July 21, 1953 A. W. HOLZER 2,645,862

BAKE OVEN FOR INCANDESCENT LAMPS

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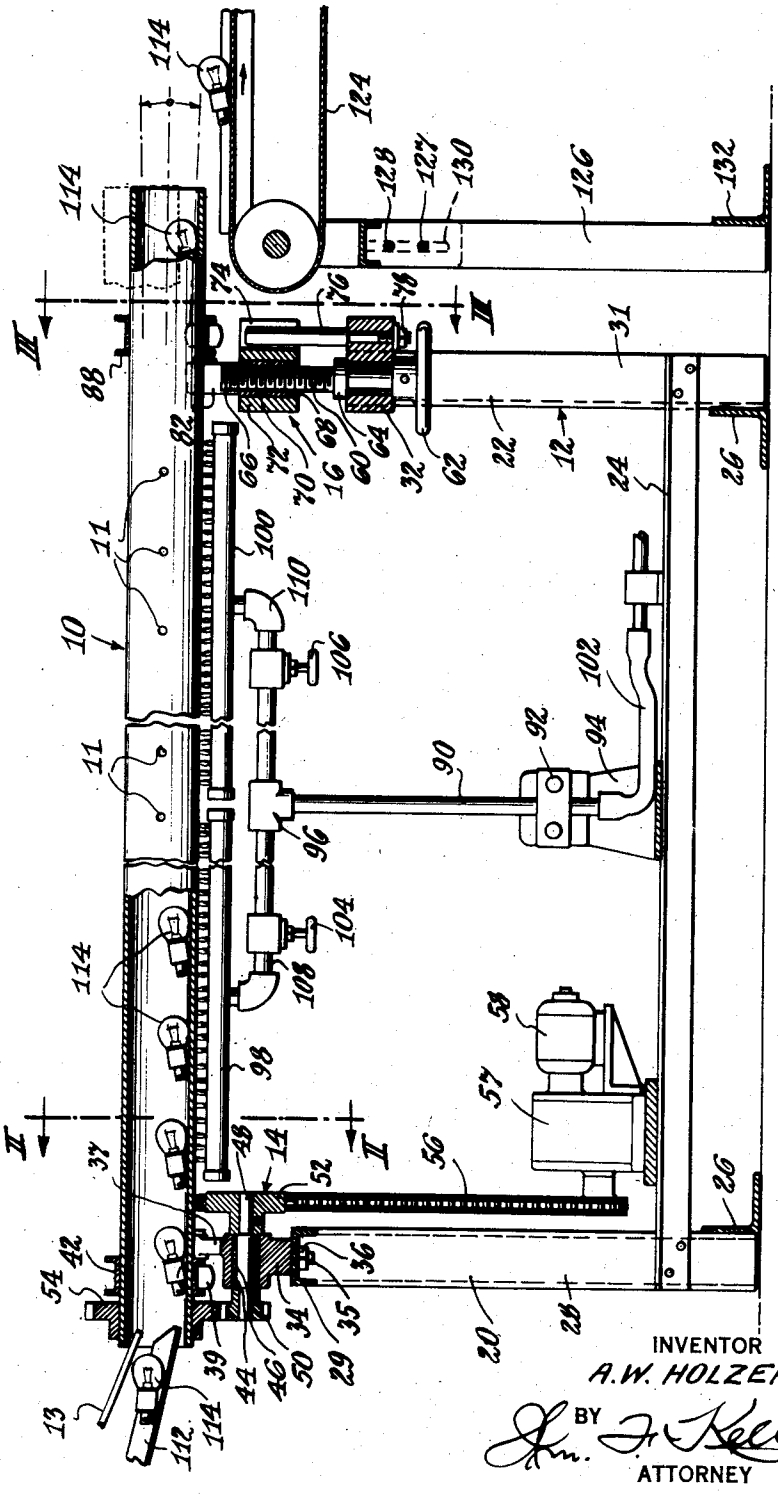

Fig. 1.

INVENTOR
A. W. HOLZER.
BY
ATTORNEY

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Fig. 2.

