 728, which shank is fitted and secured by a screw within the extremity of a crosshead 730 mounted at the top of a supporting shank or sleeve 731.

By reference to Fig. 1 and others it will be seen that the crosshead 730 is symmetrical and that all of the described parts supported by it are in symmetrical duplication about the vertical shank or axis, thus providing two containers or cups operable simultaneously for supplying leadwires to the symmetrically opposite converging tracks 700.

The bodily lowering and rising movements of the crosshead 730 may be performed by the following illustrative mechanism. Near the lower end of the shank or sleeve 731 is pivoted a link 733 connecting the shank with the fork 734 of a lever arm 735. The link 733 is of special construction and provides an underneath recess for the relative movements of a rod or shank 744 to be described. The lever 735 is pivoted on a stud 736 mounted at the lower end of a bracket 710^d attached underneath the extension table 710. The lever is in the nature of a bell crank and its depending arm 737 carries a roll 738 entered in the cam groove 739 of a cam disk 740 mounted on a jack shaft 741 which has its bearings in a depending bracket 710^e below the table 710. The operation of the cam will be subsequently described.

To effect the shifting or tilting movements of the opposite leadwire containers 720 the following illustrative mechanism is shown. The tilting extensions 726 of the yokes which carry the cups have their extremities entered between the upper and lower flanges of a head 743 mounted at the top of a shank or rod 744 which extends downwardly through the hollow shank or sleeve 731 and at its lower end has a head 745 with a connecting pin that is engaged slidingly by the yoke 746 of an operating lever 747 pivoted on the stud 736 and having a depending arm 748 carrying the follower 749 bearing on the cam periphery 750 of the disk 740. The peripheral cam thus swings the lever 746 to tilt the two leadwire cups from and toward each other, while the cam groove operates the lever 735 to move bodily downwardly and upwardly the described mechanism; and as shown the two cams are coordinated so that the cups are first tilted from each other and are then lowered and subsequently restored to upright position and raised to initial position.

Preferably the described supply mechanism is driven at a considerably slower rate than the cycle of the machine, for example one supplying or brushing operation for each three advances of the turret and head system. To effect such drive the jack shaft 741 is shown in Figs. 14 and 15 as carrying a spur gear 752 driven by a smaller gear 753 on an upper jack shaft 754, the latter carrying also a larger gear 755 driven by a smaller gear 756 mounted on the drive shaft 73. Thus the supply device is put through methodical operation to insure the constant supply of leadwires to the track, excess supply being prevented by a detector and guard to be described.

Having now described the leadwire tracks and the means for supplying wires thereto there will next be described the cooperating feed mechanism comprising first an escapement device, near the lower end of the inclined track, which permits one leadwire at a time to escape or advance to the next section of the track. Between the bottom of the incline and the horizontal section is formed a shallow notch 759, Fig. 4, from which the successive leadwires are advanced in spaced relation along the horizontal section. The escapement device is shown in Figs. 1-4 and Figs. 9, 18 and 21. It comprises primarily a pair of escapement fingers 760 and 761 shown in right elevation in Fig. 4 and in top view in Figs. 2 and 3, Figs. 2 and 4 showing one position of the parts and Fig. 3 a subsequent position. The finger 760 is to the front of and slightly higher than the finger 761, and

is seen out of engagement with the leadwires. The two fingers have curved or bevelled extremities to assist their engaging the leadwires. In Figs. 2 and 4 the rear finger 761 is shown as confining the foremost leadwire on the inclined track, while the front finger 760 is retracted rightward at a slightly higher level. The two fingers may be slightly flexible but are preferably in fixed relation and move left and right across the path of the leadwire hooks. As the fingers move leftward from the Fig. 2 to the Fig. 3 position the front upper finger 760 first engages and holds back the second leadwire and those beyond, the continued movement then causing the rear lower finger to release the first leadwire to complete its descent to the notch 759 in readiness for the horizontal feeding operation. On the return or rightward movement the rear finger 761 again enters the path of the leadwires before the release thereof by the front finger, so that at the end of the rightward movement the parts resume the position shown in Figs. 2 and 4.

The fingers 760 and 761 are each provided with a shank or stem 762 and the two stems are mounted in a carriage or bar 763, being adjustable therein. The carriage bar 763 in turn is adjustably mounted by means of a slot 764 in the carriage cooperating with a slot 765 in a vertical lever 766, a bolt and nut 767 passing through the two slots and holding the parts in their proper adjustment. Another adjustment is provided in the form of a sliding connection near the middle of the lever 766, for lengthening or shortening the lever, comprising a slot 768 in the upper lever part and a bolt 769 securing together the two lever parts. The lever 766 is adapted to swing leftward and rightward to operate the escapement fingers as described, being mounted on a pivot axle 770 at its lower end, this axle being supported on the bracket member 715, as shown also in Figs. 9 and 10.

The swinging of the upright lever 766 to reciprocate the escapement fingers or blades may be controlled by cam or other connections from a shaft of the machine. For this purpose the lever has a rearwardly projecting pivot stud 772 of considerable length since the operating connections thereto are arranged to have, in addition to their swinging movement, a sliding movement lengthwise of the stud, that is, rearwardly and forwardly, for the purposes of the step-by-step feeding device yet to be described. The stud 772 therefore has pivotally and slidably engaged upon it a transverse link 773 extending from a stud 775 on the upwardly extending arm 776 of a bell crank lever which has a leftward extending arm 777 and is fulcrumed on a pivot stud or axle 778 on the bracket member 715, also shown in Fig. 10. When the bell crank lever is rocked this effects the required swinging movements of the upright lever 776 and the escapement fingers. A spring 780 is shown pulling down the lever arm 777 and said arm carries a follower or roll 781 which is thus maintained in engagement with the peripheral cam 782 of a cam disk 783 mounted on a shaft 785 having its bearings in brackets 714^e depending from the frame shelf 714.

