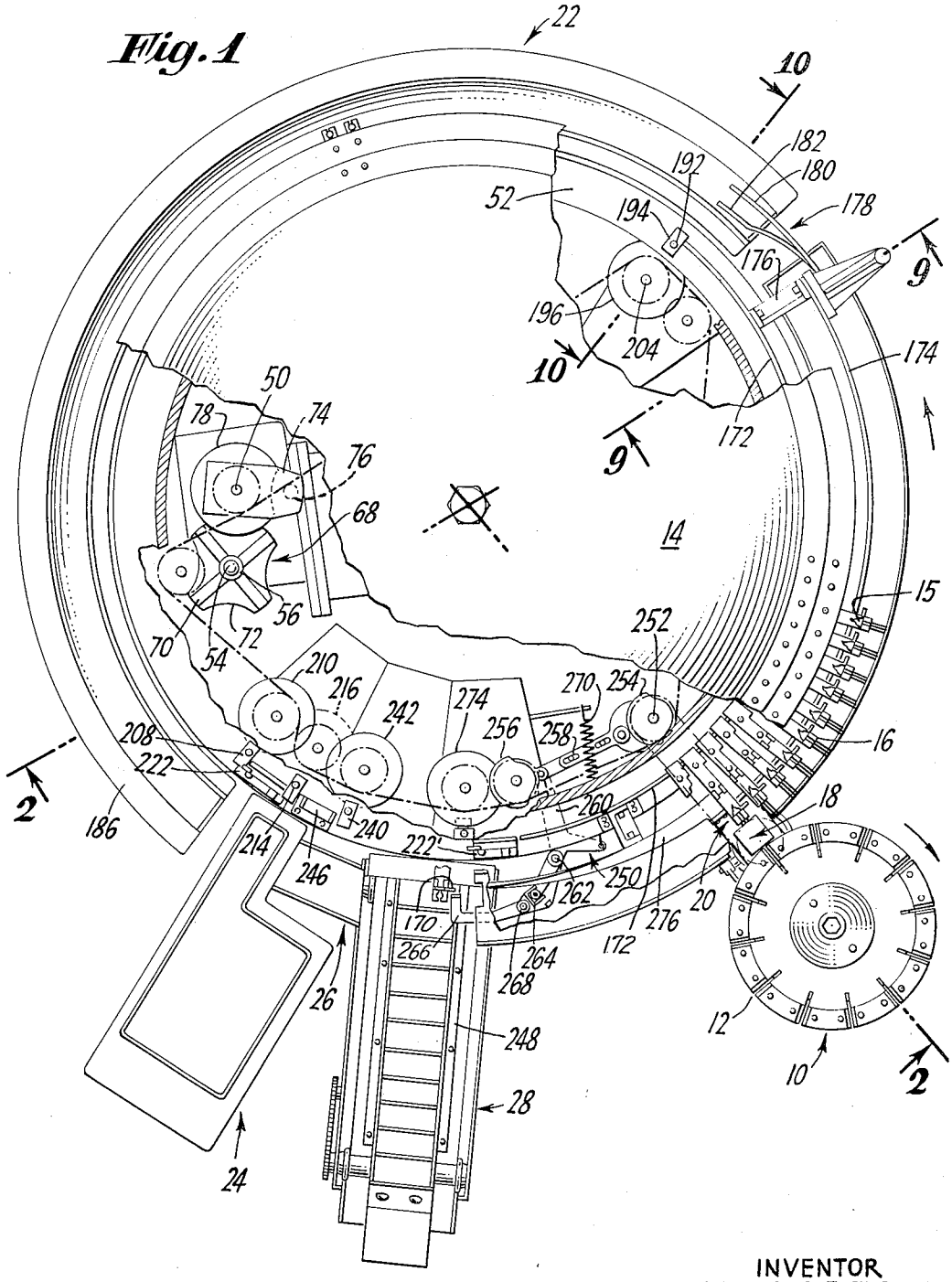
Nov. 15, 1955 R. E. FLEMING 2,723,922

LEAD TINNING MACHINE

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Fig. 1



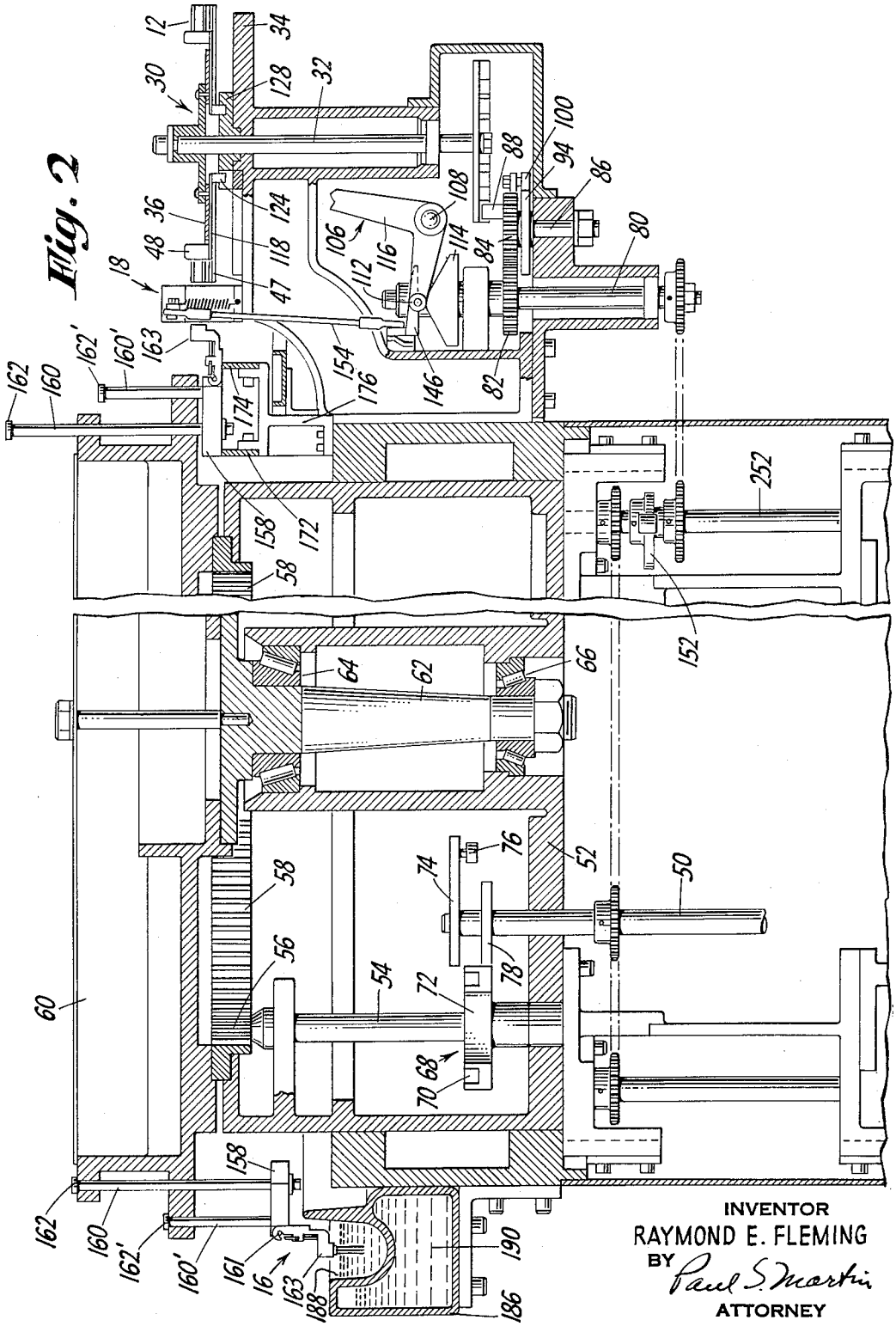
INVENTOR
RAYMOND E. FLEMING
BY Paul S. Martin
ATTORNEY

