Oct. 18, 1927. 1,646,258

A. RAUS ET AL.

STEM FORMING MACHINE

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Fig. 1

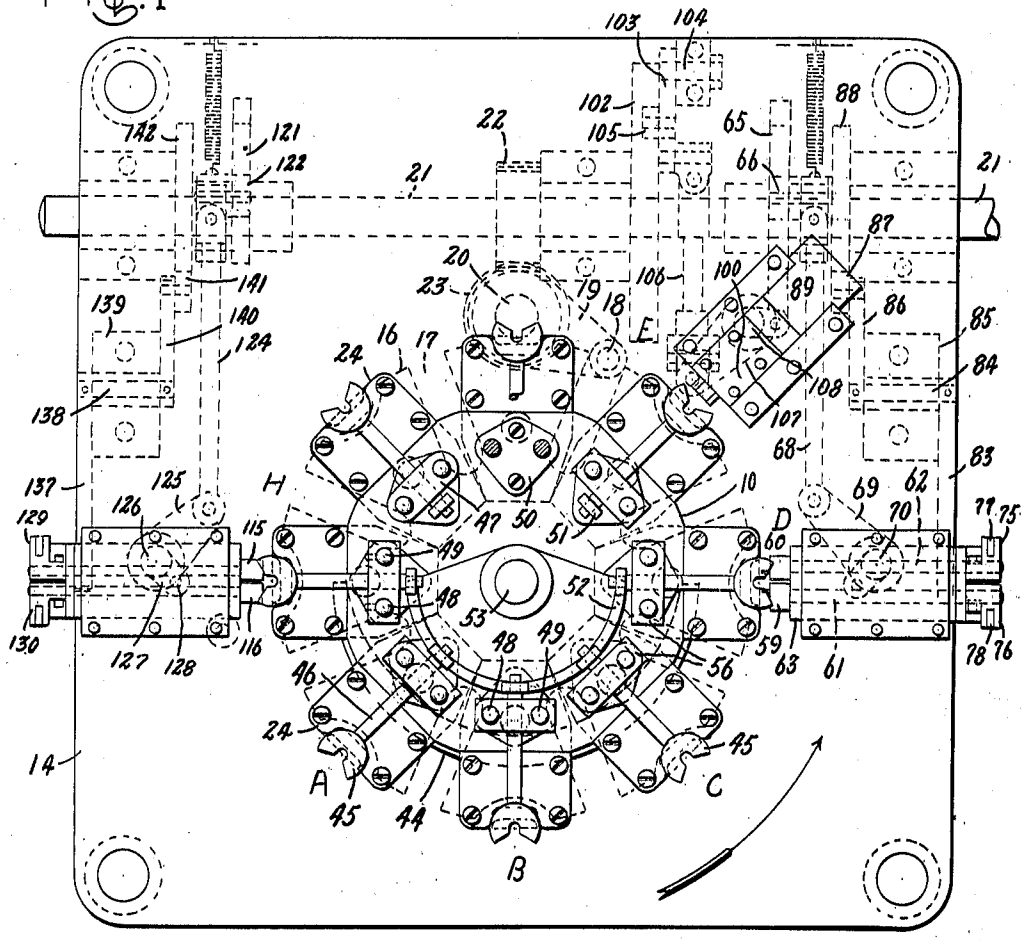


Fig. 14

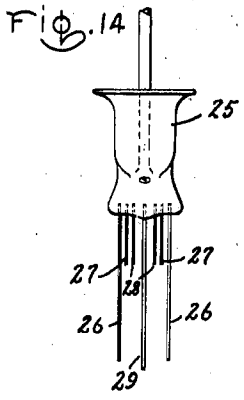


Fig. 15

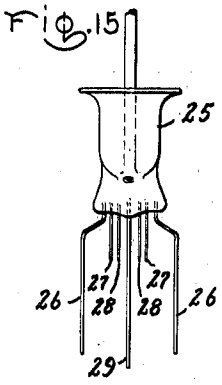


Fig. 16

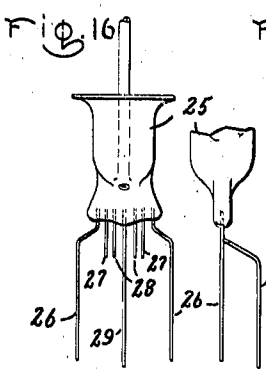
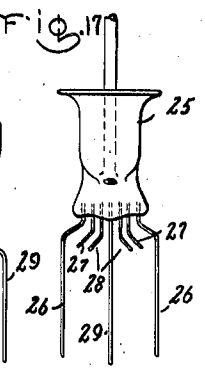


