March 3, 1931. E. A. BOHLMAN ET AL 1,794,753

TUBE MECHANISM

Filed Dec. 31, 1927 3 Sheets-Sheet 1

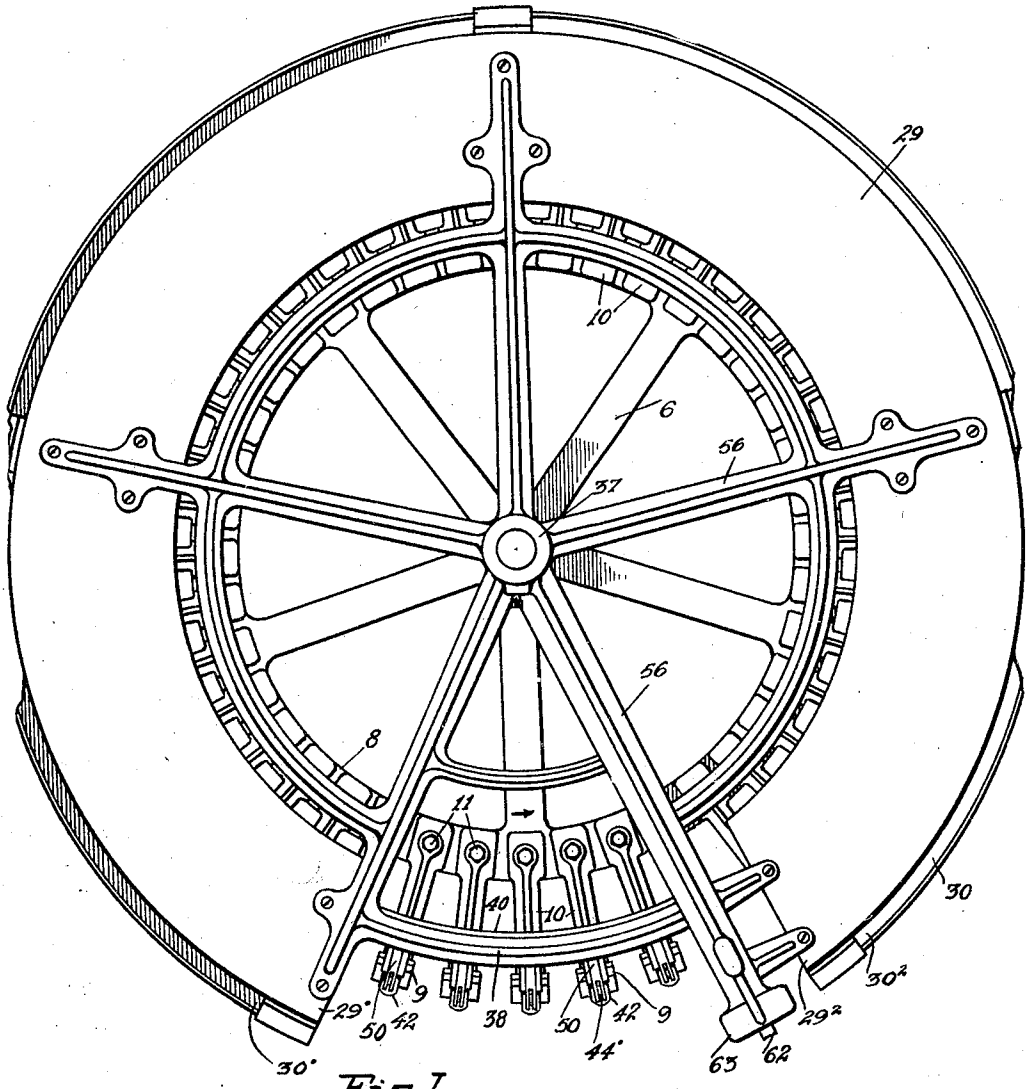


Fig. 1.