Nov. 15, 1955 R. E. FLEMING 2,723,922

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Fig. 2



INVENTOR
RAYMOND E. FLEMING
BY Paul S. Martin
ATTORNEY

Nov. 15, 1955 R. E. FLEMING 2,723,922

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Fig. 3

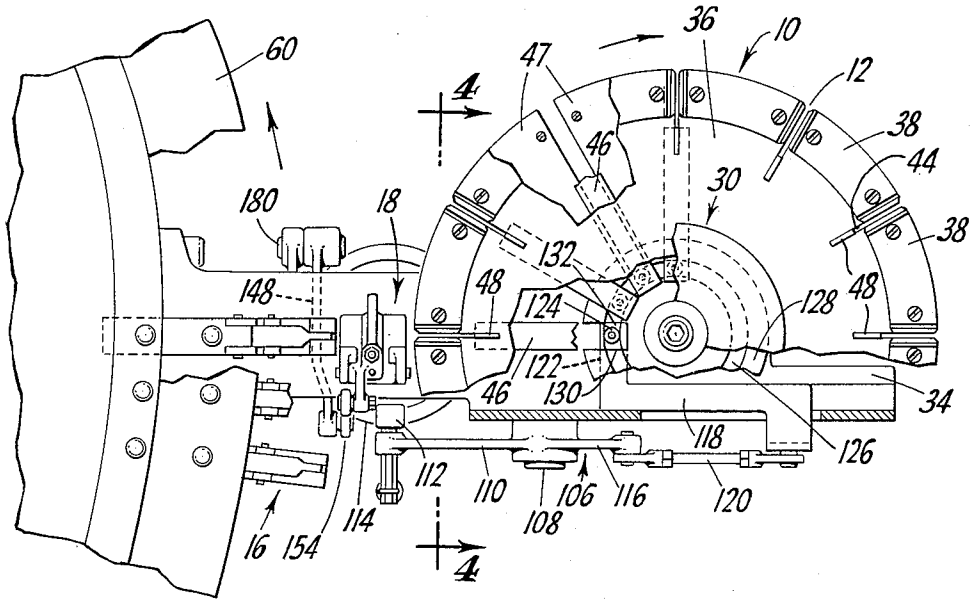
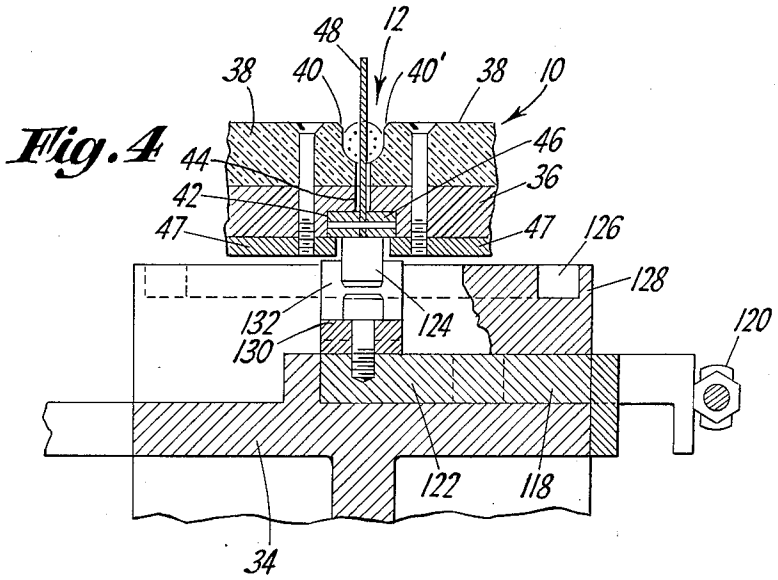


Fig. 4



INVENTOR
RAYMOND E. FLEMING
BY Paul S. Martin
ATTORNEY

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Fig. 5

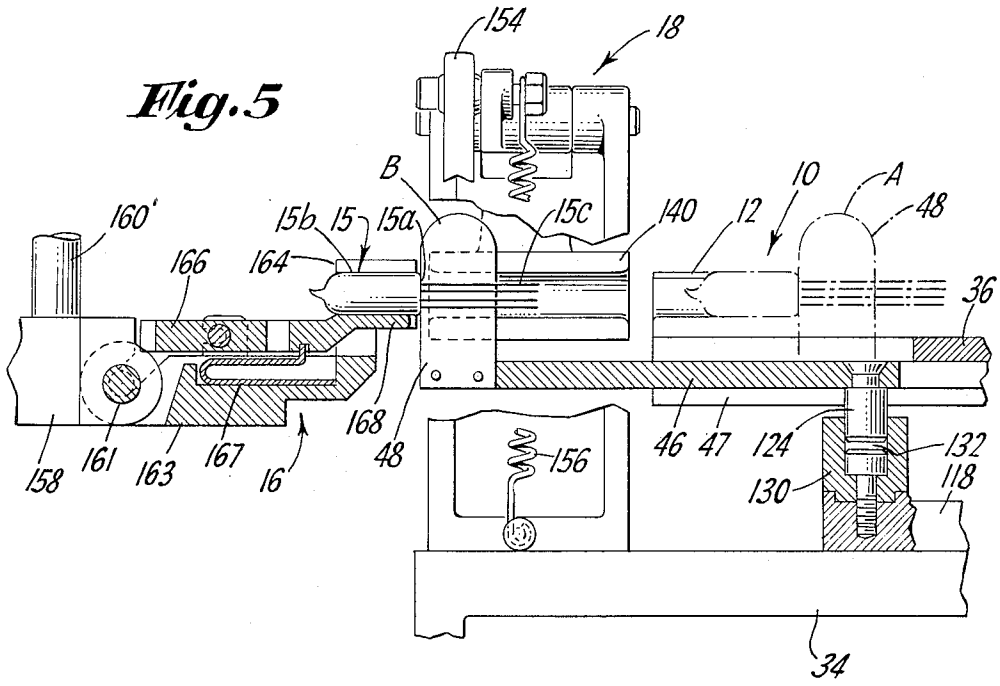
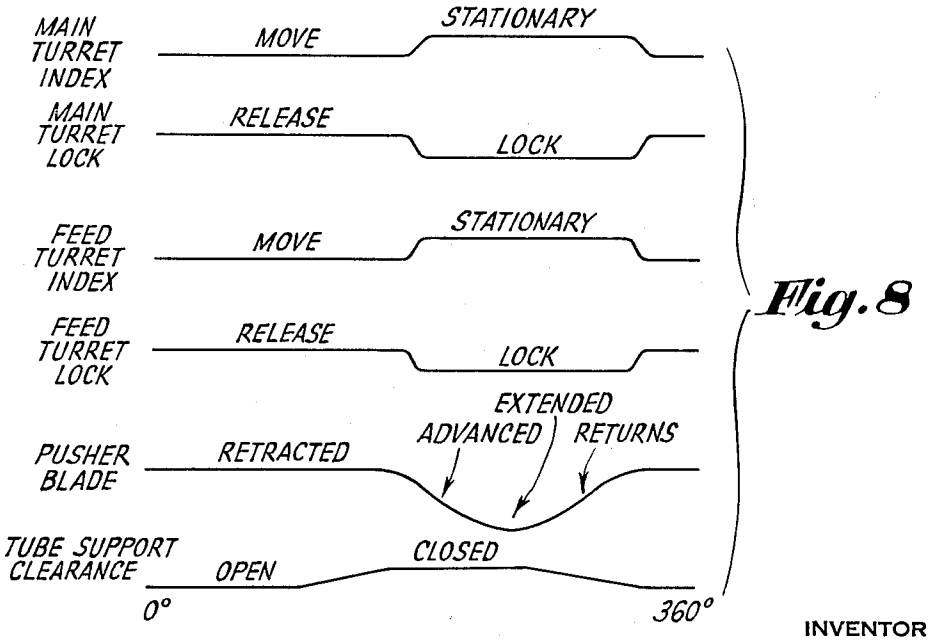


Fig. 8



INVENTOR
RAYMOND E. FLEMING
BY Paul S. Martin
ATTORNEY

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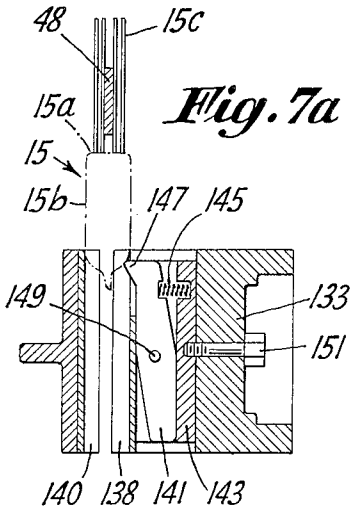