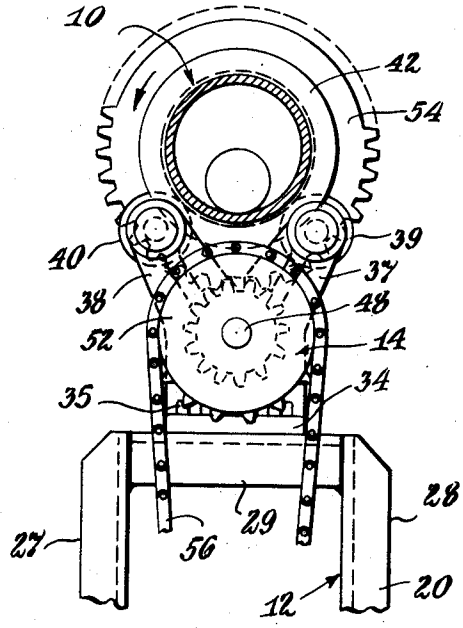


Fig. 3.

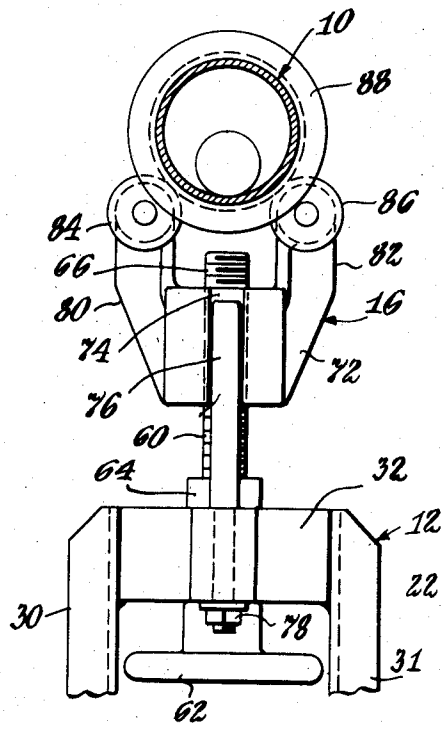


Fig. 4.

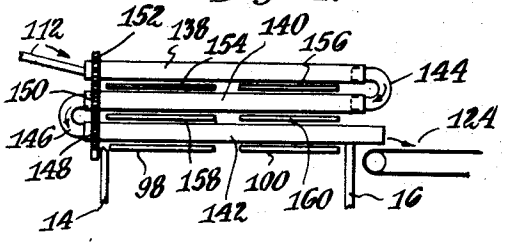


Fig. 5.

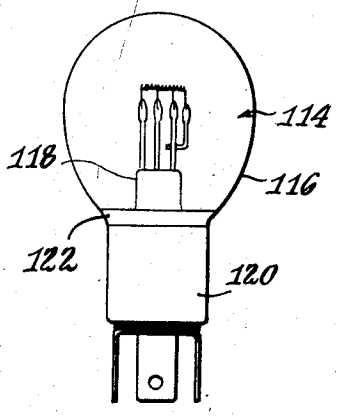
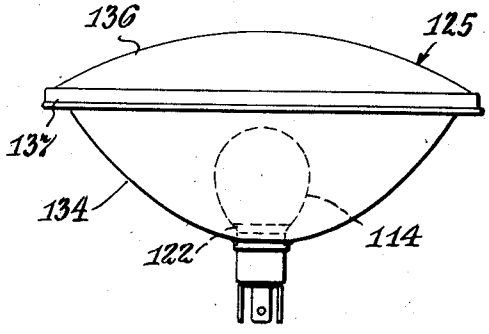


Fig. 6.



INVENTOR
A. W. HOLZER.
BY
ATTORNEY

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BAKE OVEN FOR INCANDESCENT LAMPS

Albert W. Holzer, Arlington, N. J., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

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2 Claims. (Cl. 34—105)

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This invention relates to ovens and, more particularly, to a baking oven for curing the varnish seal between the bases and the envelopes of miniature lamps.

A sealed package unit for use as an automotive light source comprises a generally parabolic reflector sealed to a lens at one end and soldered to the base shell of a minature automotive lamp at the other end. The lamp for a sealed package unit has the conventional vitreous envelope, a filament mount sealed to the neck of said envelope, and a base cemented to the sealed end of said envelope. To prevent "breathing" of the unit through the junction between the envelope and the base of the lamp and the porous conventional basing cement therebetween as a result of internal filamentary heat which produces pressure differentials between the inside of the sealed package unit and the outside atmosphere, a band of sealing varnish having heat resistant, non-volatile, and plastic characteristics is employed to cover the spaces and irregularities between the base and bulb. The sealing varnishes employed for this purpose contain very plastic heat resistant resins and solvents having a high boiling point and require a drying and curing period of long duration.