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TUBE MECHANISM

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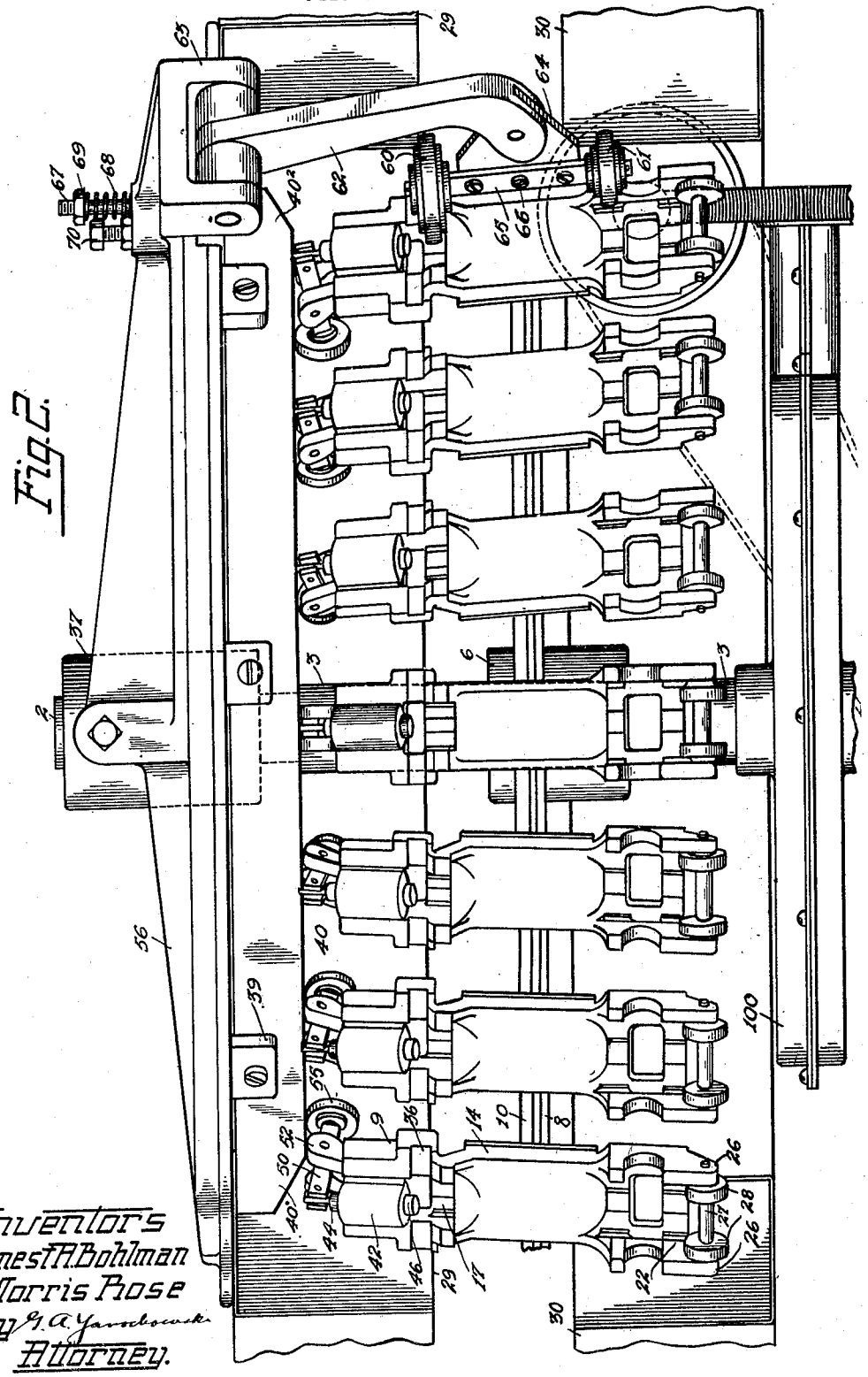


Fig. 2.