Fig. 7a

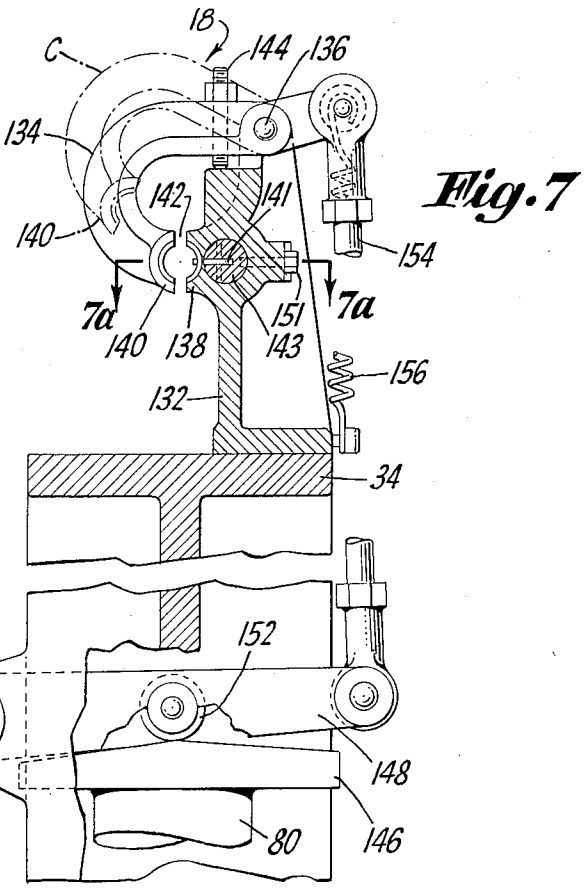


Fig. 7

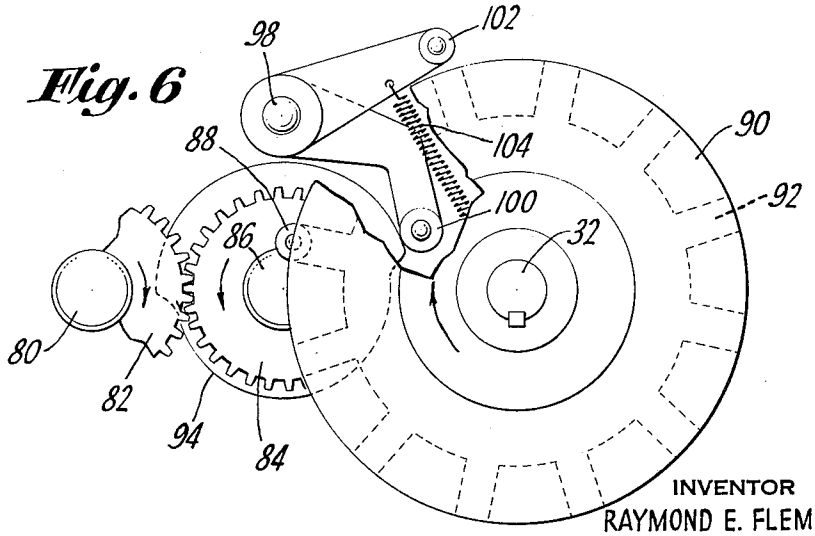


Fig. 6

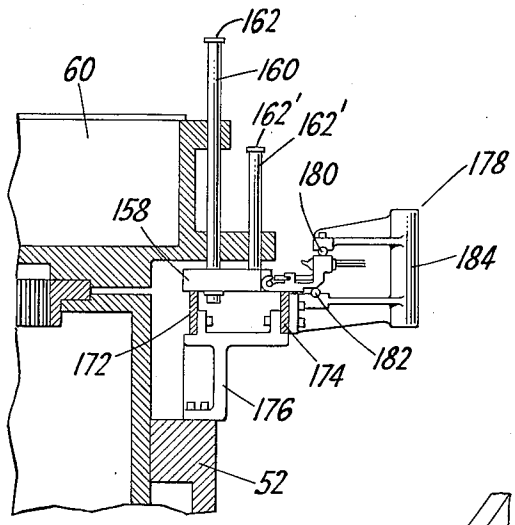
INVENTOR
RAYMOND E. FLEMING
BY Paul S. Martin
ATTORNEY

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Fig. 9



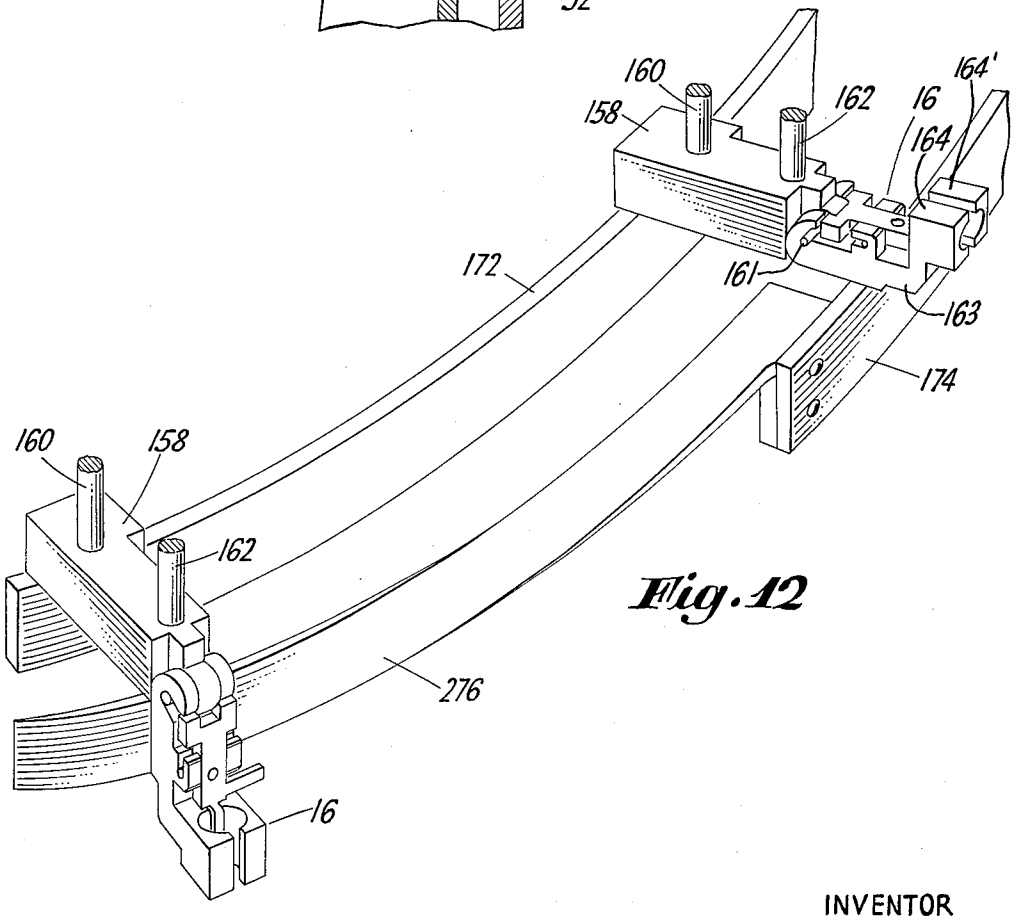


Fig. 12

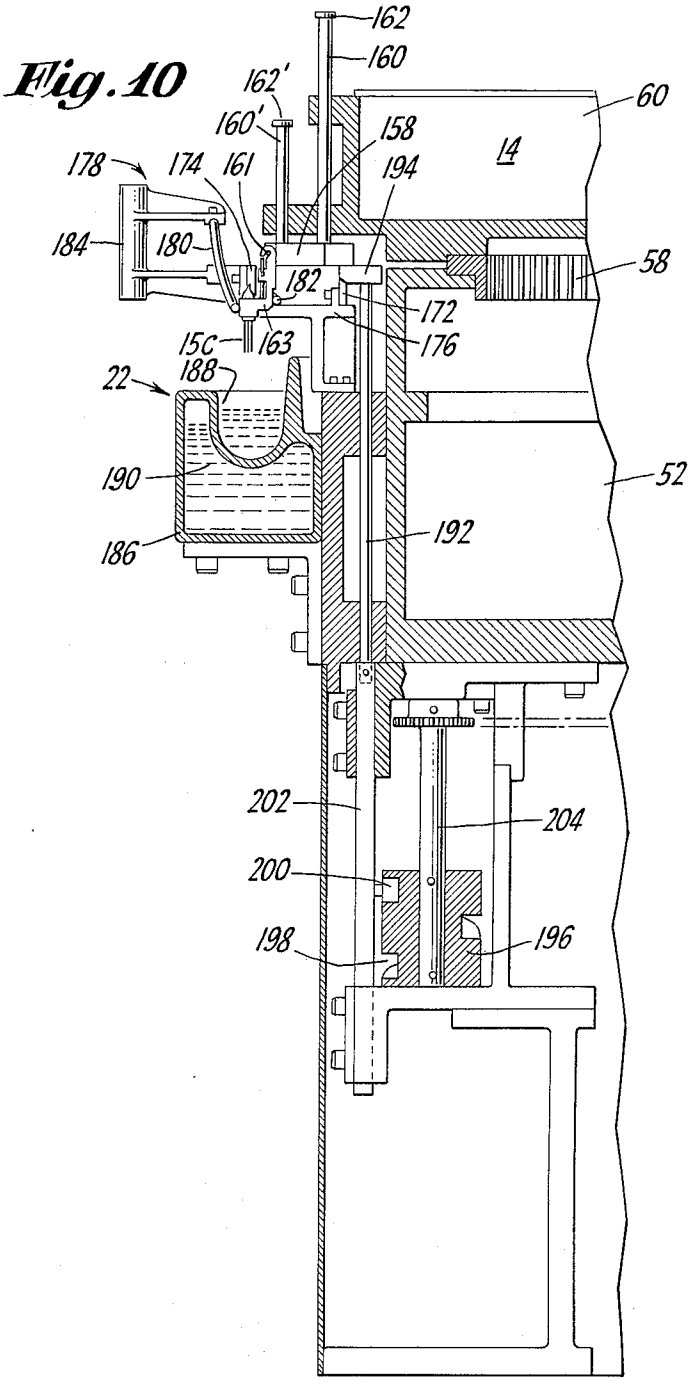
INVENTOR
RAYMOND E. FLEMING
BY Paul S. Martin
ATTORNEY