The connections for turning the cam shaft 785 in coordination with the cycle of the machine may be as follows. As seen in Figs. 9 and 18 the shaft carries a bevel gear 787 at its front end and this gear engages a complementary bevel gear 788 mounted on a sleeve 789 turning loosely on the front fixed post 713, and the sleeve having a lower

bevel gear 790 which in turn engages a bevel gear 791 on a horizontal shaft 792 extending across the front of the machine and symmetrically communicating drive to the shafts 785 at both sides and to the escapement and other devices actuated thereby. For driving the shaft 792 it is shown as provided with a bevel gear 794 loose upon, but normally clutched to, the shaft as will be later described, this bevel gear being engaged by a bevel gear 795 mounted on a vertical shaft 796 having its bearings in the lower shelf 712 and a lower bracket 710^b. At its lower end the vertical shaft 796 as shown in Figs. 5 and 6 carries a bevel gear 797 engaging a bevel gear 798 on a horizontal shaft 799 turning in the depending brackets 710^a and near its right end carrying a sprocket wheel 800 driven by a sprocket chain 801 from a sprocket wheel 802 mounted directly on the drive shaft 83.

By the escapement device and its actuating connections thus described one leadwire is released in each cycle while the succeeding leadwires are restrained, by the operation of the blades or fingers 760 and 761.

While the inclined portion of the track 700 might be continued at an incline to the point where each leadwire is delivered to the transfer mechanism, preferably a horizontal track portion 700^b is interposed and a succession of leadwires advanced rearwardly therealong in single file or spaced relation by the step feeding device now to be described. A series of fingers or pushers which will be referred to as a multiple pusher or comb 808 constitutes a convenient step feeding device, this being given an advancing motion along the track, a retraction laterally from the track, a return motion parallel to the track and a fourth motion back to the track, in each cycle; these movements serving to advance the spaced leadwires, each leadwire newly received in the track notch 759 being removed and advanced therefrom by the first or front finger, and the last or rear finger placing the foremost leadwire in position for delivery and transfer.

The comb or multiple feeder 808 is supported at the upper end of a shank having an upper section 809 adjustably connected by a bolt 810 to a lower section 811 which is mounted directly on a head 812 formed at the top end of the upright lever arm 776 already described in relation to the escapement operation. By this means the oscillation of lever 776—777 moves the feeding comb to and from the track, and this entire system is adapted also to slide longitudinally on the pivot axle 778 and the pivot stud 772 already described. The peripheral cam 782 for effecting the oscillating movements has already been described. The sliding or longitudinal movements may be effected from the lever arm 777 as follows. This arm is provided with a lug 814 at its rear side carrying a depending pin 815 engaged by a face or crown cam 816 at the side of the cam disk 783. The two cams 782 and 816 on the disk 783 are so coordinated as to give the lateral oscillating and the longitudinal sliding movements of the comb feeder as described.

The delivery device 819 of the feed mechanism is best shown in Figs. 21 to 26, see also Figs. 9 and 18. The function of this mechanism is to advance one at a time, with their hooks up, the successive leadwires, taking them from the track section 700^b beyond the comb feeding device and positioning them to be taken by the gripper member 850 of the transfer mechanism to be described. The delivery device is preferably rotary, thus permitting two opposite such devices to be

located in closely facing positions so as to supply a leadwire from each side to the gripper, which is double, having opposite pairs of jaws.

The rotary delivery device 819 is mounted upon a fixed circular base 820 best shown in the exploded view Fig. 26, this base constituting the top of the upright hub 714^a. Fixedly provided at the top side of the base 820 are an outer segmental lug 821 and an inner segmental lug 822 cooperating with the movable parts to be described. The actuation may be from the horizontal shaft 785 already described, this carrying a bevel gear 823 at its front end engaging a bevel pinion 824 at the foot of an upright shaft 825 turning in the hub 714^a, and which, above the base 820 see Fig. 23, is formed with a shoulder 826 supporting certain parts to be described. The shaft carries also an operating cam or eccentric 827 turning with the shaft. Near the top of the shaft it is surrounded by a friction washer 829 for causing rotation of the parts therebeneath, and this washer is pressed downwardly by a spring 830 which in turn is confined by a washer and nut 831 at the top of the shaft, the shaft thus giving a slip drive to the rotary guide member 833 to be described.

The feeding fingers of the rotary delivery device may be operated by the following connections intermediate the shaft 825 and the fingers. Turning loosely on the shaft 825 and resting on the shoulder 826 is a box or guide member 833 having attached to it a cover piece 834. The guide member has a diametrical slideway 835 which accommodates a radially shiftable slide 837, as best shown in Figs. 23 and 26. The slide or carrier 837 is centrally apertured to accommodate the shaft cam 827; the cam cooperating with the contact surfaces 838 of the slide to move the latter radially back and forth in the slideway 835. The slide is provided at one end with a depending lug 839 cooperating with the fixed lugs 821 and 822 already described. The feeding members comprise a pair of fingers 841 outstanding directly from the other end of the slide 837, and above the slide at this end extends a post 842, the head 843 of which carries an outstanding feed finger 844. As seen in Fig. 23 the feed finger 844 is at the proper height to overreach the track section 700^c and engage the leadwire C for pushing it around the track, the lower fingers 841 being merely to engage the lower part of the leadwire to prevent pendulum movements thereof.

The rotary elements, the slide 837 and its guide 833 are idle during part of each cycle and in fact go through a complete cycle only in two rotations of shaft 825; hence at the gears 823—824 the shaft is geared up to double speed to coordinate the delivery device to the feeding and transferring cycle. The motions of the rotary members 833 and 837 and the feed fingers carried by the latter may be as follows. Figs. 1, 10, 18, 21 and 22 show what may be called the initial position. The slide lug 839 is radially out and bears against fixed lug 821, so the friction drive by shaft 825 is ineffective. The slide may be considered as retracted and the fingers 841, 844 are radially in. As the shaft turns the cam 827 comes into action and shifts the slide to move the fingers out, timed to occur just after the comb 808 has pushed the foremost wire to the position shown in these figures. Simultaneously of course, at its other end, the slide shifts the lug 839 in. This movement disengages the lug from the outer fixed lug 821, and the friction drive acts to rotate the parts to the short extent necessary to bring the lug 839

against the inner fixed lug 822, the leadwire thus being advanced to transfer position. Fig. 24 shows this position, the rotation pausing, and during this pause the transfer gripper closes on the leadwire, in fact on two leadwires, one at each side. The continued rotation of the shaft next causes the cam to reverse the slide, thus retracting the fingers and shifting outward the lug 839. Fig. 25 shows this position. Being released from both fixed lugs the lug 839 is free and the parts at once rotate, by friction, entirely around to the initial position of Figs. 22 and 23. The return movement to initial position is thus preferably in the same rotary direction as the short feed movement, obviating any need of reversal of rotation.