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TUBE MECHANISM

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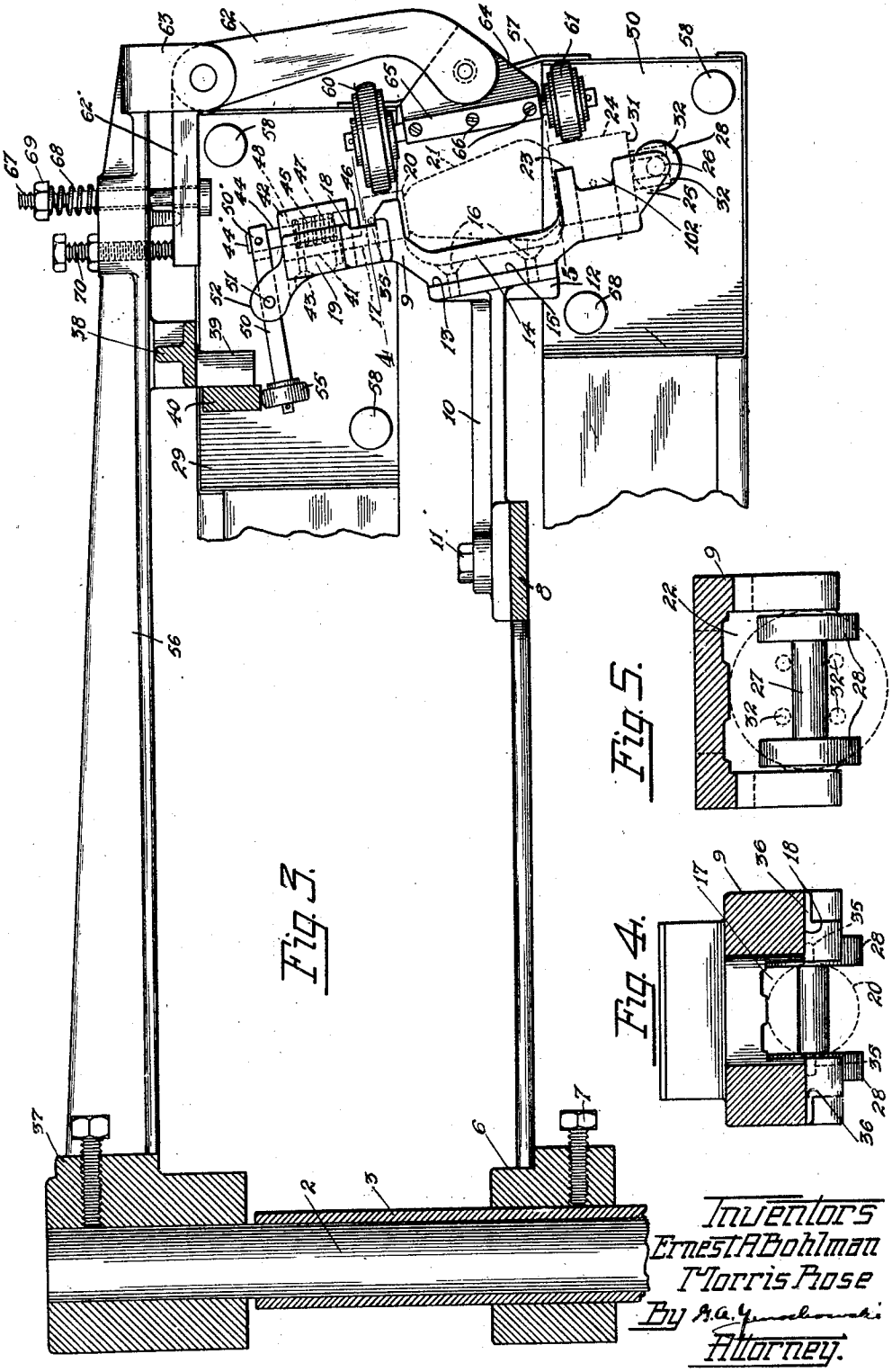


Fig. 3.

Fig. 5.

Fig. 4.

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Patented Mar. 3, 1931 1,794,753

UNITED STATES PATENT OFFICE

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TUBE MECHANISM

Application filed December 31, 1927. Serial No. 243,800.

Our invention relates to mechanism used in connection with the manufacture of audion tubes and more especially to a machine provided with aligning means for supporting an audion tube structure such as the glass envelope during the tube basing process and an object of our invention is the provision of an improved machine structure which is simple in construction, most efficient in its operation and in which the tubes are rigidly supported during the base baking process to maintain the glass envelope and base in alignment relative to each other.