Fig. 17



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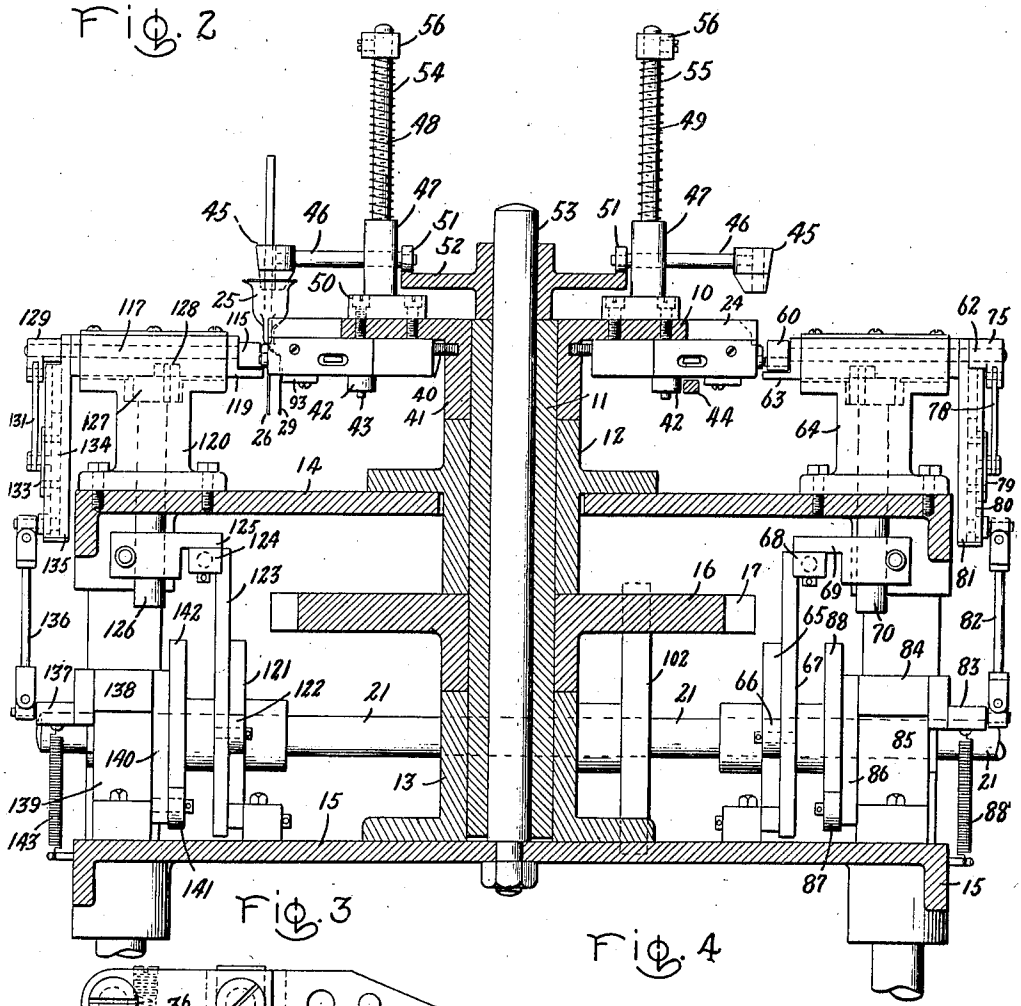
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STEM FORMING MACHINE