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Fig. 10



INVENTOR
RAYMOND E. FLEMING
BY Paul S. Martin
ATTORNEY

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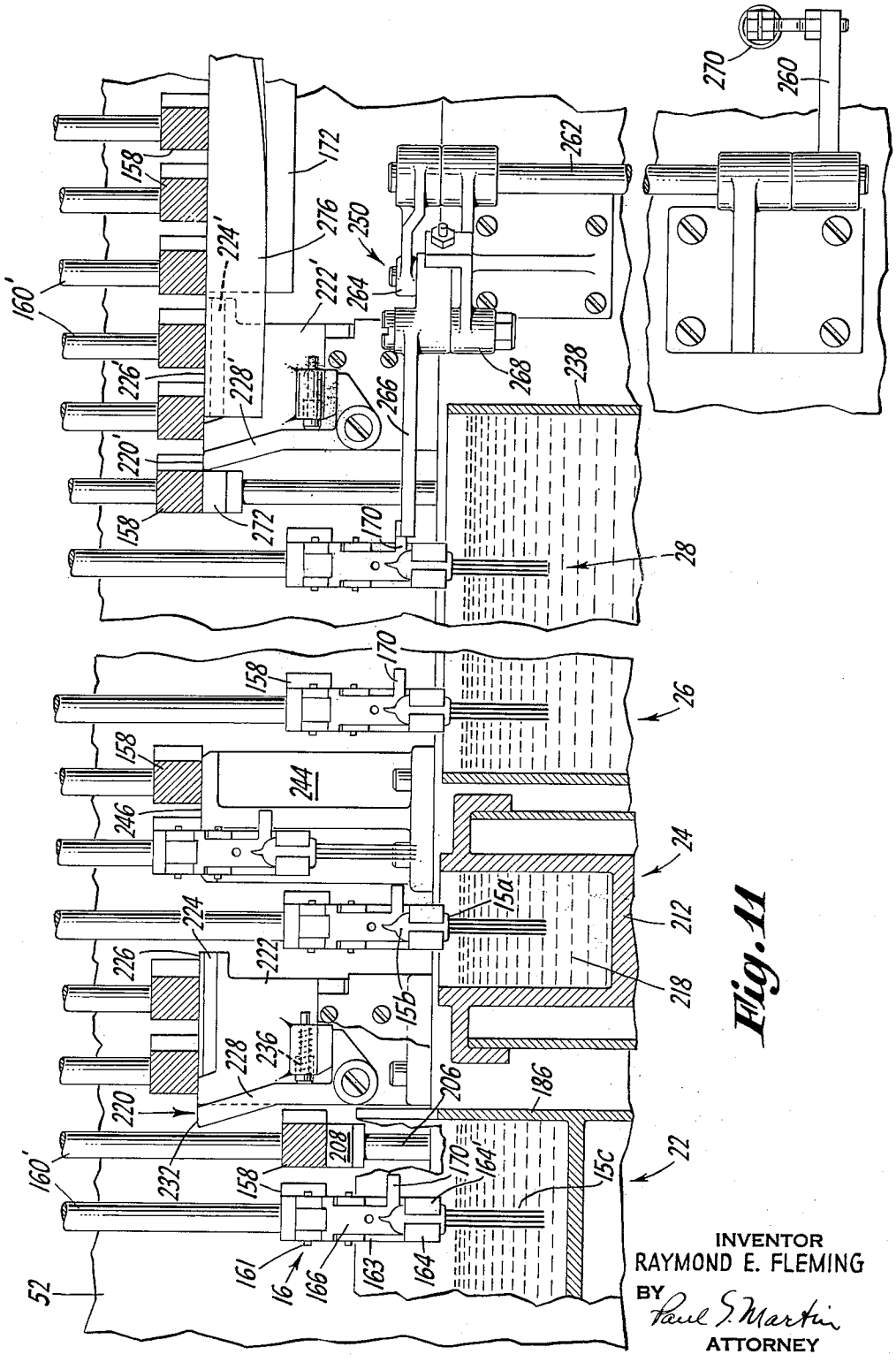


Fig. 11

INVENTOR
RAYMOND E. FLEMING
BY Paul S. Martin
ATTORNEY

United States Patent Office

2,723,922

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2,723,922

LEAD TINNING MACHINE

Raymond E. Fleming, Philadelphia, Pa., assignor to Sylvania Electric Products Inc., a corporation of Massachusetts

Application December 31, 1952, Serial No. 329,034

12 Claims. (Cl. 117—47)

The present invention relates to article processing machines of the type providing for one or more treatment stages, and more particularly to the controlled handling of the article in such machines. More specifically this invention is concerned with apparatus for tinning wires or leads extending from a glass-walled vacuum tube or the like.

It is often necessary to load articles into holders or the like and to properly pos tion the articles relative to the respective holders for subsequent treatment. Especially in a machine for tinning the lead of vacuum tubes, it is advantageous to load the machine in a manner assuring a uniform extent of exposure of the tube leads to the cleaning, tinning and washing stages in order to achieve uniformity in the tinning of the leads. It is important to minimize the risk of twisting or breaking of the relatively fragile tube leads or wires and to avoid mechanical and thermal shock to the vitreous tube bodies and the elements contained therein during processing. Additionally, handling and processing of the vacuum tubes should be accomplished in a manner consistent with the considerations of low unit cost, relatively high production speed, and simplicity of operation, maintenance and repair.

Accordingly, it is an object of the present invention to provide a novel article processing machine achieving some or all of the foregoing desirable results.

It is another object of the present invention to provide a processing machine in which articles are automatically engaged accurately for treatment and thereafter carried through progressive treatment stages.

A further object of the present invention is the provision of a processing machine for articles of the type having projecting leads or wires which is automatically operable to uniformly expose the leads to one or more treatment stages.

A still further object of the present invention is the provision of a machine for tinning the leads of vacuum tubes which may be manually fed and automatically carries the tubes through a treatment cycle without twisting or breaking the relatively fragile tube leads.

A still further object of the present invention is the provision of a lead tinning machine providing for the controlled and adjustable height of exposure of the leads to one or more treatment stages.

It is still a further object of the present invention to provide an automatically operated machine for tinning the leads of vacuum tubes and the like which minimizes production losses incident to the processing of the tubes, by avoiding erratic exposure of the leads to the various treatment stages.

A still further object of the present invention is the provision of a manually fed lead tinning machine which is automatically operable to completely and uniformly process the leads of vacuum tubes.

A still further object of the present invention is the provision of a machine for accurately and uniformly

tinning the leads of large numbers of vacuum tubes at a relatively low unit cost.

A still further object of the present invention is the provision of an automatically operated machine for tinning the leads of miniature vacuum tubes which subjects only predetermined portions of the tube leads to the various treatment stages, yet does not require constant surveillance and is capable of relatively high production speeds with minimum losses due to breakage. The leads extending from a glass-walled tube body should be immersed in a molten tin bath as deep as possible for tinning their entire length; but particular caution must be exercised to avoid damaging contact of the glass with the hot tin.

The foregoing objects and others will become apparent from a detailed description below of an illustrative embodiment particularly advantageous for the uniform handling and sequential processing of vacuum tubes having leads to be tinned. Briefly, this embodiment provides a step-wise feed carrier having a number of receivers which may be manually loaded with the vacuum tubes and a main carrier having tube holders to which the tubes are transferred from the feed carrier at a loading station. The envelope portions of the successive tubes are inserted into the holders to a definite extent determined by the uniform stroke of a transfer element.

In transferring the tubes in this illustrative apparatus, the relatively fragile leads are arranged to trail and project from the supporting holder. The tube body is supported during transfer through a length of travel much greater than the length of the body itself because of these leads, yet the support provides clearance for the leads during the indexing of the loaded holders away from the transfer station, and the arrangement accommodates free movement of the next loaded receiver and unloaded holder into the transfer position. The carriers are spaced apart and a tube support is arranged at the loading station along the transfer path from the feed carrier to the main carrier.

After the controlled transfer and uniform insertion of the tubes into the holders of the main carrier, the tubes are carried through a cycle including exposure of the tube leads to an acid cleaning bath, a solder or tinning bath, and a wash bath. This progressive treatment, likewise accurately controlled to obtain the desired uniformity in the level to which the leads are immersed to be tinned, is accomplished by the provision of further operating mechanisms of limited and uniform stroke which move the respective holders relative to the various baths to immerse the leads therein.