The machine of our invention is especially adapted for use with audion tubes of the type known in the art as alternating current tubes which are provided with a tube base of the usual character from which project terminal contact pins for the usual purposes and an auxiliary base or cap carrying contact pins which form the terminals of the resistance element of the tube. It is understood, however, that our machine may be used to base other types of tubes. The base and auxiliary base or cap of the alternating current tube are supported on the extremities of the glass envelope of the tube and secured thereto by means of suitable cement which is hardened by means of a suitable baking process.

It is essential that the base and auxiliary base or cap of the tube are properly aligned on the glass envelope relative to each other and it is also essential that means be provided to hold them so until the cement which secures them to the extremities of the glass envelope is baked hard and it is to this end that the machine of our invention is applicable.

A feature of our invention is the provision of a rotatable member to which are secured a plurality of supporting members which support the glass envelopes and attached bases and caps at the extremities of the envelopes in their travel through a suitable heating chamber to bake and harden the cement which secures the bases and caps to the extremities of the glass envelopes.

Another feature of our invention is the provision of recessed portions or aligning seats in the supporting members receiving the bases and caps after having been placed on the extremities of the glass envelopes to align them on the glass envelopes relative to each other.

Another feature of our invention is the provision of a pair of rollers rotatably and adjustably supported on an adjustable member which engage respectively the caps and bases on the glass envelopes in their travel past the rollers to positively seat the bases and caps in the respective aligning seats of the supporting members to insure positive alignment of the bases and caps on the glass envelopes relative to each other, and to also overcome any slight irregularities which may be present when the caps and bases are placed on the glass envelopes.

Still another feature of our invention is the provision of automatic clamping means associated with the supporting members which is applied vertically against the caps of the tubes after they have passed the rollers to maintain the bases and caps in aligned position during their travel through a heating chamber to harden the cement which secures them to the extremities of the glass envelopes. Means are also provided for releasing the clamping means automatically after their travel through the heating chamber to permit the tubes to be removed from the supporting members.

The above features as well as others not herein specifically pointed out will be more fully described in the ensuing specification and appended claims.

For a more complete understanding of our invention reference may be had to the accompanying drawings in which like reference characters in the several views denote like parts and in which:

Fig. 1 is a plan view of the base and cap cementing machine of our invention;

Fig. 2 is a front elevation of a portion of Fig. 1 on an enlarged scale clearly illustrating the brackets which support the audion tubes;

Fig. 3 is an enlarged side elevation of one of the tube supporting brackets and its associated parts;

Fig. 4 is a sectional view along the line 4—4 of Fig. 3, and

Fig. 5 is a sectional view along the line 5—5 of Fig. 3.

Referring now more in detail to our invention as illustrated in the accompanying drawings the machine of our invention comprises a supporting rod or post 2 which is secured to a suitable pedestal or base (not shown). A hollow shaft 3 through which the supporting rod or post 2 extends has secured to its one extremity a suitable worm gear enclosed in a casing 100 which gear meshes with a worm also in the casing. The worm is driven through suitable connecting machinery by a suitable power means such as a motor and through the medium of the worm gear, worm and motor, the hollow shaft is rotated at a predetermined speed for purposes as will be presently described.

A spider 6 is provided which is secured to the hollow shaft 3 near its upper extremity by means of a suitable set screw 7, and an annular ring 8 integrally formed with the spider 6 has secured to it a plurality of radially disposed arms 10 forty in number to which the aligning brackets 9 are secured, and which aligning brackets 9 carry the glass envelopes and attached bases and caps through a suitable heating chamber as will be more fully hereinafter described. Each arm 10 has associated with it an aligning bracket 9 and as each arm 10 and aligning bracket 9 is similar in construction and as each arm 10 is secured to the spider 6 and as each aligning bracket 9 is in turn secured to an arm 10 in a similar manner a description of an arm 10 an its associated aligning bracket 9 will suffice.

