Oct. 27, 1931. V. J. VERPENT 1,828,884

WIRE BENDING MACHINE

Filed April 30, 1924 2 Sheets-Sheet 1

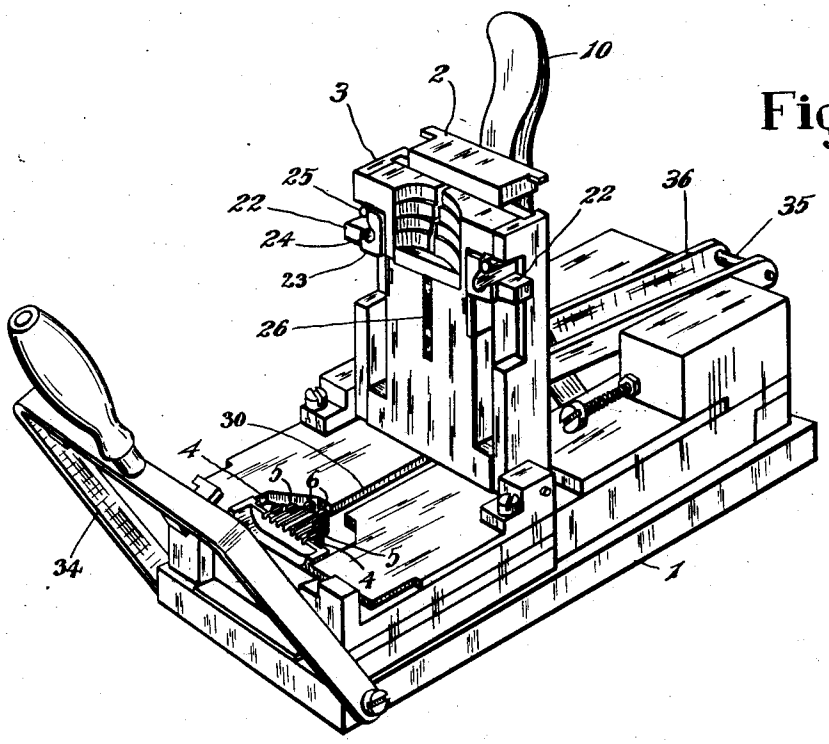


Fig. 1.

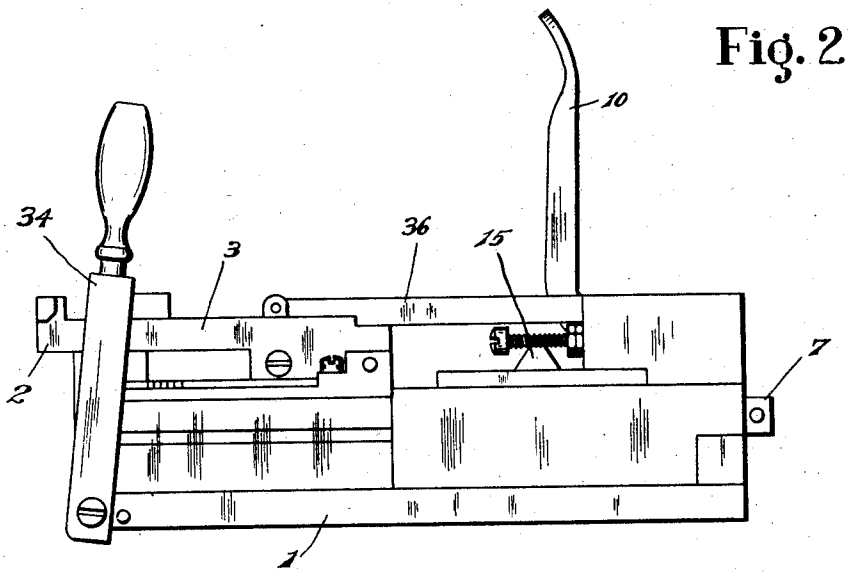


Fig. 2.

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Fig. 3.