The transfer mechanism comprises a double gripper 850 mounted to transfer each pair of leadwires from the two opposite delivery devices to a position over the head, preferably operating to invert leadwires during transfer, and then to lower them into the leadwire chuck in the head. The gripper engages the leadwires somewhat below the hooked top ends thereof, and in order that the gripper may accompany the wires to their final position it is constructed quite thin and rod-like so as to enter between the wires to grip them and so as to pass down with the wires into or through the glass flare, thus keeping control throughout. By the inversion the hooks become placed downward, and the gripper carries them down to a predetermined height in the head so that the chuck may then close and the gripper then open, leaving the leadwires chucked in position for uniting with the glass components, and indeed with the leadwire hooks in a predetermined position, preferably extending outwardly from the axis of the product.

The transfer gripper is shown dissected in Fig. 19 and in enlarged top view in Fig. 20 and, with its mountings, is shown in various other figures. The gripper comprises two pairs of jaws 851 and 852, the former being mounted on an outer head 853 and the latter on an inner head 854. The leadwire at each side is gripped between one jaw 851 and one jaw 852, the jaw faces being slightly bevelled to insure retention of the leadwires, as indicated in Fig. 20. Preferably both pairs of jaws are movable, and a convenient mounting is shown for this action, consisting of a hollow stem or sleeve 855 for the jaw head 853, and a stem 856 for the jaw head 854, in the form of a rod extending through the stem 855. At the foot of the hollow stem 855 is a pinion 857 and at the foot of the rod stem 856 is a pinion 858 at a slightly lower level than the other pinion, for actuation in opposite directions by opposite toothed racks. By this construction the gripper is slender and rod-like and so adapted to enter between the two leadwires to be gripped and to descend with them into the flare.

The mountings of the transfer gripper are shown in front position in Figs. 1 and 9, while Figs. 5, 6 and 27 show the rear position after the transfer and inversion of the gripper. The outer sleeve 855 extends through and rotates in a shiftable bearing member 860 wherein it is confined by the pinion 857 and a collar 859 on the sleeve. The bearing is at the extremity of a transfer carrier or lever 861 which is adapted to swing clear over through 180°, as indicated by the dotted path in Fig. 9, to transfer the gripper from front to rear position and simultaneously invert it. Upon the carrier lever 861 is mounted

a depresser or foot 862 which, after the inversion and during descent, operates as indicated in Fig. 8 to lower the flare A in the flare chuck of the head. At its left side the transfer carrier has a boss 863 forming a stop contact and as well as bearing for a lever 894 to be described. The transfer lever or carrier 861 has its hub 865 mounted for rotation upon a stud 866 outstanding leftwardly from a downwardly and upwardly shiftable carriage 867 sliding in the vertical guide or fixed slideway 716. The stud 866 is formed with shoulders and the outer or left end of the stud has secured to it a confining collar 868. From this collar extend a stop arm 870 with a contact screw 871 for determining the front position of the transfer lever and a second stop arm 872 with a contact screw 873 for determining the rear swung position of the carrier lever; the contact screws 871 and 873 cooperating with the projection or boss 863 on the left side of the carrier.

For effecting the shifting and inverting movements of the transfer gripper carrier 861 and for effecting the bodily lowering and lifting of the slide carriage or block 867 on which the transfer carrier is mounted the following mechanism is shown. On the hub 865 of the carrier lever is a gear 875 and this is engaged by a gear or segment 876 mounted on a lower stud 877 on the sliding carriage 867. The full line position seen in Fig. 9 may be considered as the normal position of the parts, with the gripper in its frontward or receiving position. The rear confining plate 716^b of the vertical slideway 716 is formed with a contour 716^c affording a pocket for the normal reception of a stud and roller 878 mounted near the rear edge of the segment gear 876. The vertically sliding parts are held frictionally in place, unaffected by gravity. This may be done by constructing the front edge of the carriage or block 867 as a separate bar 867^a as shown in Figs. 1 and 27, with strong springs 869 pressing them apart to create friction.

The stud 878 on segment 876 is adapted to roll forward out of the pocket 716^c and over and down along the front vertical edge of the confining plate 716^b, the opposite or front confining plate being spaced far enough away to permit this motion.

By this combination of elements the segment gear 876 may be operated to cause first the swinging movements of the transfer mechanism, while friction holds the carriage, and then the descending movements which preferably do not commence until the rearward inverting swing of the carrier is stopped. For causing these motions an operating stud 879 extends leftwardly near the front edge of the segment gear and this stud is shown connected by a depending link 881 with the front arm 882 of a bell crank lever, seen in full and dotted lines in Fig. 6, said lever being mounted on a bracket 61^a depending from the frame table 61. The extremity of the depending arm 883 of the lever carries a cam follower 884 which is entered in the cam groove 885 of a cam disk 886, shown separately in Fig. 7. The disk has a cam lug 887 to be referred to later in connection with the element 919.