The arm 10 is secured to the annular ring portion 8 of the spider 6 by means of a suitable bolt 11 and the free end of the arm 10 is provided with an integrally formed plate portion 12 provided with an angular face 13 against which the aligning bracket 9 is secured. The aligning bracket 9, of which there are forty in number, is provided with an intermediate offset portion 14 having a finished face 15 which rests against the angular face 13 of the arm 10 and screws 16 passing through suitable orifices in the intermediate portion 12 of the aligning bracket 9 have threaded engagement with tapped orifices in the face 13 of the plate 12 integral with the arm 10 to secure the bracket 9 thereto. A vertical cap aligning seat or channel 17 in the face 18 of the upper portion or head 19 of the aligning bracket 9 is of a size to receive the auxiliary base or cap 20 on the upper extremity of the glass envelope 21 and a base aligning seat or channel 22 in the face 23 of the bottom portion of the bracket 9 and in alignment with the cap aligning channel 17 in the upper portion 19 of the bracket 9 is of a size to receive the base 24 on the lower extremity of the glass envelope of the tube. A pair of ears 25 depending from the bottom portion of the bracket 9 are provided with aligned orifices 26 which are adapted to receive a stub shaft 27 which supports a pair of rollers 28 fixed to the shaft 27 for purposes as will presently be described.

Having described in detail one of the aligning brackets 9, we will now describe how an audion tube of the type previously referred to is positioned on an aligning bracket 9 preparatory to its travel through the heating chambers 29 and 30 to bake and harden the cement which permanently affixes the auxiliary base or cap 20 and base 24 to the extremities of the glass envelope 21 of the audion tube. The attendant of the machine grasps a glass envelope prepared as previously described and places the bottom face 31 of the base 24 against the rollers 28 affixed to the stub shaft 27 with the depending terminal pins 32 in the base 24 astraddle the shaft 27 and resting between the rollers 28. When thus positioned the audion tube may now be moved inward with the point of contact between the periphery of the rollers 28 and the bottom face 31 of the base 24 serving as a pivot point permitting the base 24 of the tube to enter the base aligning channel 22 in the lower portion of the bracket 9 and permitting the auxiliary base or cap 20 to enter the cap aligning channel 17 in the upper portion or head 19 of the bracket 9. The depth of the cap aligning channel 17 relative to the depth of the base aligning channel 22 is such as to place the cap 20 and base 24 in alignment. The terminals 35 protruding laterally from the cap 20 rest in a transverse shallow channel 36 in the upper portion 19 of the bracket 9 when the cap 20 is positioned in the cap aligning channel 17 to position them relative to the depending terminals 32 of the base.

A spider 37 secured to the upper end of the supporting rod 2 is provided with an arcuate shaped rib 38 from which depend lugs 39 to which is secured an arcuate shaped rail 40 for purposes as will presently be described. The upper portion 19 of the bracket 9 is provided with a channel 41 of the same width and depth as the cap aligning channel and in alignment therewith and is adapted to receive a spring retaining member 42 which is secured in the channel 41 by means of screws 43. A clamping member or rod 44 extends through a central orifice 45 in spring retaining member 42 and is provided with an enlarged head 46, and a coil spring 47 which encircles the reduced portion of the clamping rod 44 and is contained within the orifice 45 of the member 42 is provided for purposes as will presently be described. The end 44′ of the reduced portion of the rod which protrudes through an orifice 48 in the end of the spring retaining member 42 is as-

sociated with a lever 50 which is pivotally supported intermediate of its ends by means of the pivot pin 51 which passes through aligned orifices in a pair of ears 52 integrally formed with the bracket 9. A pin passing through the bifurcated end 50′ of the lever 50 and the protruding end of the clamping rod 44 links the lever 50 and clamping rod 44 together. The free end of the lever 50 rotatably supports a roller 55 which engages the arcuate rail 40 secured to the spider for a portion of its travel of one complete revolution for purposes as will presently be described.