The base of the tube envelope from which the leads extend is relied on in the initial operation of inserting the tubes into holders, and this base as a reference is uniformly transported during the processing operations.

From the foregoing it is apparent that each of the vacuum tubes is accurately positioned initially relative to its holder, and subsequently has its lead immersed in the treatment baths to a uniform extent by predetermined control. Further, the handling and processing from loading through the complete treatment cycle is accomplished in a manner protecting the leads, the tube body, and the elements therein.

The above objects and brief description will be best understood by reference to the following detailed description of an illustrative embodiment when taken in conjunction with the accompanying drawings wherein:

Fig. 1 is a top plan view, with parts broken away and shown in section, of the lead tinning machine of the present invention;

Fig. 2 is a sectional view partially broken away and taken substantially along the line 2—2 of Fig. 1 looking

in the direction of the arrows, the scale of Fig. 2 being larger than that of Fig. 1;

Fig. 3 is a fragmentary top plan view, with parts broken away and shown in section, of the feed turret and tube support at the loading station of the main turret;

Fig. 4 is a fragmentary sectional view, with parts broken away, taken along the line 4—4 of Fig. 3 and looking in the direction of the arrows, the scale of Fig. 4 being larger than that of Fig. 3 but somewhat reduced as compared to the actual embodiment;

Fig. 5 is a sectional view, with parts broken away in the view for clarity, showing the tube holder in the loading position and in alignment with the tube support at the loading station of the main turret;

Fig. 6 is a top plan view, with parts broken away, showing a form of Geneva drive for the feed turret;

Figs. 7 and 7*a* are vertical and horizontal cross-sectional views, respectively, with parts broken away, showing details of the tube support **18** (Figs. 1, 2, 3 and 5) at the loading station;

Fig. 8 is a timing diagram showing the correlation between the various mechanisms of the tube processing machine that participate in the transfer operation;

Fig. 9 is a fragmentary sectional view taken substantially along the line 9—9 of Fig. 1 and looking in the direction of the arrows;

Fig. 10 is a sectional view taken substantially along the line 10—10 of Fig. 1 and looking in the direction of the arrows;

Fig. 11 is a fragmentary vertical cross-section along the circular path traveled by holders **16** in Fig. 1 with parts broken away; and

Fig. 12 is a perspective view showing the holder raising track **276** of Fig. 1 and associated parts for bringing the holders into the horizontal loading position.

Referring now to Fig. 1, there is illustrated an article processing machine, specifically a device for tinning the leads of vacuum tubes, including a rotatable intermittently-indexed feed carrier or turret **10** having radially-spaced receivers **12** for vacuum tubes. The feed turret **10** is spaced from a rotatable main turret **14** that is intermittently indexed in timed relation with respect to the feed turret **10**. The main turret **14** carries radially spaced tube holders **16** successively movable into a transfer position in alignment with the successive receivers **12**. The holders **16** are successively loaded with the vacuum tubes **15** which are transferred from the feed turret **10** to the main turret **14** via a tube support or guide **18** arranged at a loading station **20** of the turret **14**. At the loading station **20** successive holders **16** are brought into position to receive the vacuum tubes in a manner thereafter permitting the uniform exposure of the tube leads. The main turret **14** provides a cleaning zone **22**, for preparing the leads of the vacuum tubes **15** for tinning; a tinning station **24** for uniformly exposing the leads to a tinning melt; a wash station **26** at which the tinned leads are cooled and cleaned; and an unloading station **28** for delivering the vacuum tubes **15** with uniformly tinned leads.

In Figs. 2 to 7, there are shown the details of the structure in Fig. 1 for transferring the vacuum tubes from the receivers **12** of the feed turret **10** through the tube support **18** and for inserting the tubes to a predetermined extent into the holders **16** of the main turret **14**. The extent of insertion is in reference to the surface of the glass tube-envelope from which the wires emerge, and the tinning is to extend as near to this surface as practicable. Specifically, the feed turret **10** includes a turret body **30** rotatably mounted on a vertical shaft **32** journaled in the feed turret support **34**. The turret body **30** comprises a circular plate **36** carrying a plurality of spaced-apart tube receiver segments **38** on the upper surface thereof. The adjacent segments **38** are formed with cooperating radially extending cut-outs **40**, **40'** defining the receivers **12** for vacuum tubes **15**. The under surface of the plate **36** is provided with a plurality of radially extending downwardly opening guideways **42**, each underlying an adjacent receiver **12** and communicating therewith through a vertical and radial slot **44**. Supported within each of the guideways **42** is a radially reciprocal pusher bar **46** maintained within the guideways by slide keeper plates **47** and carrying an upstanding pusher blade **48** which projects upwardly through the adjacent slot **44**.

As shown in Figs. 2 to 4, the pusher blades **48** normally extend longitudinally of the adjacent tube receivers **12** and are arranged in a retracted position. The blades reaching the unloading station are projected and retracted, as illustrated in Fig. 5 in solid lines and in phantom respectively. The partly retracted position is designated by the letter A, at the time the blade engages the base **15***a* of the adjacent vacuum tube **15**. Upon radial movement of pusher blade **48** to the extended position, designated by the letter B, the tube **15** of the particular receiver **12** at the transfer station is pushed through the support **18** and the tube body **15***b* is inserted into the adjacent holder **16** of the main turret **14** to an extent determined by the uniform stroke of the blade **48**. During transfer, the tube leads **15***c* to be tinned trail behind the body **15***b* and, when transfer is completed, the leads project beyond the holder into the tube support **18**.

In order to bring successive loaded tube receivers **12** and unloaded tube holders **16** into the transfer position in alignment with the tube support **18**, the feed turret **10** is intermittently indexed in one direction and the main turret **14** is simultaneously indexed in the opposite rotational direction, the apposed portions of the two turrets being advanced together, like meshed gears. For this purpose, a main drive shaft **50** is journaled on the main turret base **52** and coupled to respective Geneva drives for intermittently indexing and locking the main turret **14** and the feed turret **10**.

Referring specifically to Fig. 2, the main turret indexing and lock mechanism is seen to include a main turret drive shaft **54** rotatably mounted on the base **52** and carrying a pinion **56** on its upper end. The pinion **56** meshes with an internal circular rack **58** carried by the main turret body **60**, the latter being journaled on the base **52** by a supporting shaft **62**, and bearings **64**, **66**. The main turret drive shaft **54** carries a star wheel **68** provided with cam tracks **70** and curved locking surfaces **72**. The main drive shaft **50** supports a Geneva drive arm **74** having a depending drive roller **76** which periodically engages within the cam tracks **70** of the star wheel **68** to index the drive shaft **54** of the main turret **14**. The drive shaft **50** further carries a locking plate **78** constructed to engage the locking surfaces **72** during the intervals between indexing to lock the main turret **14** in position, and plate **78** also has the usual cut-out to clear the extended portions of wheel **68**.

As seen in Figs. 2 and 6, the feed turret indexing and lock mechanism includes an intermediate drive shaft **80** connected by a suitable sprocket and chain coupling to the main drive shaft **50** and carrying a pinion **82** meshing with a Geneva drive gear **84** mounted on a rotatable stub shaft **86**. The Geneva drive gear **84** supports an upwardly projecting drive pin **88** which periodically engages within peripherally spaced openings **92** provided in a Geneva wheel **90**, the latter being keyed to the lower end of the turret shaft **32** for intermittently indexing the feed turret **10**. The stub shaft **86** further carries a lock cam **94** constructed to periodically rock a latch member **96** mounted on a shaft **98** into an operative position locking the feed turret **10** against movement. The latch member **96** supports a cam roller **100** for the lock cam **94** and a lock roller **102** for the Geneva wheel **90**. A tension spring **104** is operatively connected to the latch member **96** for normally biasing the lock roller **102** into engagement with the Geneva wheel **90** to lock the same until the cam roller **100** rocks the latch member **96** in a direction disengaging the lock roller **102** from the Geneva wheel **90**. By means of the foregoing drive mechanism,

the main turret and the feed turret are indexed stepwise synchronously.

During the intervals between the indexing of the main and feed carriers **14**, **10** to bring successive holders **16** and receivers **12** into the transfer position, the pusher blade **48** of the receiver **12** in the transfer position is brought to the extended position B by an operating mechanism of limited stroke. As shown in Figs. 2 to 4, the pusher-blade operating mechanism includes a bell crank lever **106** pivoted on a horizontal shaft **108**. One arm **110** of the bell crank lever **106** carries a cam roller **112** which rides on a blade-actuating cam **114** and the other arm **116** of the lever **106** is operatively connected to a slide bar **118** through a connecting rod **120**. The slide bar **118** is mounted on the feed turret support **34** for reciprocal movement along a chord of the turret body **30** and includes a lateral projection **122** for coupling to the pusher blade **48** of the receiver **12** in the transfer position. Each pusher bar **46** carries a depending roller **124** receivable within a circular upwardly opening track **126**, formed in a ring **128** secured to the feed turret support **34**. The ring **128** overlies the slide bar **118** and is cut away radially at the transfer position. This cut away position of the ring **128** is replaced by a roller-receiving block **130** carried on the lateral projection **122** of the slide bar **118**. The block **130** is provided with an upwardly opening curved track segment **132** forming a continuation of the circular track **126** and receiving the slide rollers **124** of the receivers **12** and associated pusher bars **46** which are successively brought into the transfer position. Accordingly, upon counterclockwise pivotal movement of the bell crank lever **106** about the shaft **108** (Fig. 2), the slide bar **118** is urged outwardly, and through the selective coupling of the slide roller **124** and the roller-receiving block **130**, moves the selected pusher bar **46** and blade **48** into the extended position B to effect the transfer of the vacuum tube **15** in the associated receiver **12**, with the wires projecting for a substantial distance into the transfer guide **18**.