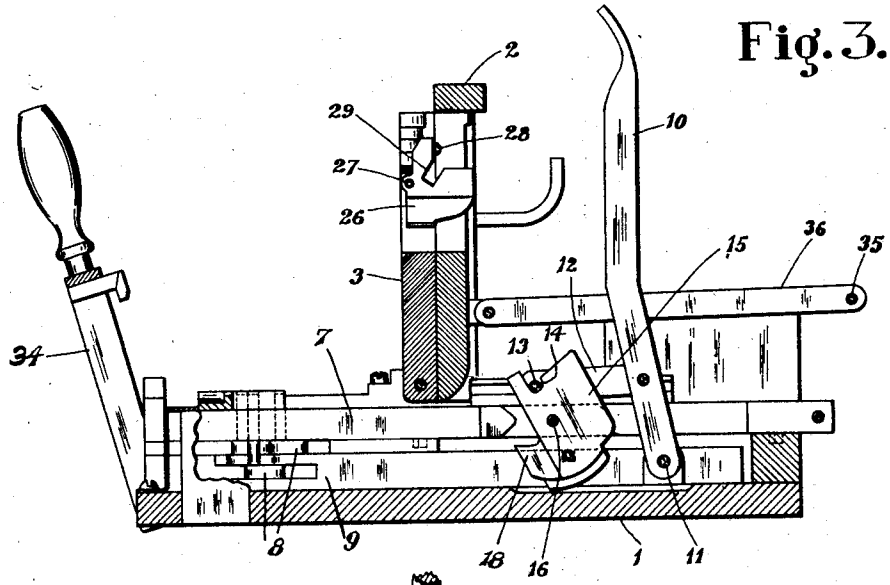


Fig. 4.

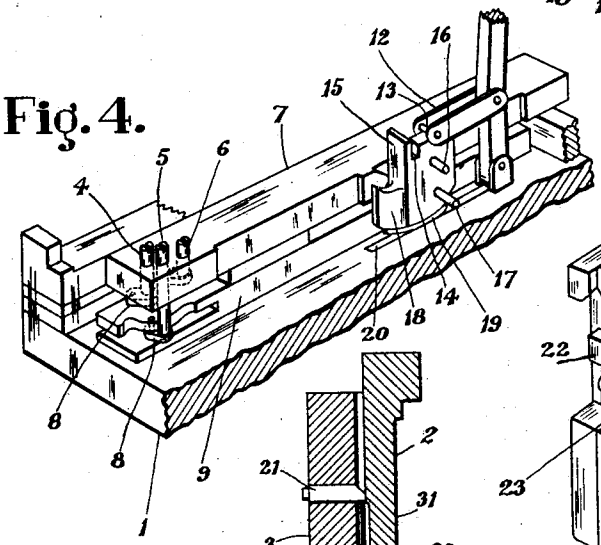
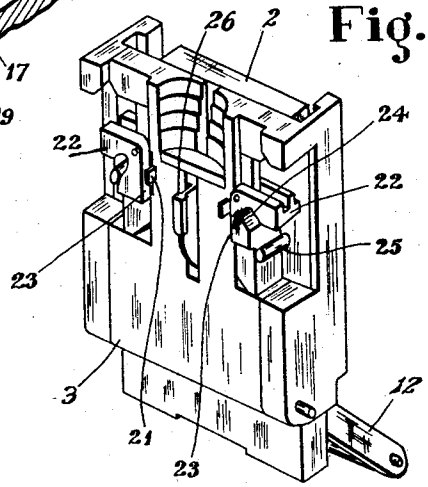


Fig. 6.

Fig. 5.



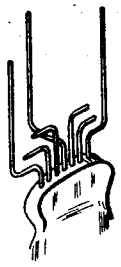


Fig. 7.

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UNITED STATES PATENT OFFICE

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WIRE BENDING MACHINE

Application filed April 30, 1924. Serial No. 709,963.

This invention relates to wire bending machines and more particularly to machines for bending the wires projecting from a stem of an electron discharge device. It is to be understood in order that the various parts of an electron discharge device may be accurately positioned with respect to each other that it is highly important that the wires which support said parts be bent to proper and exact position, and I have accordingly devised the machine constituting the present invention for that purpose.

The objects of the invention are to obtain a very exact bending of the supporting wires of an electron discharge device; to enable the wires to be bent with minimum operations; to obtain all the necessary bends in the wires before the stem is removed from the machine; to avoid strain on the stem in bending the wires; to provide a machine wherein the operations to be performed will not be confusing to the operator; to provide a compact structure and one which will not readily get out of order as well as one which is adapted to rapid operation; to secure simplicity of construction and operation, and to obtain other advantages and results as may be brought out in the following description.