As before described the machine of our invention is provided with forty arms 10 and attached aligning brackets 9 which rotate at a predetermined speed through the upper and lower heating chambers 29 and 30. The speed of the machine is so adjusted as to provide proper baking time for the caps. While our device is provided to handle forty tubes at one time it is obvious that it may be made to handle any predetermined number of tubes. The upper and lower heating chambers 29 and 30 are horseshoe shaped and of U shaped cross section, the upper chamber 29 being inverted and is secured to the arms 56 of spider 37 supported on the supporting rod 2. The lower heating chamber 30 is suspended from the upper chamber 29 by means of suitable straps 57 which are secured respectively to the upper and lower chambers 29 and 30 by means of suitable screws. Gas leads in the form of pipes 58 supported in the respective chambers 29 and 30 are provided with a plurality of vents for the passage of the gas flame to heat the chambers 29 and 30. The gap between the respective ends 29′, 29² and 30′, 30² of the heating chambers 29 and 30 permits the finished tubes to be removed from the aligning brackets 9 and tubes to be baked inserted in the brackets 9. The oven may be heated by electricity or any other desired means. The temperature of the chambers is regulated to properly bake the bases on the tubes.

The arcuate rail 40 which is secured to the depending lugs 39 of the rib 38 is provided with tapered ends 40′ and 40², and these tapered ends 40′ and 40² and rail 40 cooperate with the rollers 55 rotatably supported on the levers 50 pivotally secured to the aligning brackets 9 for purposes as will be described. The roller 55 rotatably supported on the lever 50 upon engaging the rail 40 causes the lever 50 to be moved about its pivot 51 to raise the end 50′ linked to the end 44′ of the clamping rod 44. The clamping rod 44 is thus raised against the normal pressure of the spring 47, around the rod 44, to allow the glass envelopes and the affixed cap 20 and base 24 to be positioned on the aligning bracket 9 as before described. As the bracket 9 continues its rotation in the direction of the arrow in Fig. 1 the cap 20 and base 24 are engaged by a pair of rollers 60 and 61. A bell crank lever 62 pivotally secured between a pair of depending ears 63 integral with an arm 56 of the spider 37 pivotally supports a plate 64 to which is secured a bar 65 by means of screws 66 the respective ends of which support rotatable rollers 60 and 61. The arm 62′ of the bell crank lever 62 is provided with an orifice to permit the passage of a bolt 67, the end of which protrudes through the arm 56 of the spider 37. A helical spring 68 around the protruding end of the bolt 67 is placed under compression by a nut 69 having threaded engagement with the bolt 67 and an adjusting bolt 70 having threaded engagement with a tapped orifice in the arm 56 of the spider 37 engages the free end of the arm 62′ of the bell crank lever 62.

As the aligning bracket 9 rotates in the direction of the arrow the rollers 60 and 61 supported on the lever 62 as just described engage respectively the cap 20 and base 24 positioned in the aligning channels 17 and 22 in the bracket 9. The adjusting bolt 70 which engages the free end of the arm 62′ of the bell crank lever 62 may be raised or lowered to adjust the rollers 60 and 61, relative to the cap 20 and base 24 of the audion tube supported in the bracket 9 so that as the cap 20 and base 24 pass the respective rollers 60 and 61 a slight pressure is applied thereto through the agency of the adjustable spring 68 to overcome any slight irregularities which may be present in the alignment of the cap 20 and base 24 when the same were placed on the extremities of the glass envelope 21 and also insure perfect seating of the cap 20 and base 24 in the respective aligning channels 17 and 22 in the bracket 9.

The instant that the aligned cap 20 and base 24 in their travel have passed the respective rollers 60 and 61 the roller 55 on the lever 50 engages the tapered end 40² of the rail 40 and the clamping rod 44 is moved down under the influence of the spring 47 causing the same to engage the top face of the cap 20 to exert a downward pressure to maintain the cap 20 and base 24 in aligned position relative to each other. The bracket 9 now enters the open ends 29² and 30² of the respective heating chambers 29 and 30 and continues its rotation with the cap 20 traveling through the upper heating chamber 29 and the base 24 traveling through the lower heating chamber 30. The spider 6 secured to the hollow shaft 3 rotates at a predetermined speed and as the cap 20 and base 24 travel through the heating chambers 29 and 30 the cement for affixing the cap 20 and base 24 to the respective ends of the glass envelope 21 is baked and hardened and when the bracket 9 and its supported audion tube emerges from the other ends 29′ and 30′ of the heating chambers 29 and 30 the cap 20 and base 24 are permanently secured in position

and in perfect alignment. As the roller 55 on the lever 50 engages the tapered end 40′ of the rail 40 it rides up on this inclined end 40′ to cause the lever 50 to be moved about its pivot 51 and as the end 50′ of the lever 50 is linked to the clamping rod 44 the same is moved up against the normal compression of the spring 47. The end 46 of the clamping rod 44 now disengages the cap 20 and permits the finished audion tube to be removed from the bracket 9.