The transfer cam groove 885 is so contoured as to give the transferring, inverting and lowering movements in proper time with the cycle of the machine. As the cam pulls downwardly the long link 881 this first rotates the segment gear 876 on the sliding carriage 867. The immediate result is the upswinging of the carrier 861, thus

lifting the gripper 850 and the pair of leadwires from the track sections 700^c. The continued movement swings the gripper over rearwardly and downwardly to a position represented by the dotted lines at the left side of Fig. 9, before the commencement of the descending movement. When the segment gear commences to turn, its fulcrum stud 877 remains stationary due to the frictional holding of the carriage, while its rotation causes the inverting shift of the gripper. This rotation also causes the rising of the stud 878 out of engagement with the pocket 716^c. When the rotation is stopped by stop screw 873 the roller 878 has swung into axial position in line with the straight edge of plate 716^b. The continued down pull of link 881 now overcomes the friction of the carriage, which slides downward, the stud 878 following the stud 877 downwardly to a lowered position, indicated by dotted lines at the foot of Fig. 9. On the return movement, when the link 881 causes the carriage to ascend, the stud 878 ascends in sliding contact against the straight edge of plate 716^b. When the stud 878 passes off the vertical edge the rise of the carriage continues while the segment begins to rotate, to restore the carrier and gripper, as the stud 878 swings rearward, until eventually the initial positions of all parts are resumed and the stud is accommodated in the pocket 716^c.

The one lowering movement of the link 881 therefore effects, in immediate succession, the inverting transfer movement and the bodily lowering movement of the transfer mechanism, with leadwires, the final part of the lowering movement operating through the foot 862, as shown in Fig. 8, to readjust the flare A downwardly to surround partially the cane B, with the leadwires C within the flare and at each side of the cane. As seen in Figs. 8 and 16 the cane jaw 159 has a pair of opposite inclined ribs 889 acting as a spreader to hold apart the lowered leadwires, and the retractible spreader 919 to be described ensures the separation of the leadwires during descent so that one will pass at each side, as shown.

The opening and closing of the transfer gripper may be effected by mechanism such as the following, timed in coordination with the bodily movements of the transfer mechanism and with the closing of the leadwire chuck in the head. The pinions 857 and 858 on the gripper jaw stems 855 and 856 are utilized for rocking said stems to swing all of the jaws simultaneously between open and closed positions. The upper pinion 857 is operated by an upper right hand rack 891 and the lower pinion 858 by a lower left hand rack 892, these racks having a common shank 893 which therefore has only to be moved longitudinally to cause the opposite rocking of the two stems 855 and 856. These parts are well shown in Figs. 1, 5, 6, 9 and 27. The shank 893 is in the nature of a link engaging the two pinions at one end and at its other end pivoted to the right arm 894 of a bell crank lever having its hub 895 fulcrumed on the left extension or boss 893 of the carrier lever 861, the other or front arm 896 of the bell crank lever extending to a contact point in line with the axis or stud 866 about which the carrier lever swings. A spring 897 pulls constantly frontward on the shank 893 and the racks, thus holding the extremity of the arm 896 leftward where it is shown in contact with a vertical bar 899 by which it is actuated.

The contact bar 899 has a long vertical dimension as seen in Fig. 9 so as to maintain control

of the gripper racks during the lowering and rising movements. It will be noted that the point of contact between the bar 899 and the arm 896 is always substantially at the axis of swinging, notwithstanding the inverting swing of the carrier 861 and the vertical sliding movements of the carriage 867. It is only necessary therefore to move the contact bar 899 rightward and leftward to cause rearward and return movements of the gripper racks and the consequent opening and closing of the gripper. The bar however has also an idle movement further leftward during which the actuating connections control the head chuck closing in coordination with the gripper opening, as will be later described. The connections for the actuation of the contact bar 899 include a lever 900 to which the bar is secured, said lever being mounted at the upper end of a vertical fulcrum shaft 901 turning in an upper bearing 712^b and the lower shelf 710, the lower end of said shaft having a rock arm 902 connected by a long curved link 903 with a lever arm 904 pivoted on a bracket 61^b depending from the frame table 61, the lever having a second arm 905 which is bent and at its extremity carries a cam roll 906 engaging the groove of a cam 907 on the drive shaft 73, see Figs. 5 and 6. The roll 906 is shown at a midway position indicating that the head chuck jaw 170 has closed upon the leadwires and the gripper is about to open. Figs. 1 and 27 show in dotted lines the position the lever 900 and vertical contact bar 899 take when the head chuck is closed.

By the described connections 893 to 906 the cam 907 causes the movements of the racks 891, 892; and the timing of the cam is such that the racks will close the gripper immediately after each pair of leadwires has been delivered at gripping position, and will hold it closed during the transferring, inverting and lowering movements, and until the leadwire chuck in the head has been closed, the gripper thereupon opening to permit its return rising and swinging movements.

Preferably the same cam 907 is used to effect the closing of the leadwire chuck in the head, thus insuring the proper timing of the gripper and the chuck, the latter closing slightly before the former opens. The connections from the cam 907 to operate the leadwire chuck may be as follows, recalling that the cam roll 171^c on the head governs the open or closed position of the chuck jaw 170. The cam 907 operates through the arms 905 and 904 and the link 903 already described, and from the link 903 is shown extending an additional link 910 to a rock arm 911, with a yielding pivot 912 between the link and rock arm. The arm is mounted at the lower end of a vertical rock shaft 913, turning in a bearing 61^c on the frame table 61, see Fig. 6, and this shaft at its upper end carries a bent rock arm 914 having an upper offset and at the top thereof a cam track section 915 cooperating with the cam roll 171^c which controls the leadwire chuck. As already explained the leadwire chuck is closed by a spring, but it is held open, as it comes to position, by a fixed cam track 917 shown in Fig. 5. The cam roll rolls along the front edge of the fixed track 917, thus holding the chuck in open position, and as the head comes into leadwire receiving position the cam roll runs from the fixed track 917 to the movable track section 915, which is then in alinement with the fixed track and continues to hold open the leadwire chuck. At the proper moment the cam 907 oper-

ates to swing the rock lever 911—914, the track section 915 thereby being swung rearwardly to the position shown in Fig. 5. This movement allows the cam roll 171^c to shift rearwardly with the result that the leadwire chuck jaw 170 is closed by its spring. The two leadwires are thus gripped by the leadwire chuck in the head, and following this action the continued movement of cam 907 causes the gripper to open as described, the connection 912 yielding during this movement.