Prior to or concurrently with the indexing of the main turret **14** to bring an unloaded holder **16** into the transfer position and to transport the loaded holder **16** away from the loading station, clearance is provided for the trailing leads of the tube previously transferred into the loaded holder and now to be moved out of the transfer position. This would not be readily feasible if guide **18** were omitted and the leads projected into the path of elements **38** of the feed plate. Accordingly, the tube support or guide member **18** is constructed to accommodate the tube leads during indexing to provide the requisite clearance in order to avoid bending, twisting or shearing of the tube leads. As best seen in Fig. 7 the tube support **18** includes a fixed guide bracket **132**, and a movable guide bracket or arm **134** mounted on the fixed guide bracket **132** for swinging movement about the guide latch pin **136**. The fixed and movable brackets **132**, **134** are formed with cooperating tunnel or sleeve-forming jaws **138**, **140** confronting each other and defining a transfer tunnel for guiding the vacuum tubes **15** endwise toward the main turret **14**. As illustrated, the jaws **138**, **140** are spaced to provide a vertical guideway **142** of a width sufficient to permit the passage of the pusher blade **48** when transferring the tubes from the successively aligned receivers to the holders. An adjusting screw **144** is operatively connected to the movable guide arm **134** for adjusting the latter with respect to the fixed guide bracket **132** in accordance with the desired width of passage **142**.

In Fig. 7*a* there is shown a latch **141** which assures proper initial positioning of the tube **15** prior to transfer by the pusher blade **48**. Specifically, the latch is pivoted about pivot pin **149** and supported within a slotted cylindrical shaft-retaining member **143** fixed to the bracket **132** by screw **151**. The latch is rockable about an axis normal to the guide latch pin **136**. The latch **141** includes a finger or latch tip **147** at the entry end of the tunnel and in position to engage the leading end of the tube **15** to be transferred therethrough. A spring **145** is interposed between the latch **141** and the retaining member **143** and normally biases latch tip **147** into the path of the tube. Accordingly, latch tip **147** serves to detain the tube **15** against passage through the tunnel until the pusher **48** firmly engages the base **15***a* of the tube at which time the latch is cammed inwardly against the spring **145**.

An operating mechanism is connected to the movable guide arm **134** for swinging the latter outwardly and in the direction of indexing of the turrets **10**, **14**. This mechanism (Figs. 2, 7) is controlled by a guide bracket actuating cam **146** carried on the intermediate drive shaft **80** and includes a guide bracket actuating cam lever **148** pivoted on a stud **150** and carrying a cam roller **152**, the cam lever being coupled to the movable guide bracket **134** by the connecting rod **154**. The movable guide arm **134** is biased away from the fixed guide bracket **132** by a guide spring **156** and is periodically moved into the clearance-providing position, illustrated in phantom in Fig. 7 and designated by the letter C, under the control of the guide cam **146**.

Specific reference is made to the timing diagram of Fig. 8 for a more thorough understanding of the correlation between the indexing and locking of the main and feed turrets **14**, **10**; of the advance of the pusher blade **48** into the extended position B and the subsequent return to the retracted position A; and of the movement of the movable guide latch **134** to the open or clearance-providing position C. As can be seen, the advance and return of the pusher blade **48** to effect a transfer of a tube occurs during the interval in which both the main and feed turrets **14**, **10** are stationary and locked in place. Further, opening of the tube support or guide member **18** occurs during the return of the pusher blade **48** to the retracted position A, the tube support remaining in the opened or clearance-providing position C during movement of the turrets, and returning to the closed position prior to the advance of the next successive pusher blade.

The tubes loaded manually in the feed turret **10** may be at various positions, radially, with the glass envelope outermost radially. The wires are spread somewhat by the operator during the loading operation so that some of the wires lie on one side of blade **48** and the rest of the wires extend along the other side of each blade. Binding of the wires against the blade frictionally is overcome by latch **141** with the ultimate result that tubes **15** that are transferred to the holders carried by the main turret are all uniformly located, with reference to the surface of the glass envelope from which the wires extend. After insertion of the tubes into the holders, the wires are clear of feed turret **10**, which is then free to index and to carry the next tube into the transfer station. The wires of the newly transferred tube extend radially from the main turret and into the guide **18**, but movable arm **134** swings out of the way of the wires as the holder carrying the newly transferred tube advances with the indexing main turret. As will be seen, the horizontally extending tubes and wires are then swung into vertical position for dipping the wires into various baths, being maintained at a level uniformly determined by transfer blades **48** and the associated mechanism, despite random variations in the positions of the tubes in turret **10** as manually inserted.

Referring now to Figs. 1, 5 and 9 to 12, there are shown details of the main turret **14** which exposes the uniformly loaded tubes to the sequential processing steps of cleaning, tinning and washing. Specifically, the main turret body **60** carries a plurality of radially spaced supports **158** each mounted for uniform vertical reciprocation by parallel holder rods **160**, **160'** having enlarged upper ends **162**, **162'**. Suspended from the supports **158** are the tube holders **16**, the details of which are dis-

closed and claimed in my copending application Serial No. 294,737 filed June 20, 1952. Tube holders **16** are pivotally mounted on the respective supports **158** by pins **161** and are movable from a horizontal loading position to a depending treating position. Each holder is fabricated of a non-corrosive material. It includes (see Fig. 5) a holder body **163** having fixed opposed jaws **164, 164'** and a movable jaw **168** pivotally mounted on the body **162** and biased counterclockwise by spring **167**, jaw **168** thereby cooperating with the split holder body jaws **164, 164'** to firmly grip the envelope of the vacuum tube **15**. For releasing the tubes after treatment, the movable jaw **168** of the holder **16** is provided with a laterally extending operating element **170** (best seen in Fig. 11) which may be engaged to move the pivotal jaw **168** away from the holder body jaws **164, 164'**. A rearward extension or latch **166** prevents unintentional removal of jaw **168** from the holder assembly.

The holders **16** are maintained in the horizontal position at the loading station **20** of the main turret **14** by the radially separated, circular inner and outer supporting rails **172, 174** (Figs. 2, 9 and 12), carried by the rail supporting bracket **176** on the main turret support **52**. The inner rail **172** underlies the vertically reciprocal supports **158** of the holders **16**, while the outer rail **174** underlies the bodies **163** of the holders. These supporting rails **172, 174**, extend about the main turret **14** in the direction of indexing from the tube transfer support **18** toward the cleaning station **22** and terminate in a "run-down" track **178** which gradually brings the holders **16** into the depending treating position for subsequent lowering into the cleaning solution at the station **22**.

In Figs. 1, 9 and 10 the "run-down" track **178** is clearly illustrated and is seen to embody a pair of spaced apart curved holder guide rails **180, 182** carried on a holder guide bracket **184**. At the beginning of the "run-down" track the curve guide rails **180, 182** are disposed in substantially the same vertical plane and receive the horizontal holder body **163** therebetween. At the end of the "run-down" track, both guide rails are at substantially the same horizontal level, guide rail **180** being curved downwardly from beginning to end, as shown in Fig. 10. Accordingly, the "run-down" track receives successive holders from the supporting rails **172, 174** and swings the holders into the depending position.

Referring now to Fig. 10 there is shown the beginning of the cleaning station **22** and the operating mechanism for lowering the loaded holders coming from the "run-down" track **178** into the cleaning solution. The cleaning station **22** includes a curved semi-circular vat or tank **186** extending about the main turret support **52** from beneath the "run-down" track **178** toward and terminating adjacent the soldering or tinning station **24**. The tank **186** is formed with an upwardly opening trough **188** containing an acid cleaning bath or the like. The level of the cleaning bath or solution is maintained at a predetermined critical level and may be automatically controlled and regulated in accordance with principles and practices well understood per se. The vat or tank **186** is additionally formed with a compartment **190** for the circulation therethrough of a heating fluid which maintains the acid cleaning bath at an elevated temperature to render the bath highly reactive.