In describing the operation of the machine thus far we have only described the cycle of operation of one of the aligning brackets 9 but as there are forty aligning brackets 9 rotating at a predetermined speed it is apparent that as the brackets 9 successively emerge from the ends 29′ and 30′ of the heating chambers 29 and 30 the finished product is removed from the aligning brackets 9 and the empty brackets 9 are again filled with glass envelopes 21 and the attached caps 20 and base 24 and after passing the aligning rollers 60 and 61 enter the heating chambers 29 and 30 to be baked and again emerge from the other end affixed permanently to the glass envelopes.

The tubes are placed in the brackets in one way and when placed therein the brackets line up the caps and bases relative to each other and position the same relative to the glass envelopes.

The contact pins or terminals in the upper caps engage an upper portion of the wall of brackets as shown most clearly in Fig. 4 while the contact pins or studs in the base straddle the shaft 27 and the pin in the side of the base enters the recessed portion 102 of the retaining brackets. The rollers press the caps and bases into position and the upper spring pressed shaft retains the cap, base and envelope in position during the baking operation. The spring pressure is applied to the upper portion of the tube just after the rollers have pressed the cap and base into position.

While we have described and illustrated a preferred embodiment of our invention it is to be understood that we do not wish to be limited to the exact structure as shown and described but aim to cover all such changes and modifications which may come within the spirit and scope of the appended claims.

Having described our invention, what we claim is new and desire to secure by United States Letters Patent is:

1. A machine of the character described including brackets for supporting audion tubes, a rotatable shaft and a spider secured to said shaft for supporting said brackets, and means including a pair of channels in said brackets for automatically aligning the base and auxiliary base of said audion tubes relative to each other.

2. A machine of the character described including brackets for supporting audion tubes, a rotatable shaft and a spider secured to said shaft for supporting said brackets, means including a pair of channels in said brackets for automatically aligning the bases and auxiliary bases of said audion tubes relative to each other and clamping means for maintaining said bases in aligned position.

3. A machine of the character described including brackets for supporting audion tubes during a basing period of said tubes, heating chambers associated with said machine, a rotatable shaft and a spider secured to said shaft for supporting said brackets, means including a pair of channels in said brackets for automatically aligning the bases and auxiliary bases of said audion tubes relative to each other, and clamping means for maintaining said bases in alignment during their travel through said heating chambers.

4. A machine of the character described including brackets for supporting audion tubes, each of which has a main base and an auxiliary base, during a basing operation of said tubes, a rotatable shaft and a spider secured thereto for supporting said brackets, seats in said brackets adapted to receive the bases and auxiliary bases of said audion tubes to automatically align the same relative to each other, and clamping means for maintaining said bases in aligned position.

5. A machine of the class described including brackets for supporting audion tubes each of which has a main base and an auxiliary base during the basing of said tubes, a rotatable shaft and a spider secured thereto for supporting said brackets, seats in said brackets adapted to receive the bases and auxiliary bases of said audion tubes to align the same relative to each other, and spring pressed means adapted to engage said respective bases to positively align the said bases in their respective seats.

6. A machine of the character described including brackets for supporting audion tubes each of which has a main base and an auxiliary base during the basing of said tubes, a rotatable shaft and a spider secured thereto for supporting said brackets, seats in said brackets adapted to receive the bases and auxiliary bases of said audion tubes to align the same relative to each other, spring pressed means adapted to engage said respective bases as said brackets travel past said spring pressed means, and clamping means associated with said brackets for maintaining said audion tubes and attached bases in their aligned positions.

7. A machine of the character described including brackets for supporting audion tubes each of which has a main base and an auxiliary base, heating chambers associated with said machine, a rotatable shaft and a spider secured thereto for supporting said brackets, seats in said brackets adapted to receive the

bases and auxiliary bases of said audion tubes to align the same relative to each other, spring pressed means adapted to engage said respective bases to positively align said bases in their respective seats, and clamping means effective after said bases have been aligned to maintain them in aligned position during their travel through said heating chambers.