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Fig. 2



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STEM FORMING MACHINE

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Fig. 5

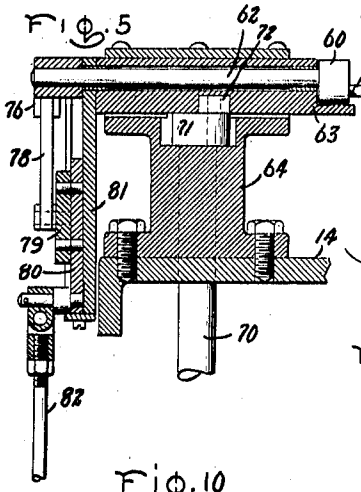


Fig. 6

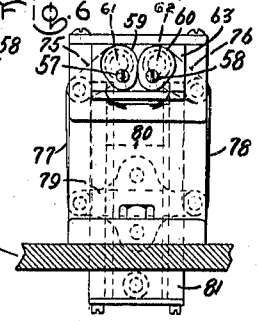


Fig. 12

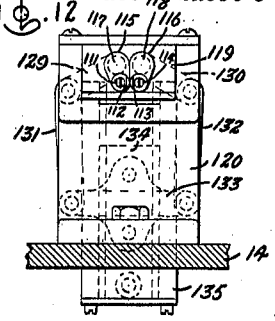


Fig. 7

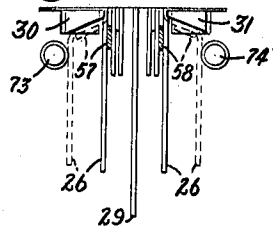


Fig. 13

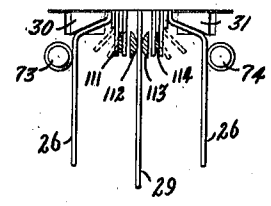


Fig. 10

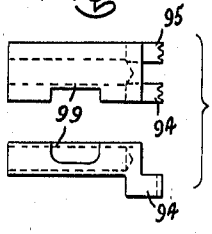


Fig. 8

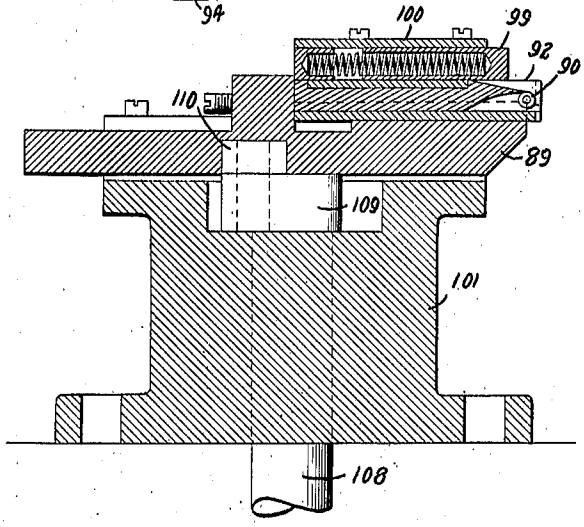


Fig. 9

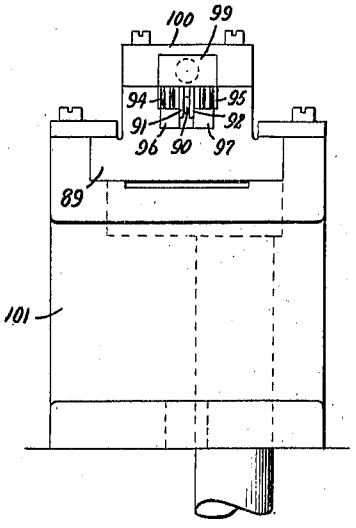
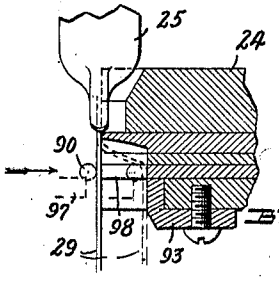


Fig. 11



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Patented Oct. 18, 1927. 1,646,258

UNITED STATES PATENT OFFICE.

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STEM-FORMING MACHINE.

Application filed November 12, 1924. Serial No. 749,505.

Our invention relates to the manufacture of vacuum tubes and similar articles and more particularly to machines for automatically shaping and cutting the supporting and conducting wires therefor.

Vacuum tubes contain several elements such as a cathode or filament, a grid, and an anode or plate, which are supported within a container such as a glass bulb. The support usually comprises an inwardly projecting stem sealed to the neck of the bulb and having a plurality of wires extending therefrom and securely anchored therein. The said wires act as supports and conductors for the various elements within the tube. Preparatory to mounting the elements upon the conducting and supporting wires therefor, it is usually necessary to so shape the supporting and conducting wires that the elements when assembled are positioned properly with respect to each other.

According to our invention, we provide a machine which consists of a movable carrier, as for example a rotatable turret, carrying a plurality of work-holding chucks, which after being loaded with a stem, intermittently transfer the same to a series of stations at which are located, respectively, means for automatically shaping and cutting the supporting and conducting wires extending from the stem. The object of our invention is to accomplish the shaping of these supports accurately and efficiently. Our invention has resulted in decreasing the amount of hand work in the manufacture of vacuum tubes.