The present method of curing the varnish sealing band comprises packing the freshly coated lamps base up in trays and storing them for about six days to dry in air. During this period, if the varnish is thin or applied more heavily than is required, or if the lamp reclines at an angle from the vertical, the varnish will run on to the lamp bulb or envelope. The lamps are then baked in ovens having temperatures gradually increasing from 80 to 155° C. During baking, the sealing varnish thins and then further tends to run. The varnish which has run on to the bulb is generally removed by hand scraping or other similar means. This is an expensive and tedious task.

Hence it has been found advantageous, according to my invention, to rotate the coated lamps while slowly baking out the varnish solvent in the varnish sealing band, thereby eliminating the running of the varnish on to the bulb. The coated lamps are fed base first into a slowly rotating tubular oven externally heated as desired in gradually increasing increments of temperature along its length. Due to the base diameter being smaller than the bulb diameter, the oven rotation causes the lamps to rotate and to roll forward along the bottom of the oven wall. A series of these ovens interconnected by gravitational chutes can be arranged to meet any required production rate and total baking time per lamp.

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In its general aspect, the present invention has the objective of overcoming the afore-mentioned disadvantages of the prior art method and apparatus for curing the varnish seal between the base and envelope of miniature headlight lamps.

Specifically, an object of the present invention is elimination of the runnng of the sealing varnish on to the lamp envelope during the baking process, and make possible the completion of processing of the lamp without a time delay.

Another and specific object is the elimination of the hand scraping of lamp envelopes to remove the excess sealing varnish therefrom.

An additional object is to rotate the lamps while slowly baking out the varnish solvent in the sealing band to prevent the running of the varnish on to the bulb.

A further object is to provide a slowly rotatable tubular oven for curing the sealing band between the envelope and the base of incandescent lamps employed in a sealed package unit.

An additional object is a series of tubular ovens interconnected by gravitational chutes and heated by external means in a gradually increasing temperature gradient along its length, which can be arranged to meet any required production rate or total baking time per lamp.

A still further object is a tubular baking oven which eliminates excessive handling and storing and appreciably shortens the required baking time.

Other objects of the invention will appear to those skilled in the art to which it appertains as the description thereof proceeds, both by direct recitation and by implication from the context.

Referring to the accompanying drawings, in which like numerals of reference indicate similar parts throughout the several views:

Fig. 1 is a side elevational view, partially in section, of a rotatable inclinable tubular oven embodying my invention for curing the sealing bands between envelopes and bases of miniature incandescent lamps for sealed package units;

Fig. 2 is a sectional view of the oven on the line II—II of Fig. 1, in the direction of the arrows;

Fig. 3 is a sectional view on the line III—III of Fig. 1, in the direction of the arrows;

Fig. 4 is a side elevational view of a series of tubular ovens, similar to the oven of Fig. 1, interconnected by gravitational chutes and arranged to satisfy a given production rate or total baking time per lamp.

Fig. 5 is an elevational view of a miniature in-

candescent lamp as employed in a sealed package unit.

Fig. 6 is an elevational view of a sealed package unit employing a miniature lamp, as illustrated in Fig. 5.

Referring to the drawing, and particularly to Fig. 1 in detail, a rotatable inclinable tubular oven embodying my invention is designated by the reference numeral **10**. This oven **10**, suitably a five or six inch iron pipe of desired length, is supported on a frame **12** on its rearward or entrance end by means of a rotating mechanism **14** between the frame **12** and said oven, and on its forward or exit end by an elevator mechanism **16** between said frame **12** and said oven. The oven is heated in a gradually increasing temperature along its length by a gas burner system or heating system **18** juxtaposed between the rotating mechanism **14** and the elevator mechanism **16** on frame **12**. Suitable vent holes **11** in oven **10** and an air blast **12** at one end may be provided to remove vapors from the baking operation.

Frame

The frame **12** consists of a vertical rear pillar or pedestal **20** and a vertical forward pillar or pedestal **22**, shorter than pedestal **20**, interconnected near their lower extremities by a platform **24** and secured to the floor by means of brackets **26**. As shown in Fig. 2, rear pedestal **20** has two parallel vertical channel bars **27** and **28** joined together at their tops by a horizontal top channel bar **29**. The forward pedestal, as shown in Fig. 3, comprises two vertical channel bars **30** and **31**, similar to bars **27** and **28**, connected by a horizontal top plate **32** suitably of greater depth than member **29**.