When the transfer mechanism descends bodily to lower the pair of leadwires into their assembled position indicated in Fig. 31 it is important that the leadwires shall descend properly, within the glass flare, and one at each side of the glass cane, and with the cane chuck jaw spreader ribs 889 between them. To assure this movement there is provided a shiftable guide member or spreader 919 shown in Figs. 5, 6, 8 and 27 and separately in Figs. 29 and 30. The spreader is in the form of a bar sliding in a fixed slideway 64^a on top of the fixed cap 64 and at its front or active end being formed with a pair of opposite spreading or guiding surfaces 920 engaging and deflecting the respective leadwires. This spreader being mounted on a fixed part of the machine serves for each of the heads as they come to position and thus simplifies the construction of the heads by obviating the need of movable spreading members on the heads.

The spreader 919 however requires to be retracted rearwardly after each operation in order to permit the travel of the heads. For this purpose the rear end of the spreader bar 919 is shown as formed with an upstanding stud 921 connected by a link 922 with a bell crank lever 923 pivoted on a rising extension at the rear end of the bracket 64^a. Said bracket has an overhanging part 64^b confining the spreader bar. A spring 924 is arranged to pull upon the bell crank thereby tending to slide the bar forwardly into operative position. The retracting movements of the bar may be effected by a depending connecting rod 925 extending down to the rear arm of a bell crank 926 pivoted on the bracket 61^a. The short depending arm of the bell crank 926 carries a pin 927 engaged with lost motion in the slot 928 of a link 929 of curved shape having its front end pivoted to or operated by the same follower 884 that actuates the bell crank 882 through which the transferring and lowering movements are effected.

The spreader bar 919 is thereby operated from the cam groove 885, the spreader coming forward into position as the transfer gripper lowers the leadwires into the head. It is so shown in one set of dotted lines in Fig. 6, and the cam 885 will next operate to retract fully the spreader to the other set of dotted lines, clear of the head, to permit advance of the latter. However a quick partial retraction is first necessary to allow the final descent of the gripper and flare, and Fig. 6 in full lines shows this partially retracted position. For this purpose the bell crank 926 is shown as formed with a third arm 932 carrying a follower cooperating with the cam lug 887 on the cam disk 886 already mentioned, this cam lug being timed to give the preliminary retraction of the spreader bar, to clear the gripper and flare at the center of the head, after the leadwires have descended to the lever of the spreader ribs 889. The link slot 928 permits this double control of the bell crank.

The preferred cooperation of the spreader with

the other elements may be reviewed as follows, referring to Fig. 8. As the transfer gripper 850 lowers the leadwires it passes through the position shown in full lines, this being the instant at which the depresser foot 862 has contacted the top of the flare. The spreader 919 has stood frontward and performed its function of steering the leadwires outwardly out of conflict with the ribs 889 and has withdrawn rearwardly out of the path of the descending flare and gripper. The lowering movement continues, and the flare and gripper are lowered to the dotted position of Fig. 8, bringing the leadwires C to the desired height. The parts there pause with the flare surrounding the cane and the leadwires, and the leadwire chuck jaw 170 then closes into its dotted line position to hold the leadwires; following which the gripper opens and then rises out of the flare for return to receiving position.

The supply device comprising the cups 720 by which the leadwires are supplied upon the tracks 700 is necessarily more than sufficiently efficient to supply the leadwires at the rate at which the machine will consume them; and there has therefore been provided a means to stop the supply operation when the leadwire track is filled up to a predetermined point. Preferably this control means operates not by stopping the brushing movements of the supply containers but by interposing a guard 935 to prevent the engagement or hooking of the leadwires upon the track at each side. See Figs. 1, 11 to 13 and 18, Fig. 13 showing the guard in its operative position, preventing access of the leadwires to the track, while the other figures show it retracted. Each guard is shown as a curved plate extending over the top of each track and outside the track being connected to a shank 936 which is adjustable for height and is provided with an adjustable stop screw 937 contacting the fixed bar 701 to determine the operative position of the guard. At its lower end the shank 936 is attached to a swinging block 938 pivoted on a stud 939 mounted in the bracket 714^a. Attached also to the block is an outward extension plate 940. Extending from the bracket 714^a is a fixed plate 714^c and upstanding therefrom is an extension plate 714^d on which is mounted a solenoid 942 having a cooperating core 943, the lower end of which has a loose pivotal connection with the extension 940. By this arrangement when the solenoid is energized to lift the core this swings the guard 935 from retracted to operative position.

The leadwire supply preventer or guard device may be electrically operated through a feeler 945 adapted, when the track is filled with leadwires up to the position of the feeler, to cause the contacting of a pair of electrical contacts 946 mounted in opposition respectively upon a movable spring 947 and a relatively fixed spring 948, the former spring carrying the feeler 945. The contacts are normally slightly separated, but when the feeler comes in contact with a leadwire as seen in Fig. 13 this causes the contacts to meet, thus closing an electric circuit, not shown, extending at each side to the corresponding solenoid and, thus causing the guard to swing over the track and restrain the leadwire supply action. The two springs 947 and 948 are connected by insulated bolts 949 to an upright carrying lever 950 fulcrumed on the axle 770. The lever also supports electric terminals 951 and 952 that are connected respectively to the springs and contacts and to the solenoid circuit. The lever 950 has an operating extension 954 on which is a contact screw

955 adjustable to regulate the extent of movement of the detector or feeler 945 toward the track 700. A spring 956 pulls the lever toward its retracted position.

For swinging the two detector levers 950 to detecting position at each supply operation, their adjusting screws 955 both bear upon a central T-shape operating lever 958, so that when the lever is swung upwardly it will lift both extensions 954 and move both levers 950 outward as in Figs. 12 and 13. The lever 958 is fulcrumed on a special bracket 715^a on the bracket plate 715, and the lever has a depending arm 959 carrying a roller 960 which is operated by the vertical rising movement of a cam plate 961 mounted on the cross-head 730 by which the supply containers are lifted.