The operating mechanism for lowering the loaded holders includes a vertically reciprocal operating member **192** (Fig. 10) mounted on the main turret support **52** and carrying a head **194** arranged adjacent the ends of the inner rail **172** and the "run-down" track. The head **194** receives the successive loaded tube holders **16** coming from the "run-down" track and is movable through a uniform stroke to lower the depending leads **15c** into the acid cleaning bath to an extent predetermined by the initial positioning of the tubes in the respective holders and the level of the acid cleaning bath. The operating member and head, **192, 194** is raised and lowered by a barrel cam **196** provided with a continuous cam track **198** having roughly helical ascending and descending and dwell portions which receives a pivotal cam-following block **200** and is connected to the operating member **194** through a connecting bar **202**. The barrel cam **196** is carried by a cam shaft **204** journaled on the main turret support **52** and is driven through a suitable chain and sprocket coupling from the main drive shaft **50**. As is apparent, the stroke of the operating member **192** and the speed of lowering may be determined by, and accurately controlled through, the design of the barrel cam **196**. The lowermost position of the holders **16** is finally controlled by the length of the holder rods **160, 160'**, after members **158** are indexed away from member **194**.

In Fig. 11, a mechanism is illustrated for raising the holders **16** at the end of the cleaning zone **22**, and for thereafter transferring the cleaned tube leads to the soldering and washing stations **24, 26**. Specifically, a vertically reciprocal lifting member **206** is arranged adjacent the acid cleaning tank **186** and carries a raising head **208** in position to engage the supports **158** of the successive holders **16** reaching the end of the cleaning station **22**. The head **208** is periodically moved upwardly under the control of an operating mechanism including barrel cam **210** (Fig. 1) connected to the lifting member **206**. A similar operating mechanism has been illustrated in Fig. 10 in connection with the lowering of the loaded holders at the beginning of the cleaning station **22**, and accordingly a detailed showing of the operating mechanism for raising head **208** has been omitted as superfluous. When the head **208** is moved upwardly, it lifts the overlying support **158** to remove the leads **15c** of the supported tube from the acid cleaning bath.

Following the acid cleaning tank **186**, is the solder tank **212** of the tinning station **24** which contains a molten mass of solder likewise maintained at a critical level by known regulators. A suitable operating member **214** and head therefore controlled by a cam **216** (Fig. 1) are arranged adjacent to tank **212** for sequentially lowering successive holders to dip the tube leads **15c** of the supported tube **15** into the solder and for thereafter raising the holders to remove the tube leads from the solder. The cam controlled operating mechanism **214** is also of the type illustrated in Fig. 10. It will suffice to point out that the stroke of the member **214** is accurately controlled to immerse the leads **15c** of the successive tubes **15** to the same extent and as determined by the spacing of the solder level **218** from the base **15a** of the tube body **15b** when the holders are in the lowered position, as illustrated.

Interposed between the tinning station **24** and the cleaning station **22** is a latch and rail mechanism **220** which is operative to maintain the holder supports **158** in an elevated position from the end of the cleaning vat **186** to the beginning of the solder tank **212**. The latch mechanism **220** includes a fixed body **222** connected to the turret supporting base **52** and including a horizontal track **224** providing a supporting surface **226**. Pivoted on the body **222** is a latch member **228**, having a supporting surface **232** forming a continuation of the supporting surface **226** of the track **224**, which receives the supports **158** as they are successively raised by the vertically reciprocal lifting head **208**. An adjustable latch biasing spring **236** is operative to urge the movable latch member **228** to the extended position of Fig. 11. The holder support **158** being raised, pivots the latch member **228** in a clockwise direction until the support **158** is above the surface **232** of the latch member. Thereupon the spring **236** returns the latch member **228** to the extended position wherein the support **158** is maintained in the elevated position. When the turret is subsequently indexed, the support **158** is brought onto track **224**.

Immediately following the solder or tinning station **24**, is the wash station **26** which includes a tank **238** con-

taining a wash fluid automatically maintained at a predetermined level in any suitable manner. As shown in Fig. 1, an operating mechanism is provided at the beginning of the wash station for lowering the successive holders to bring the tube leads 15c into the wash. This mechanism is similar to the lowering mechanism at the beginning of the cleaning station 22, and includes a lowering head and operating member 240 periodically operated under the control of the barrel cam 242.

Interposed between the wash station 26 and the tinning station 24, is a fixed intermediate bracket 244 for maintaining the holder supports 158 in the elevated position after being raised out of the solder tank 212 and prior to being lowered into the wash tank 238. As shown in Fig. 11, the bracket 244 includes a support surface 246 arranged in coplanar relation with respect to rail 224. Member 214 of the solder-dipping mechanism remains elevated during turret-indexing operations, so as to support each holder 16 as it approaches guide rail 246, and to receive each approaching holder 16 from guide rail 224.

The unloading station 28 includes an upwardly inclined conveyor 248 (see Fig. 2) of any suitable known construction, and has its inner end lowered and extending into the wash tank 238, in position to receive the fully treated tubes upon release from their respective holders carried by the turret. The holders travel in lowered positions as determined by heads 162, 162' (Fig. 2), from station 26 to station 28, thus allowing the tube leads 15c to remain in the washing bath.

In order to release the tubes when brought into position over the conveyor 248, a release mechanism 250 is provided which periodically and successively engages the lateral extending operating elements 170 of successive tube holders 16 to move the pivotal jaw 168 away from the holder body jaws 164. As seen in Figs. 1 and 11, the release mechanism 250 includes a drive shaft 252 rotatably journaled on the main turret support 52 and connected to the main drive shaft 50 through suitable chain and sprocket couplings. The shaft 252 carries an operating cam 254 which cooperates with a similar synchronously driven cam 256 for periodically urging the double cam follower 258 back and forth. The enlarged portion of element 258 near cam 252 is slotted and receives shaft 252 so as to be guided thereby. Operatively connected to the cam follower 258 is a bell crank lever 260 which is joined to pivot shaft 262 and has one arm 263 connnected to the cam follower 258. Another arm of the bell crank lever 260 is connected through a pin-and-slot 264 to a tube release arm 266 pivoted at 268. A suitable biasing spring 270 is operatively connected to the bell crank lever 260 for biasing the same, whereby, upon endwise movement of the cam follower 258 under the control of cams 254, 256, the bell crank 260 is pivoted in counterclockwise direction. This movement of bell crank 260 pivots the tube release arm 266 clockwise into engagement with the operating element 170 whereupon the tube is released.

A suitable operating mechanism including a lifting head 272 is arranged to raise the emptied or unloaded holders 16 at the end of the wash station 26. This operating mechanism, which is controlled by a barrel cam 274, is similar to mechanism previously described in connection with lifting member 206 and accordingly has not been illustrated in detail. The lifting head 272 raises the emptied holders 16 to the elevated position and on to the track 224' of a latch mechanism 220', adjacent the unloading station 28. The supporting rail 224' overlaps a "run-up track" 276 (Figs. 1, 11 and 12) which brings the holders 16 from the depending treating position to the horizontal loading position. The outer rail 174 previously described terminates short of the end of the inner rail 172 and the "run-up track" 276 is carried by the outer rail 174 and forms a substantial continuation thereof. The "run-up track" 276 includes an elongated strap of material which extends vertically adjacent its leading end and gradually curves until its trailing end is substantially horizontal. Accordingly, as the turret carries tube holder support 158, the holder is retained in elevated position by the inner rail 172. The "run-up track" 276 engages the tube holder body 163 and swings the latter into the horizontal loading position.

In order to more fully understand the operation of the lead tinning machine of the present invention in uniformly exposing the tube leads to the various treatment stages, a complete treating cycle will be described.

The feed turret 10 is loaded with tubes 15, with the leads 15c thereof extending radially inward and spread on opposite sides of the associated pusher blade 48. Thereafter, the tube within the reciver 12 coming into the transfer position is unloaded from the receiver and transferred through the hollow tube support 18 into the aligned one of the holders 16. The tube thus transferred has its body inserted into the holder 16 to an extent predetermined by the stroke of the pusher blade 48 in moving from the retracted position A to the extended position B. During the transfer the tube leads 15c which are to be subsequently cleaned, tinned and washed, trail behind the body 15b and project beyond the supporting holder 16 into the tube support 18.

Substantially concurrently with the indexing of the turrets 10, 14, the movable guide bracket 134 swings in the direction of indexing and into the clearance-providing position C, whereupon the relatively fragile tube leads 15c are freed from the tube support 18 and accordingly are not deformed during indexing of the main turret 14.

As the main turret 14 continues to index, the tube holder 16 which is maintained in the horizontal loading position by the inner and outer supporting rails 172, 174, is brought to the beginning of the "run-down" track 178. Thereupon the holder is engaged by the curved guide rails 180, 182 of the "run-down" track 178 and is rocked from the horizontal loading position to a depending treating position. At the end of the "run-down" track 178, the reciprocable head 194 which holds the support 158 in the elevated position, is lowered under the control of the barrel cam 196 to thereby immerse the depending tube leads 15c into the acid cleaning bath of the cleaning station 22 to an extent readily controlled through the adjustment of the level of the bath, and the length of the parallel guide rods 160, 160'.