Our invention is illustrated in the accompanying drawings in which Fig. 1 is a plan view of a machine embodying it; Fig. 2 is an elevation thereof partially in section; Fig. 3 is a plan view of one of the work-holding members; Fig. 4 is a front elevation thereof; Fig. 5 is a sectional elevation of the plate supporting and conducting wire shaping mechanism; Fig. 6 is a front elevation thereof; Fig. 7 is an enlarged elevational detail view showing the corresponding chuck and related parts; Fig. 8 is a sectional elevation of the grid and filament supporting and conducting wire cutting and shaping mechanism; Fig. 9 is a front elevation thereof; Fig. 10 is a plan and side elevation of the grid and filament wire bracing forks; Fig. 11 is a fragmentary sectional elevation showing a portion of the filament support bending mechanism and the stem holding chuck; Fig. 12 is a front elevation of the grid and filament supporting and conducting wire shaping mechanism; Fig. 13 is an enlarged elevational detail view showing the corresponding stem holding chuck and related parts; and Figs. 14 to 17 are elevations of stems during the various stages of manufacture.

As shown in Figs. 1 and 2, our machine comprises a rotatable turret 10 which is mounted upon a hollow shaft 11 supported by bearings 12 and 13 which are carried by the tables 14 and 15 respectively. The turret 10 is rotated through the shaft 11 by means of the disc 16 comprising a number of slots 17 which are engaged by a pin 18 extending from an arm 19 mounted on a shaft 20 which is driven by a power source such as a motor (not shown) which drives the main driving shaft 21. A gear 22 fastened to the shaft 21 meshes with and drives the horizontal gear 23 mounted upon the shaft 20. This drive gives an intermittent motion to the shaft 11 causing the turret 10 to pause for a time at each position and then to be moved on to the next position.

The turret 10 carries a number of chucks 24 for carrying the stems 25 to the various positions at which are located mechanisms which shape and cut the supporting and conducting wires thereof, which consist of plate supporting and conducting wires 26, grid supporting and conducting wires 27, filament conducting wires 28, and a filament support wire 29. The stems 25 are loaded into the chucks 24 at positions A, B and C, (Fig. 1), the plate wires 26 of the stem being placed between the jaws 30—31 which are pivotally mounted at 32—33 in the plate 34 which forms part of the chuck 24. The jaws are forced open against the action of the springs 35—36 which extend through passages in the plate 34 and bear against the jaws 30—31, keeping them normally closed. It is necessary that the jaws 30—31 be in a locked position during the rotation of the turret 10 to the various mechanisms, and to this end a wedge 37 (Fig. 3) is provided which is slidably mounted in the plate 34 and is forced between the extensions 38—39 of the jaws 30—31 by means of the spring 40, which extends from the collar 41 of the turret 10 into the said wedge. In order that the jaws may be unlocked at positions A,

B and C, for the removal or insertion of a stem, a roller 42 which is supported by the wedge 37 through the pin 43 rides against a stationary cam track 44 carried by the table 14 and of such shape that the wedge 37 is forced out from between the extensions 38—39.

After the chuck 24 has been loaded with a new stem 25 the turret 10 is intermittently advanced in the direction of the arrow, (Fig. 1) at which time a centering and steadying head 45 attached to a horizontal rod 46 is forced down into the stem in order that the same may be properly braced during the shaping and cutting operations. The horizontal rod 46 is carried by the block 47 which is slidably mounted on the vertical rods 48—49 extending from the base plate 50 fastened to the turret 10. When a chuck 24 is in the unloading or loading position, the head 45 is raised out of contact from a stem 25 by means of the roller 51 which is carried by the rod 46 and rides on the stationary cam 52 fastened to the shaft 53 which extends from and is supported by the table 15.