The operation of this control device is that in each lifting movement of the supply device the vertical cam plate 961 comes into operation to throw the lever 958 and therefore the two levers 950, thus swinging each detecting device toward the track. As long as each track is not filled with leadwires up to this point the usual supply operations will take place as indicated in Figs. 11 and 12 the feeler 945 passing closely over and beyond the track. When however either track is filled up to this point the device at that side is operated by the presence of the leadwires, as in Fig. 13, thus causing the guard to shift laterally and prevent access of the leadwire supply to the track.

Another control device comprises a detector or feeler 965 shown in Figs. 1, 5 and 27 in the form of a light finger adapted to be contacted by the flare A in each head at the station next before that at which the leadwires are fed into the head, with connections such that when the flare is missing from the head the operation of feeding the leadwires will be prevented. For this purpose a controlling clutch is shown on the transverse shaft 792 from which the escapement operation and the horizontal step feeding operations are derived, so that when the clutch is open a pair of leadwires is not placed in position for the transfer gripper to take and carry over and down into the head. The detecting or feeling finger 965 is shown as formed at one end of a bell-crank lever 966 fulcrumed on a bracket 712^c on the lower shelf 712. The left arm of the bell-crank is shown connected by a long link 968 with a rock arm 969 mounted on a vertical rock shaft 970 having at its top end a rightwardly extending rock arm 971. Pivoted to the rock arm 971 is a clutch control pin 973 sliding in a fixed bracket 712^a on the lower shelf. The clutch on the shaft 792 may be driven by the bevel gear 794 loose on the shaft but held between shoulders or collars. The driven clutch member 974 is shown as keyed to rotate with the shaft but slidable longitudinally thereon. Formed with the driven clutch member 974 is a cam or collar 975, its right hand edge constituting a cam cooperating with the control pin 973. The driven clutch member also has a clutch pin or dog 976 cooperating with a corresponding recess in the driving clutch member 977 formed at the left side of the bevel gear 794. Surrounding the shaft is a spring 978 tending to press the driven clutch member toward the driving clutch member, thus causing the dog 976 to enter the recess in the driving clutch member, when the two come into line, giving a positive drive with definite relation between the driving and driven parts.

In Figs. 1 and 5 the flare is shown as present in the head with which the feeler is cooperating, 75

but in Fig. 27 the flare is missing and the clutch 974, 977 is shown open. The opening of the clutch is effected by the action of the pin 973 on the cam 975, causing the driven clutch member to cam itself leftward, thus disengaging the clutch and causing immediate stoppage of the leadwire feeding mechanism, to be reengaged at the end of one rotation. As each head comes along containing a flare the pin 973 is retracted in time to prevent the clutch opening operation, so that the drive of the shaft 972 and the leadwire feeding operations will continue regularly until a head comes along wherein the flare is missing.

As hereinabove stated, the step or comb feeding device may be dispensed with by omitting the horizontal length 700^b of track and inclining the track all the way from the leadwire receiving point to the transfer point where the gripper takes the leadwires, one from each track for transfer to the head chuck. The leadwire supply means, in such modified apparatus, is preferably near the front upper end of the track and the track from this point is slanted steeply enough toward the rear to insure gravity feed. The escapement device is near the rear lower end of the track, the track therebeyond however being continued at a downward slant and curved as before described, so that the opposite feed mechanisms may bring each pair of leadwires, after release by the escapements, into facing relation at each side of the transfer gripper. The extreme lower end of the track has a shoulder or stop to position the leadwire in its transfer position, and a simple auxiliary device may be employed in lieu of the rotary device 819 to insure that each pair of leadwires travels clear to the end of the tracks prior to the closing of the gripper. With such construction the track and the escapement are preferably mounted on a vertically adjustable carriage by which the feed mechanism can be bodily set to exactly the correct height required by the length or character of the leadwires or their position in the product; and this carriage will preferably carry also the guard device for preventing excess supply of leadwires to each track, also the detecting device or feeler for detecting such excess of leadwires and the solenoid or other actuator by which the guard is positioned to prevent further supply. The escapement device may consist of cooperating fingers as before but working with descending and rising movements in relation to the lowermost of the supplied leadwires, rather than lateral movements as already described. The operation of the escapement fingers may be through oscillating levers, with a vertical bar having pushing contact with one of them so as to retain actuating relation notwithstanding vertical adjustments of the carriage, somewhat as bar 899 maintains actuation relation to the lever 896 already described. The solenoid as before may be operated by the closing of a circuit but with a tilting mercury switch, normally open but adapted to be tilted to close the circuit and swing the guard when the track is full of wires to the predetermined point. The feeler may consist of a depending finger or strip carried by a laterally swinging arm, the finger being thereby movable closely over the inclined track, so that on movement in one direction it may be blocked by the presence of the leadwires, but being hinged like a pawl so as to return freely. When such finger is so blocked it modifies the action of an associated device which normally does not affect the mercury switch, but which, when the feeler is

blocked causes the tilting of the switch. As before, the feeler oscillating connections may be actuated in time with the brushing movements of the leadwire container; and the rise of the two containers may be accompanied by the rise of a cam at each side which effects the motion of the feeler in that side, through a vertical contact bar operating upon a lever which thus preserves its relation to the bar despite vertical adjustments. In this modified structure the flare detecting feeler has merely to prevent the release by each escapement of a leadwire, and again a contact bar and lever permit the necessary vertical adjustments. The transfer gripper might be rendered inoperative for the empty head, but preferably is allowed to make an idle movement as with the before described mechanism.

There has thus been illustratively described a lamp stem manufacturing apparatus of the kind referred to embodying the characteristic principles of leadwire infeeding of this invention; since various features of method, operation, combination, arrangement and construction may be modified in many ways without departing from the principles of the invention, it is not intended to limit the invention to such features except to the extent set forth in the appended claims.

We claim:

1. A lamp stem manufacturing apparatus of the kind having one or more heads each with holders for holding the leadwire and other components in assembled positions in the head, and having means for uniting the assembled components; said apparatus having mechanism for infeeding to each leadwire holder one or more preformed leadwires of the hooked end kind, comprising a leadwire track having a single upper edge adapted to receive leadwires hanging thereon by their preformed hooks and to support them solely by the hook engagement of the wires over the track, means supplying wires into hooked position on the track upper edge, means controlling the leadwires on the track to advance in single file to the transfer point and means for transferring the advanced leadwires successively to position in the leadwire holders.