Rotating Mechanism

The rotating mechanism **14**, as shown in Figs. 1 and 2, has a body or housing **34** secured to top channel bar **29**, as by a bolt **35** and nut **36**. This housing has roller arms **37** and **38** projecting from its side portions, as shown particularly in Fig. 2, for affixing rotatable rear guide and oven support rollers **39** and **40** on their respective upper extremities.

As shown in Fig. 1, the arm **37** projects from the rear portion of housing **34** and the arm **38** from the forward portion of said housing in spaced relationship thereon, so that roller **39** on arm **37** rotates within a circular channel **42** provided on the periphery of oven **10** and roller **40** on arm **38** rotates against the forward flange of said channel, thereby preventing longitudinal movement of oven **10** during rotation thereof. Housing **34** further has a longitudinal shaft hole **44** and a bushing **46** therein, wherein a shaft **48** rotates and projects therefrom on both sides of housing **34**. The projecting portions of shaft **48** are of an appropriate smaller diameter than the central portion.

On the rearward end of shaft **48** a driver spur gear **50** is secured, as by pinning. On the forward end is secured a sprocket wheel **52**. Both gear **50** and sprocket wheel **52** abut housing **34**, thereby locking shaft **48** within housing **34** and preventing any longitudinal movement thereof. A driven spur gear **54** of suitable diameter larger than spur gear **50** is affixed as by welding to the periphery of oven **10** in toothwise engagement with spur gear **50**. A chain **56** connects sprocket wheel **52** with another sprocket wheel (not shown) on the drive shaft of gear reduction mechanism **57** driven by a motor **58** on frame platform **24**.

Elevator mechanism

The elevator mechanism **16**, as shown in Figs. 1 and 3, has a height adjustment screw **60** with a handle wheel **62** depending from top plate **32** of forward pillar **22** between the channel bars **30** and **31** of said pillar **22**, a shoulder **64** on the top surface of plate **32** and a threaded upper portion **66**. Shoulder **64** and handle **62** prevent vertical travel of the screw **60** but permit slidable rotation thereof in a lining **68** (Fig. 1) secured in a vertical hole **70** provided in plate **32**. This elevator housing or body **72**, as shown in Fig. 3, has its lining **68** suitably threaded so that it travels up and down as the vertically stationary screw **60** is turned. A vertical guide pin slot **74** is machined into the forward face of housing **72**. This slot is slidable about the upper portion of a pin guide **76** having its suitably smaller diameter and threaded lower portion extending through top plate **32** and secured thereat by a nut **78**.

As shown particularly in Fig. 3, the elevator housing **72** is provided with roller arms **80** and **82** arranged like the arms **37** and **38** of rotating mechanism housing **34**. These arms **80** and **82** have forward guide and oven support rollers **84** and **86** rotatably affixed to their respective upper portions. Roller **86** on arm **82** rotates within an annular channel **88**, similar to channel **42**, secured as by welding to the periphery of the oven **10**. Roller **84** on arm **80** in turn rotates against the rearward flange of channel **88**. Thus longitudinal generally horizontal motion of the oven **10** is further prevented by the coordinated locking action of the rollers **84** and **86** in and against the channel **88**.

Heating system

The heating system **18**, as shown in Fig. 1, has a gas line **90** affixed by means of an adjustable bracket **92** to a stanchion **94** on frame platform **24**, for supplying, from a T **96**, gas for two pipe-like burners **98** and **100**. These burners are maintained parallel to oven **10** by means of adjustable bracket **92** and a flexible lower portion **102** of gas line **90**. The gas flow to burner **98** and **100** and the resultant temperature gradient of approximately 80 to 155° C. along the length of oven **10** are controlled by a valve **104** and a valve **106** in the connecting lines **108** and **110** respectively between T **96** and burners **98** and **100**.

An inclined gravitational entrance chute **112** is provided near the rearward portion of oven **10** for delivering miniature incandescent lamps, such as lamp **114** shown in Fig. 5, bulb end first to the oven **10**. This lamp **114** comprises an envelope or bulb **116** having an outside diameter, for example, of 1⅝ inches, a mount **118** sealed therein, a base **120** having a shell diameter, for example, of ¾ inch, affixed to the envelope by an appropriate cement and a band **122** of sealing varnish, such as Dow Corning "Silicon 996," between the base **120** and the bulb **116**. "Silicon 996" is the trade name for a solution of silicon resin in a solvent, toluol, having a viscosity of 5 to 10 min. at 29° to 30° C.