As a chuck reaches position D, which is the first shaping position, the head 45 is forced down into the stem 25 by the action of the springs 54—55 which surround the rods 48—49 between the cross piece 56 and the block 47. As the turret 10 pauses at position D, a pair of horizontal pins 57—58 are advanced until they come in contact with the plate wires 26. The pins 57—58 extend from eccentrics 59—60 which are fastened to the ends of shafts 61—62 rotatably mounted in suitable bearings carried by the reciprocating block 63 as shown in Figs. 5, 6 and 7. The block 63 is slidably mounted in the standard 64 suitably attached to the table 14, said block being advanced and retracted at the proper time, as shown in Figs. 1 and 2, by means of a cam 65, roller 66, lever 67 and link 68 which are attached to an arm 69 carried by a shaft 70. The shaft 70 extends through the standard 64 and carries at its upper end an eccentric block 71 having an extension 72 which rides in a slot in the block 63. The rotation of the shaft 70 causes the advance or retraction of the block 63. After the block 63 has been advanced the proper distance, the shafts 61—62 are rotated which cause the pins 57—58 to travel in an arc-shaped path, thus bending the wires 26 around the jaws 30—31 which act as forming dies therefor, and against stops or gauges 73—74. The shafts 61—62 are actuated by cranks 75—76 to which are attached the links 77—78 pivotally connected to a cross piece 79 which is carried by a plate 80 slidably mounted in the depending member 81 which is fastened to the block 63. The plate 80 is reciprocated by means of the rod 82 attached thereto. As shown in Figs. 1 and 2, the rod 82 is fastened to a crank arm 83 which is carried by a shaft 84 mounted in a bearing in a standard 85. The shaft 84 carries at its opposite end an arm 86 having a roller 87 which rides on the cam 88 mounted upon the main power shaft 21. The rod 82 after having been raised by the action of the cam 88 is returned by means of a spring 88′ which is attached to the crank arm 83 and table 15.

After the plate supporting and conducting wires 26 have been properly shaped, as shown in Figs. 7 and 15, the turret 10 is advanced to position E. At this position is located the mechanism for cutting to their proper lengths the grid and filament wires 27 and 28 respectively, and also the shaping die for the filament support wire 29. As the turret 10 stops at this position, a reciprocating block 89 which carries the wire shaping and cutting means is advanced toward the stem 25, as shown in Figs. 8, 9, 10 and 11. This movement of the block 89 causes the shaping roller 90 mounted between the plates 91—92 to contact with the filament support wire 29 and force the said wire in toward a gauge or die 93, which is carried by the chuck 24 (Fig. 11). In the meantime a pair of forked shaped arms 94—95 come in contact with the grid and filament wires 27—28 in order that they may be held firm while their lower ends are sheared off by the shearing means which comprises the members 96—97 carried by the block 89 and member 98 carried by the chuck 24. The arms 94—95 extend from a spring pressed holder 99 which is slidably mounted in the cover plate 100 carried by the block 89. A continued movement of the block 89 carries the roller 90 in the direction of the arrow (Fig. 11) which causes the wire 29 to be forced in against the gauge or die 93, the said die being of such shape that the proper bend of the wire 29 is secured. After the lower ends of the wires 27 and 28 have been sheared off and the wire 29 has been shaped, the block 89 is withdrawn. The block 89 is slidably mounted in the standard 101 attached to the table 14 and is advanced and retracted at the proper time by means of a cam 102 which is mounted upon the main power shaft 21, as shown in Figs. 1 and 2. The cam 102 operates an arm 103 which is pivotally mounted on a shaft 104 and carries a roller 105 which rides in a slot in the said cam. Attached to the other end of the arm 103 is a horizontal rod 106 which is fastened to an arm 107 carried by the vertical shaft 108 (Fig. 8) which extends up through the standard 101. The said shaft carries at its upper end an eccentric block 109 having an extension 110 which rides in a slot in the block 89. The rotation of the

shaft 108 causes the advance or retraction of the block 89.

The next step is to shape the grid and filament wires 27 and 28 and to this end the turret 10 is intermittently advanced to position H at which is located means for shaping the said grid and filament wires. As the turret 10 stops at this position, pins 111, 112, 113 and 114 are advanced until they reach a position alongside the depending wires 27 and 28, as shown in Figs. 12 and 13. The pins 111, 112, 113 and 114 extend from eccentrics 115—116 which are fastened to the ends of shafts 117—118 rotatably mounted in suitable bearings carried by the reciprocating block 119, the said block being slidably mounted in the standard 120 which is attached to the table 14. The block 119 is advanced and retracted at the proper time (Figs. 1, 2 and 12) by means of a cam 121, roller 122, lever 123, and link 124 which is attached to an arm 125 carried by a shaft 126. The said shaft extends through the standard 120 and carries at its upper end an eccentric block 127 having an extension 128 which rides in a slot in the block 119. The rotation of the shaft 126 causes the advance and retraction of the block 119. After the block 119 has been advanced the proper distance, the shafts 117 and 118 are rotated which cause the pins 111, 112, 113 and 114 to travel in an arc-shaped path thus shaping the grid wires 27 and the filament wires 28, as shown in dotted lines in Fig. 13. The shafts 117 and 118 are actuated by cranks 129—130 to which are attached the links 131—132 pivotally connected to a crosspiece 133 which is carried by a plate 134 slidably mounted in the depending member 135 which is carried by the block 119. The plate 134 is reciprocated by means of the rod 136 attached thereto, the said rod being fastened to a crank arm 137 which is carried by a shaft 138 mounted in a bearing in the standard 139. The shaft 138 carries at its opposite end an arm 140 having a roller 141 which rides on the cam 142 mounted upon the main power shaft 21. The rod 136 after having been raised by the action of the cam 142 is returned by means of a spring 143 which is attached to the crank arm 137 and table 15. The grid and filament wires 27 and 28 being properly formed (as shown in Fig. 17) the pins 111, 112, 113 and 114 are rotated back to their normal position and the block 119 is withdrawn thus allowing the turret 10 to be advanced toward position A, which is the unloading position. As the turret 10 travels toward position A, the jaws 30—31 of the chuck 24 are unlocked and the steadying head 45 is raised out of the stem 25 in order that the operator may remove the completed stem.