2. For a stem making machine, a leadwire infeeding mechanism comprising an inclined track with single edge from which preformed hooked leadwires may depend by their hooks overhanging such edge, and along which they may advance in single file, and transfer means for gripping such leadwires in succession while on said track and holding each leadwire with its hook in a predetermined lateral position while transferring it to proper position in the stem, with its hook in a definite, lateral position in the stem predetermined by its engagement upon said track.

3. A lamp stem manufacturing apparatus of the kind having one or more heads each with holders for holding the leadwire and other components in assembled positions in the head, and having means for uniting the assembled components; said apparatus characterized by mechanism for infeeding to each leadwire holder one or more preformed leadwires of the kind formed with hook ends, comprising a leadwire support or track adapted to receive and support leadwires hanging thereon by their preformed hooks, a leadwire supply container to carry leadwires in quantity with their hooks up, said support and container arranged to have relative brushing movements between them for hooking leadwires upon the support, means controlling the leadwires to advance one at a time after engagement on the

support, and means for transferring the advanced leadwires successively to position in the leadwire holders.

4. Apparatus as in claim 3 and wherein is means for methodically effecting such relative brushing movements between container and support to cause leadwires from the container to engage and hang upon the support, at a rate sufficient to maintain a supply thereof upon the support.

5. A lamp stem manufacturing apparatus of the kind having one or more heads each with holders for holding the leadwire and other components in assembled positions in the head, and having means for uniting the assembled components; said apparatus characterized by mechanism for infeeding to each leadwire holder one or more leadwires of the kind preformed with hooks, comprising a leadwire support or track adapted to receive and support leadwires hanging thereon by their hooks, a leadwire supply container to carry leadwires in quantity with their hooks up, said support and container arranged to have relative movements between them for applying leadwires by their hooks upon the support, means for causing the leadwires to advance one at a time after engagement on the support, means for transferring the advanced leadwires successively to position in the leadwire holders, means for methodically effecting such relative movements between container and support to cause leadwires from the container to engage and hang upon the support, consisting of a downward brushing action of the leadwire supply against the support, lateral retraction thereof, and rising and repeated brushing movement.

6. In an automatic stem making machine the combination of traveling heads, each having a leadwire holder of mechanism for feeding thereto a plurality of preformed leadwires having hooked ends, said mechanism comprising a plurality of converging supports or tracks each for engaging and supporting leadwires by their hooks, and a single means for transferring a plurality of hooked leadwires successively to the holders.

7. A lamp stem manufacturing apparatus of the kind having one or more heads each with chucks for holding the leadwire and other components in assembled positions in the head, and having means for uniting the assembled components; said apparatus characterized by mechanism for infeeding to each leadwire chuck one or more leadwires of the kind formed with hooks, comprising a leadwire track adapted to receive and support leadwires hanging thereon by their hooks, and arranged at a downward slant for gravity advance of the received leadwires, means including a gripper for transferring the advanced leadwires successively to a predetermined position in the leadwire chuck, and means for closing the leadwire chuck on the positioned transferred leadwires, and thereupon releasing the transferring gripper.

8. Apparatus as in claim 7 and wherein beyond the receiving track is an escapement device releasing one leadwire at a time, and beyond the escapement device means to present the leadwires to the transfer means.

9. Apparatus as in claim 7 and wherein is a carrier for the gripper adapted to invert during transfer and thereby place the leadwire hooks downward, and a carriage for bodily lowering the inverted gripper and carrier to position the leadwires in the chuck.

10. Apparatus as in claim 7 and wherein the

leadwire track determines the position of the leadwire hook, and means subsequently handling the leadwire preserves control of the hook position whereby it will have a predetermined position in the product.

11. A lamp stem manufacturing apparatus of the kind having one or more heads each with chucks for holding the leadwire and other components in assembled positions in the head, and having means for uniting the assembled components; said apparatus characterized by mechanism for infeeding to each leadwire chuck two leadwires of the kind formed with hooks, comprising a pair of leadwire tracks adapted to receive and support leadwires hanging thereon by their hooks, and arranged at a downward slant for gravity advance of the received leadwires, an escapement device at the foot of each such track, and therebeyond a converging pair of feeding devices delivering the pair of leadwires to closely facing positions for transfer and means including a double gripper for engaging both such leadwires and transferring them to a predetermined position in the leadwire chuck.

12. Apparatus as in claim 11 and wherein the double gripper is of slender rod-like construction adapted to enter between the leadwires for gripping them, and to carry the wires to chucking position in the head.

13. Apparatus as in claim 11 and wherein is a carrier for the gripper adapted to invert during transfer and thereby place the leadwire hooks downward, and a carriage for bodily lowering the inverted gripper and carrier to position the leadwires in the chuck.

14. Apparatus as in claim 11 and wherein the leadwire track determines the position of the leadwire hook, and the means subsequently handling the leadwire preserves control of the hook position whereby it will have a predetermined position in the product.

15. A lamp stem manufacturing apparatus of the kind having one or more heads each with chucks for holding the leadwire and other components in assembled positions in the head, and having means for uniting the assembled components; said apparatus characterized by mechanism for infeeding to each leadwire chuck one or more leadwires of the kind formed with hooks, comprising a leadwire support or track adapted to receive and support leadwires hanging thereon by their hooks, a leadwire supply container to carry leadwires in quantity with their hooks up, and means for methodically effecting relative brushing movements to cause leadwires in the container to engage and hang upon the support.

16. Apparatus as in claim 15 and wherein the supply container is cup-like with a concave bottom on which the leadwires loosely rest.

17. Apparatus as in claim 15 and wherein is a means or guard to prevent reception of leadwires on the track from the container, and connections controlled by the leadwires when supplied to a predetermined point for causing the operation of said means or guard.