A conveyor **124** as shown in Fig. 1 may be provided at the forward or delivery end of oven **10** for transporting the lamps **114** after curing to the packing department for cleaning, marking, packing and shipment to the manufacturer of sealed package units **125**, such as shown in Fig. 6. This conveyor **124** is mounted on a conveyor pedestal **126**, forward of pedestal **122**, by means of bolts **127** and **128**, adjustable in a vertical slot **130** in

pedestal 126 to provide the desired conveyor belt height compatible with the delivery or forward end of oven 10. Conveyor pedestal 126 is secured by a bracket 132 to the floor.

The sealed package unit 125, shown in Fig. 6, comprises a metallic parabolic reflector 134 having a metallic reflecting surface, such as silver, and an upper lip 137, a lens 136 fastened airtight, by use of gaskets, to said upper lip 137 and the cured lamp 114, the base 120 of which is soldered to the other end of reflector 134.

It will be understood that the forward rate of longitudinal travel of the lamps 114 in the revolvable and reclinable oven 10 and hence the total curing time given lamps 114 in the oven 10 depends on the speed of rotation of oven 10 in revolutions per minute (readily adjustable to any desired speed by gear box 57), the length of oven 10, the ratio of bulb diameter to base shell diameter, the surface friction to the base shell diameter inside oven 10, and the inclination of the forward end of oven 10 (adjustable by means of elevator mechanism 16). For a given length of oven 10 and speed of rotation, if the forward end of oven 10 is inclined upwardly, a given amount, a longer curing time results due to the increased surface friction inside oven 10. Similarly, as the forward portion of oven 10 is inclined downwardly, a shorter curing time for lamp 114 results.

Series of ovens

Further, for example, if a longer oven is required and floor space is limited, a series of ovens, such as 138, 140 and 142, shown in Fig. 4, aligned one below the other and interconnected by gravitational chutes 144 and 146 of semicircular vertical cross section may be employed. A driven gear 148 on oven 142, similar to spur gear 50 on oven 10, engages a spur gear 150 on oven 140. In turn, gear 150 engages a further spur gear 152 on oven 138. Gear 150 on oven 140 and oven 140 rotate counter to the rotation of the gear 152 on oven 138 and gear 148 on oven 142. The rotating mechanism 14 on the rearward portion of oven 142 and the elevator mechanism 16 on the forward end of oven 142 (not shown) function as in Fig. 1. A heating system similar to heating system 18 of Fig. 1 with additional burners 154 and 156 for oven 138 and 158 and 160 for oven 140 similar to burners 98 and 100 of Fig. 1, for oven 142 is employed. Arms 80 and 82 of elevator mechanism are extended vertically upward and two additional pairs of rollers (not shown) similar to rollers 84 and 86 are employed to support the forward ends of ovens 138 and 140.

Operation

According to my invention, each lamp 114 is baked in the oven 10 approximately 45 to 50 minutes at a temperature ranging from 80 to 155° C. If the desired production rate of cured lamps is, for example, 150 per hour, an oven 10 about 30 ft. long, rotating at approximately 5 revolutions per minute, and having no inclination of the forward end, may be employed. Lamps 114 fed by a chute 112 into said oven at the rate of one every 24 seconds advance 5/8 of an inch per second forwardly in the oven 10 and are heated by burners 98 and 100 gradually from 80 to 155° C. Thus, each lamp 114 delivered at the rearward end by chute 112 advances 24 sec.×5/8'' or approximately 3 inches into the oven 10 before the next lamp is delivered by chute 112. Each delivered lamp is heated at the desired temperature range for a period of

$$\frac{30\times12\times50}{6}$$

or 3000 seconds (50 minutes), before being delivered at the forward end of oven 10 onto conveyor 124.