The operation of the machine is as follows: At position A, B or C (Fig. 1) an operator places a stem (such as that shown in Fig. 14) in such a position in a chuck 24 that the outside wires 26 of said stem are gripped by a pair of jaws 30—31 pivotally mounted in said chuck, several of these chucks being mounted upon a rotatable turret 10. The turret 10 is then intermittently rotated in the direction of the arrow (Fig. 1) eventually reaching position C where it stops for a short interval during which the pair of pins 57 and 58 advance, contact with the wires 26, and shape them, as shown in Fig. 15. The pins 57 and 58 are then withdrawn and the turret 10 is rotated to position E where the lower portion of the wires 27 and 28 are cut off and the wire 29 is shaped by means of the cutting and shaping mechanism located at this position. When this operation is completed, the stem resembles that shown in Fig. 16, and is then rotated to position H. At this position the pins 111, 112, 113 and 114 are advanced to contact with wires 27 and 28 and are rotated to shape the wires as shown in Fig. 17. The pins are then withdrawn and the completed stem is rotated to position A where it is removed by the operator. A new stem is then inserted in the empty chuck and the cycle of operations is then repeated.

What we claim as new and desire to secure by Letters Patent of the United States, is:

1. In an automatic machine for shaping supports projecting from glass stems, the combination of a substantially horizontal movable carrier, a chuck for supporting one of said stems in a substantially vertical position mounted on said carrier, a shaping mechanism mounted adjacent to the path of travel of said chuck, and means whereby said mechanism is reciprocated substantially horizontally as said chuck registers therewith.

2. In an automatic machine for shaping supports projecting from glass stems, the combination of a substantially horizontal rotatable carrier, a chuck for supporting one of said stems in a substantially vertical position mounted on said carrier, a shaping mechanism mounted adjacent to the path of travel of said chuck, and means whereby said mechanism is reciprocated substantially horizontally as said chuck registers therewith.

3. In an automatic machine for shaping supports projecting from glass stems, the combination of a substantially horizontal movable carrier, a chuck for supporting one of said stems in a substantially vertical position mounted on said carrier, a shaping mechanism mounted adjacent to the path of travel of said chuck, means whereby said mechanism is reciprocated substantially

horizontally as said chuck registers therewith, a positioning means and means for causing the same to engage the stem during the operation of said shaping mechanism.

4. In an automatic machine for shaping supports projecting from glass stems, the combination of a substantially horizontal movable carrier, a chuck for supporting one of said stems in a substantially vertical position mounted on said carrier, a shaping and cutting mechanism mounted adjacent to the path of travel of said chuck, and means whereby said mechanism is reciprocated substantially horizontally as said chuck registers therewith.

5. The combination of a standard, a block slidably mounted thereon, a shaft carried by said block and rotatable therein, a shaping tool mounted on said shaft, means for causing said block to be advanced and retracted, means for rotating said shaft, and means for causing the aforesaid means to operate in a desired sequence.

6. In a shaping machine, the combination of a movable carrier having thereon a chuck for supporting a glass stem having a plurality of wires embedded therein and projecting longitudinally therefrom in substantially the same plane, a shaping means mounted adjacent to the path of travel of said wires and comprising movable pins and means properly timed with the movement of said carrier for causing said pins to be moved transversely of said plane into engagement with said wires and to be moved thereafter substantially parallel to said plane to bend said wires into a desired shape.

In witness whereof, we have hereunto set our hands this 3rd day of November, 1924.

ANTON RAUS.
ELMER B. ISAAC.