18. Apparatus as in claim 15 and wherein is a means or guard to prevent reception of leadwires on the track from the container, and connections controlled by the leadwires when supplied to a predetermined point for causing the operation of said means or guard, and means whereby the connections to such guard are actuated by the movements of the container.

19. A lamp stem manufacturing apparatus of the kind having one or more heads each with

chucks for holding the leadwire and other components in assembled positions in the head, and having means for uniting the assembled components; said apparatus characterized by mechanism for infeeding to each leadwire chuck one or more leadwires of the kind formed with hooks, comprising a leadwire support or track adapted to receive and support leadwires hanging thereon by their hooks, means for causing the leadwires to advance one at a time after engagement on the support, means for transferring the advanced leadwires successively to position in the leadwire chucks, and means for closing the leadwire chucks on the transferred leadwires, comprising a first finger to restrain and then release a first leadwire, and a second finger to restrain the succeeding leadwire when the first finger releases the first leadwire and to release the same when the first finger resumes restraining position, and mechanism operating said fingers in coordination.

20. A lamp stem manufacturing apparatus of the kind having one or more heads each with chucks for holding the leadwires and other components in assembled positions in the head, and having means for uniting the assembled components; said apparatus characterized by mechanism for infeeding to each leadwire chuck leadwires of the kind formed with hooks, comprising a pair of leadwire tracks each adapted to receive and support leadwires hanging thereon by their hooks, and to permit advance of the received leadwires, means including a gripper for transferring leadwires successively to a predetermined position in the leadwire chuck, and a pair of opposed delivery devices, each cooperating with one of said tracks, and the two devices adapted to engage the most advanced leadwires on the respective tracks and shift them into closely facing positions for engagement and transfer by such gripper.

21. Apparatus as in claim 20 and wherein each delivery device comprises a rotary member with a feed finger, and means intermittently turning the rotary member and means for advancing and retracting the finger.

22. A lamp stem manufacturing apparatus of the kind having one or more heads each with chucks for holding the flare, the leadwire and other components in assembled positions in the head, and having means for uniting the assembled components; said apparatus characterized by mechanism for infeeding to each leadwire chuck one or more leadwires of the kind formed with hooks, comprising a leadwire support adapted to support a leadwire hanging thereon by its hook, and mechanism for transferring the leadwire to position in the leadwire chuck, comprising a gripper to engage the leadwire at an intermediate point substantially below the hook, mechanism to shift the gripper and leadwire to a position over the head and invert them and lower them into the flare chucked in the head to a predetermined height, and means for closing the leadwire chuck to grasp the leadwire at a point between its hook and the gripper.

23. Apparatus as in claim 22 and wherein the transfer gripper is mounted on a swinging carrier which shifts and inverts it, and such carrier is mounted on a carriage which descends to lower the gripper and leadwire to a predetermined position, and timed connections to close the gripper, swing the carrier and lower the carriage in coordination.

24. Apparatus as in claim 22 and wherein the

transfer mechanism includes a device adapted to close the gripper on the leadwire and subsequently open it after shift, inversion and lowering, and timed connections for operating said device and for closing the gripper chuck before opening the gripper.

25. Apparatus as in claim 22 and wherein is a retractable deflector or spreader adapted to be introduced between the flare and the leadwire chuck to guide the leadwire or leadwires properly into the chuck, with means to retract the deflector.

26. Apparatus as in claim 22 and wherein is a retractable deflector or spreader adapted to be introduced between the flare and the leadwire chuck to guide the leadwire or leadwires properly into the chuck, with means to retract the deflector before the complete descent of the gripper and leadwire.

27. Apparatus as in claim 22 and wherein is a retractable deflector or spreader adapted to be introduced between the flare and the leadwire chuck to guide the leadwire or leadwires properly into the chuck, with means to retract the deflector before the complete descent of the gripper and leadwire, and a depresser lowered with the gripper acting to depress the flare during the final descent of the gripper.

28. A head comprising a chuck for a flare, a chuck for a cane, and a chuck for a leadwire, a transfer gripper for a leadwire, means for lowering the gripper and leadwires into the flare, and a depressor operated by the lowering of the gripper to lower the flare to surround partly the cane.

29. A lamp stem manufacturing apparatus of the kind having one or more heads each with holders for holding the flare, leadwire and other components in assembled positions in the head, and having means for uniting the assembled components; said apparatus characterized by mechanism for infeeding to each leadwire holder one or more leadwires of the kind formed with hooks, comprising a leadwire support or track adapted to receive and support leadwires hanging thereon by their hooks, means for causing the leadwires to advance one at a time after engagement on the support, means for transferring the advanced leadwires successively to position in the leadwire holders a feeler for detecting the presence of a flare in each head, and connections controlled by said feeler preventing the advancing of a leadwire to the transfer means in the absence of a flare.

30. Lamp-stem-making machine with traveling heads each having a holder or chuck for holding the flare and a holder for the leadwires and holders for other components and with means to heat and unite the components; said machine having an automatic mechanism to infeed preformed hooked leadwires to the heads the same comprising one or more tracks or supports each adapted to support such wires hanging over the top edge thereof by their hooks and upon which the hooked wires are advanced in procession, and means transferring the successive wires therefrom to their position in the successive heads to be received and held by the leadwire holders therein.

31. Machine as in claim 30 and wherein each leadwire support is a fixed track or plate slanted downward for gravity advance of the hooked leadwires thereon.

32. Machine as in claim 30 and wherein is a container or cup to hold loose leadwires with hooks up and movable to supply leadwires to the track by a brushing action.

33. Machine as in claim 30 and wherein the transfer is by a gripper which grips the most advanced leadwire below its hook and shifts it to the head with the hooks in a definite position.
- 5 34. Machine as in claim 30 and wherein the transfer is by a gripper which grips the most advanced leadwire below its hook and shifts it to the head with the hooks in a definite position; said transfer gripper operating by inversion fol-
- lowed by lowering of the leadwire to its position in the chucked flare.
35. Machine as in claim 30 and wherein the transfer means comprises a gripper, an inverting carrier for the gripper and a descending carriage on which the carrier is mounted, and means moving them in coordination.

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