Successive indexings of the main turret or carrier 14 brings the holder to the end of the cleaning station 22 whereupon the vertical lifting head 208 urges the holder upwardly into the elevated position, the holder being maintained in the elevated position between the cleaning station 22 and the tinning station 24 by means of the latch mechanism 220.

When the holder reaches the end of the intermediate track 224 of the safety latch mechanism 220, the support 158 thereof comes to rest upon the operating member and head 214, whereupon the tube leads 15c are lowered into the solder to an extent readily controlled by the initial positioning of the base 15a of the tube 15 with respect to the solder level 218, as seen in Fig. 11. After immersing the tube leads the cam controlled operating mechanism 214 raises the support 158 and the next indexing of the main turret brings the support onto the surface 246 of the bracket 244 between the tinning station 24 and the wash station 26. As the main turret continues to index, the support 158 is brought into position over the operating member and lowering head 240, which lowers the tube leads 15c into the tank 238 of the wash station 26. Continued indexing of the main turret brings the operating element 170 of the holder 16 into position to be engaged by the tube release arm which is swung at the appropriate time during the machine cycle to release the completely processed tube from its holder, whereupon the tube falls into the lower

end of the conveyor 248 of the unloading station 28 and is delivered from the wash bath.

After the holder is unloaded the lifting head 272 raises the holder to the elevated position and the holder is thereafter maintained in the elevated position by the safety latch mechanism 220'. As the main turret continues to index, the holder 16 is swung from the depending treating position to the horizontal loading position and ultimately is brought into alignment with the tube support and a loaded receiver 12 whereupon the holder is again reloaded for processing another tube.

While there has been described a machine that is especially well suited for the process described, the illustrative embodiment will be found susceptible to a latitude of changes, and features thereof may be variously employed to advantage without necessarily relying on others in varied applications. Accordingly the appended claims should be accorded a latitude of interpretation, consistent with the spirit and scope of the invention.

What is claimed is:

1. In an article processing machine having a loading station, a feed carrier including a plurality of receivers for articles having a body and at least one trailing projection, a main carrier spaced from said feed carrier and including a plurality of article holders engageable with the bodies of said articles, indexing means operatively connected to said carriers for intermittently moving said carriers to bring successive receivers and holders into a transfer position at said loading station, and article guiding means interposed between said carriers at said loading station for guiding said articles during transfer from said feed carrier to said main carrier, said article guiding means having a movable part to provide for unobstructed removal therefrom of the trailing projection of said article during intermittent movement of said carriers, means for moving said part incident to the main carrier movement, and transfer means operable in timed relation to said indexing means for displacing successive articles from said receivers along said article guiding means and into said holders when in said transfer position.

2. A transfer mechanism including a feed carrier, a main carrier, a drive mechanism moving said carriers into a transfer position relative to each other for transferring an article from said feed carrier to said main carrier, transfer means of uniform stroke operable to move said article from said feed carrier to said main carrier and effective to insert an article thus transferred only part way into said main carrier, an article guiding means between said carriers along the path of said article during transfer, said article guiding means having a movable part providing lateral clearance for the part of said article projecting from said main carrier during the movement of said main carrier from said transfer position and means for moving said part as an incident to said main carrier movement.

3. A transfer mechanism including a feed carrier, a main carrier, a drive mechanism moving said carriers into a transfer position relative to each other for transferring an article from said feed carrier to said main carrier, transfer means of uniform stroke operable to move said article from said feed carrier to said main carrier and effective to insert an article thus transferred only part way into said main carrier, an article guiding means between said carriers along the path of said article during transfer, said article guiding means having a movable part providing lateral clearance for the part of said article projecting from said main carrier during the movement of said main carrier from said transfer position, means for moving said part incident to said main carrier movement and mechanism for thereafter treating the exposed projecting portion of said article.

4. In a tube processing machine, a main turret including a plurality of tube holders, a feed turret spaced from said main turret and including a plurality of tube receivers, a tube guide interposed between said main and feed turrets for the passage therethrough of tubes placed in said receivers to be transferred to said holders, drive means operatively connected to said main and feed turrets for intermittently moving said turrets to bring successive receivers and holders into alignment with each other and with said tube guide, and a transfer mechanism comprising a pusher blade thrusting against the base of a tube and operable in timed relation to said drive means for periodically displacing said tubes from the successively aligned receivers through said tube guide and into said holders.

5. In an article processing machine having a loading station, a feed carrier including a plurality of article receivers, a main carrier spaced from said feed carrier and including a plurality of article holders, an article guide interposed between said carriers at said loading station for guiding articles during transfer from said feed carrier to said main carrier, indexing means operatively connected to said carriers for intermittently moving said carriers to bring successive receivers and holder into a transfer position relative to said article guide, and transfer means comprising a pusher blade thrusting against the base of a tube and operable in timed relation to said indexing means for displacing successive articles from said receivers through said article guide and into said holders when in said transfer position.

6. An article processing machine comprising a feed carrier, a main carrier, a drive mechanism moving said carriers into a transfer position relative to each other for transferring an article from said feed carrier to said main carrier, a transfer element operable to move said article from said feed carrier to said main carrier along a predetermined path, an operating mechanism of uniform stroke connected to said transfer element for operating the latter to partially insert said article into said main carrier, an article guide having a pivoted portion arranged along said predetermined path and between said carriers for supporting said article during transfer, and actuating means operable in timed relation to said drive and operating mechanisms for swinging said pivoted portion into a position of clearance for the part of said article projecting from said main carrier during movement of said carriers from said transfer position.

7. A machine for tinning the leads of vacuum tubes comprising a feed carrier, a main carrier including a movable tube holder, a drive mechanism for moving said carriers into a transfer position at a loading station of said main carrier, transfer means of uniform stroke operable to move a tube from said feed carrier to said main carrier and effective to insert a tube thus transferred only part way into said holder with the tube leads projecting therefrom, a tube guide, said tube guide including a pair of jaws cooperating in a closed position to provide a transfer tunnel, means for moving one of said jaws out of the path of the projecting leads as the last tube loaded is advanced with the main carrier, said jaws having operating mechanism movable in timed relation to the movement of said carriers, a lead tinning tank spaced from said loading station, and means having an operating mechanism of uniform stroke for moving said holder to lower the tube leads into said tinning tank to a predetermined extent.

8. In a lead tinning machine having a loading station and at least one processing station, a horizontal feed turret including a plurality of radially-spaced tube receivers, a main turret including a plurality of radially-spaced tube holders, a drive mechanism operatively connected to said turrets for moving successive receivers and holders into a transfer position in alignment with each other and at said loading station, a radially movable transfer element mounted on said feed turret and operable to unload the tubes from said receivers into said holders, an operating mechanism of uniform stroke connected to said transfer element for operating the latter to insert successive tubes

into said holders to a predetermined extent, mechanism disposing the holders in horizontal attitude during the loading operation and shifting the holders to vertical attitude thereafter, a tank at said processing station for a tinning bath, and another operating mechanism of uniform stroke for intermittently moving said holders vertically relative to said tank for immersing the leads of the tubes into the tinning bath to a predetermined extent.

9. A machine for tinning the leads of vacuum tubes comprising a rotatable feed carrier including a tube receiver, a rotatable main carrier including a movable tube holder, drive means for moving said receiver and holder into an aligned position relative to each other and at a loading station, transfer means of uniform stroke operable to unload a tube from said receiver and load said tube to a predetermined extent into said holder with the tube leads projecting therefrom, a tube guide intermediate said feed and main carriers and along the path of said tube during transfer, a cleaning station spaced from said loading station and including a tank for a cleaning solution, means for lowering said holder relative to said tank to immerse said tube leads into said cleaning solution to a predetermined extent, means for raising said holder into an elevated position relative to said cleaning tank to withdraw said tube leads from said cleaning solution after a predetermined time, a tinning station spaced from said cleaning station and including a tank for a tinning bath, and means having an operating mechanism of uniform stroke for moving said holder relative to said tinning tank to immerse said tube leads into said tinning bath to a predetermined extent.

10. A machine according to claim 9, including a latch mechanism between said cleaning station and said tinning station for maintaining said holder in said elevated position, said latch mechanism comprising a spring biased member in the upward path of travel of said head and forming a support for said holder when in said elevated position.

11. The method of loading tubes and the like having leads extending from one end of the envelope including the steps of loading the tube in a feed carrier with a transfer blade between said leads, pushing the tube endwise by means of the blade into a holder to a predetermined extent as determined by the end position of the blade in engagement with the envelope.

12. The method of tinning tube leads which includes the initial step of loading the tube with the leads projecting from a holder in the manner defined in claim 11, including the further steps of successively dipping the leads into cleaning, tinning and washing baths successively, through a uniform stroke of immersion and elevation.

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