Further, according to my invention, if the desired production rate of cured lamps 114 is, for example, 1500 per hour, a series of 3 ovens, such as 138, 140 and 142, as shown in Fig. 4, each 110' long and rotating at approximately 50 revolutions per minute might be employed. Lamps 114 are fed by chute 112 into the upper oven 138 at the rate of one lamp every 2.5 seconds and advance down oven 138 at the rate of 1.2'' per second. Chutes 144 and 146 transfer the lamps in the matter of a second to oven 140 and 142 respectively. Thus the lamps 114 are given a curing time of

$$\frac{330\times12\times5}{6}$$

or 3080 seconds (51⅓ minutes).

Thus it will be seen from the foregoing description that the rotatable and inclinable oven 10 of my invention has eliminated the running of the sealing varnish 122 onto the lamp envelope 116 and base 120 during the baking or curing process and the scraping of lamp envelopes and bases to remove excess sealing varnish therefrom. The lamps 114 are rotated, base end first, slowly in oven 10 thereby travelling longitudinally forward in oven 10. Simultaneously the varnish solvent in the sealing band 122 is baked out to prevent the running of the varnish onto the bulb 116. Further, a series of rotatable and inclinable tubular ovens, such as ovens 138, 140 and 142 of Fig. 4 interconnected by gravitational chutes 144 and 146 and heated by burners such as 98 and 100, 154 and 156 and 158 and 160 in a gradually increasing temperature gradient along their respective lengths may be arranged to meet any required production rate or total baking time per lamp.

Although a preferred embodiment of my invention has been disclosed, it will be understood that modifications may be made within the spirit and scope of the appended claims.

I claim:

1. Apparatus for curing a varnish sealing band between the bulb and the base of miniature incandescent lamps comprising a rotatable inclinable tubular oven, having forward and rear annular roller channels and an oven spur gear adjacent said rear roller channel, a frame having vertical rear and forward pedestals interconnected by a platform, an oven rotating mechanism on the rear pedestal of said frame between said oven and said rear pedestal, said mechanism comprising a housing secured to said rear pedestal, roller arms projecting from the side portions of said housing, guide oven support rollers on said arms for engagement with the rear channel of said oven to prevent longitudinal movement thereof, a driver shaft within said housing, a spur gear on the rearward end of said shaft for engagement with said oven gear, a sprocket wheel on the forward end of said shaft and means for adjustably rotating said sprocket wheel and said shaft, an oven elevator mechanism on the forward pedestal of said frame between said oven and said forward pedestal, said elevator mechanism having a height adjustment screw

rotatably secured but vertically fixed to the upper portions of said forward pedestal, an elevator housing in threadable engagement with the upper end of said screw and keyed to said forward pedestal, roller arms projecting from the side portions of said elevator housing, rollers on said arms for engagement with the forward channel of said oven to further prevent longitudinal movement thereof, and manual means on the lower end of said screw for rotating said screw, and a heating system on said frame between said rotating mechanism and said elevator mechanism for heating said oven in a gradually increasing temperature gradient along its length.

2. Apparatus for curing a varnish sealing band between the bulb and the base of miniature incandescent lamps comprising a series of rotatable and inclinable tubular ovens aligned one below the other and having oven spur gears on the rear portions thereof for intermeshing engagement with each other, the bottom oven also having forward and rear annular roller channels, gravitational chutes for interconnecting said ovens, a frame having vertical rear and forward pedestals interconnected by a platform, an oven rotating mechanism on the rear pedestal of said frame between said bottom oven and said rear pedestal, said mechanism comprising a housing secured to said rear pedestal, roller arms projecting from the side portions of said housing, guide oven support rollers on said arms for engagement with the rear channel of said bottom oven to prevent longitudinal movement thereof, a driver shaft within said housing, a spur gear on the rearward end of said shaft for engagement with

said bottom oven gear, a sprocket wheel on the forward end of said shaft and means for adjustably rotating said sprocket wheel and said shaft, an oven elevator mechanism on the forward pedestal of said frame between said oven and said forward pedestal, said elevator mechanism having a height adjustment screw rotatably secured but vertically fixed to the upper portions of said forward pedestal, an elevator housing in threadable engagement with the upper end of said screw and keyed to said forward pedestal, roller arms projecting from the side portions of said elevator housing, rollers on said arms for engagement with the forward channel of said bottom oven to further prevent longitudinal movement thereof, and manual means on the lower end of said screw for rotating said screw, and a heating system on said frame between said rotating mechanism and said elevator mechanism and extending beneath and along each of said aligned ovens for heating said ovens in a gradually increasing temperature gradient along their combined length.

ALBERT W. HOLZER.

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