8. A machine of the character described including brackets for supporting audion tubes each of which has a main base and an auxiliary base, a rotatable shaft, a spider secured thereto for supporting said brackets, power means for rotating said shaft and its supported parts, seats in said brackets adapted to receive and align the bases and auxiliary bases of said tubes, clamping means associated with said brackets for maintaining said bases in their aligned position, but ineffective during a portion of the travel of said aligning brackets to permit the insertion and removal of said audion tubes and attached bases on said brackets.

9. A machine of the character described including brackets for supporting audion tubes each of which has a main base and an auxiliary base during the basing process of said tubes, a rotatable shaft, a spider secured thereto for supporting said brackets, power means for rotating said shaft and its supported parts, seats in said brackets adapted to receive the bases and auxiliary bases of said tubes to align the same relative to each other, heating chambers associated with said machine, spring pressed means adapted to engage the respective bases to positively align said bases in their respective seats in their travel past said spring pressed means, clamping means associated with said brackets effective after said bases have passed said spring pressed means to maintain said bases in aligned position during their travel through said heating chambers, and means for releasing said clamping means when said brackets emerge from said heating chambers to permit the removal of said tubes and attached bases.

10. A tube basing machine comprising a movable tube holding device, automatic means including a roller for positioning the tube base relative to the tube holder, and tensioning means for holding the envelope of the tube in position relative to the base of the tube.

11. A tube machine of the class described including a rotatable member provided with tube holders adapted to receive an audion tube and its base, a roller member for automatically positioning the tube relative to the tube holder, and spring means rotatable with the holder for maintaining the envelope of the tube in position with the tube base.

12. A tube machine of the character described provided with a rotatable member having tube holders adapted to receive audion tubes having upper and lower bases, spring pressed means adapted to contact with the bases of the tube to position the same, and other means adapted to press against one of said bases for holding the bases in position relative to the envelope of said tube.

13. A tube machine of the character described provided with a rotatable member having tube holders adapted to receive audion tubes having upper and lower bases, means including a pair of rollers adapted to contact with the bases of the tube to position the same, spring means adapted to press against one of said bases for holding the bases in position relative to the envelope of said tube, and automatic means for releasing the pressure exerted by said spring upon the said base of said tube.

14. A machine of the character described including a movable member provided with tube holders adapted to receive audion tubes, a roller member for said machine for aligning the envelopes of the tubes relative to their bases, and clamping means for maintaining the envelopes of the tubes positioned relative to their bases.

15. A machine of the character described including brackets for supporting audion tubes and their bases, seats in said brackets adapted to receive the bases of said tubes to align the same relative to the envelopes of said tube, spring pressed means adapted to press the tube bases to align the same relative to their envelopes, and clamping means for maintaining said audion tubes and bases in their aligned positions.

16. A machine of the character described including rotatable brackets for supporting audion tubes, means on said brackets adapted to receive the bases of said tubes, roller members for positioning said bases in said brackets, clamping means associated with said brackets for maintaining said bases and the tube envelopes in aligned position, and means for rendering said clamping means ineffective to permit the insertion and removal of said audion tubes.

17. A machine of the character described including rotatable brackets for supporting audion tubes, means on said brackets adapted to receive the bases of said tubes, roller members for positively positioning said bases in said brackets, heating chambers associated with said machine, and clamping means associated with said brackets for maintaining said bases and envelopes in aligned position during their travel through said heating chamber.

18. A machine of the character described including rotatable brackets for supporting audion tubes each of which has a main base and an auxiliary base, means on said brackets adapted to receive and align the bases of said tubes, roller members for positively positioning said bases in said brackets, heating cham-

bers associated with said machine, clamping means associated with said brackets for maintaining said bases and envelopes in aligned position during their travel through said heating chamber, and means for releasing said clamping means when the brackets emerge from said heating chambers to permit removal of said tubes and bases.

Signed by us, at Chicago, in the county of Cook and State of Illinois, this 29th day of December, 1927.

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MORRIS ROSE.