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

Figure 1 is a perspective view of a machine embodying my invention showing the hinged clamp and slide in raised or inoperative position;

Figure 2 is a side elevation showing said clamp and slide in lowered or operative position;

Figure 3 is a central sectional view of the device as shown in Figure 1;

Figure 4 is a perspective view of a portion of the device as shown in Figure 3;

Figure 5 is a perspective view of the top clamp and slide;

Figure 6 is a sectional view showing a certain retracting holding member; and

Figure 7 is a perspective view of a stem with the wires bent by the machine.

In the specific embodiment of the invention illustrated in said drawings, reference numeral 1 indicates a fixed base upon which, at the forward end, is mounted a slide 2. Said slide is adapted to be moved longitudinally of the base and swung toward and from the same for which reason the slide is carried in a suitable slideway in a hinged member 3. If the slide 2 is in its forward position when hinged member 3 is swung down said hinged member 3 is free to be swung up or down, but when the slide is moved rearwardly the hinged member has to be in its lowered position and cannot be swung up until the slide is moved forward.

Beneath the forward end of the slide when the same is in its lowered position, are a plurality of pivotally mounted bending posts 4, 5 and 6 which are slotted transversely across their upper ends for receiving the wires to be bent. In the specific structure of electron discharge device for which the present machine is made, there are seven wires to be bent, for which reason I have shown six bending posts arranged in spaced relation to each other so as to bend each of the wires in offset relation to the others. As clearly shown in Figure 7 the bends in the wire are so the bends in the outside wires are nearest to the stem, the bends in the next to outside wires are a little further from the stem, and the bends in the two wires next to the center one are still further from the stem; all of these wires being in the same plane and bent outwardly with respect to the center wire. It is to be understood that the bending of these wires is accomplished while the hinged member of the slide is in its lowered position so the wires cannot get out of the slots in the bending posts.

After these six wires are all bent outwardly by the bending posts, the slide is moved rearwardly and operates certain mechanism to bend the two outside wires again in the plane of said wires and in the same general direction as where they issue from the stem, but offset therefrom as clearly shown in Figure 7. At the same time that these outside wires are being bent to provide the offset portions, the middle wire is being bent so as to provide an end portion which is offset from the plane of the remaining wires.

This completes the operations upon the wires, and the machine is then operated to return the slide to its original position without turning the bending posts back to their original positions. The slide and hinged member may then be swung upwardly and the stem and wires removed, after which the bending posts are returned to their original positions, and the machine is ready for operating upon another stem and wires.

The specific structure which I employ for operating the several mechanisms is preferably that shown in the drawings, but there are mechanical equivalents which may be substituted and which I contemplate in the present invention. The bending posts 4, 5 and 6 project upwardly through a support 7 above the base, said posts having merely a rotary motion in said support and prevented from longitudinal or lateral displacement therein. The invention contemplates the use of means for both rotating and revolving or swinging the bending posts 4, 5 and 6 simultaneously so as to give the said posts an eccentric movement in the direction of bending of the wires so as to enable the bending posts to follow around with the wire while bending the same and thus effect the bend without applying any strain to the stem. This is very important, because of the fact that the stem is of glass and of such a brittle character that it will break quite easily. In order to obtain this combined rotating and revolving or eccentric motion of the bending posts 4, 5 and 6, the lower ends thereof are provided with levers 8 fastened upon the posts and each set is in pivotal connection with a slide bar 9 so as to obtain a rotary and revolving motion of the posts by sliding said slide bar back and forth; (see Figure 4). It is to be noted I retain the slide bars against lateral displacement as the same are moved longitudinally, and provide for movement of the supports 7 in a direction perpendicular to the direction of movement of the slide bar. In other words, the slide bars move forwardly and rearwardly whereas the supports 7 move sidewise.

In order to operate the slide bars, I provide a handle 10 pivoted as at 11, at its lower end to the base and having pivoted between its ends a double link 12. Link 12 extends forwardly and has a cross pin 13 adapted to engage in a slot 14 in a cam lever 15 for swinging said cam lever 15 upon its pivot 16. Also extending through the cam lever 15 at a distance from the pivot 16 is another pin 17 which engages at its opposite ends in the slide bars so as to move the slide bars back and forth as the cam lever is swung upon its pivot. It may be here noted that the connection of the operating link with the cam lever is through the agency of a slot so arranged that the cam lever will be swung the proper amount and then the cross pin 13 will leave the slot and ride on the cam surface without any further turning effect on the cam lever. This enables the operating lever to be swung further than necessary and not require the lever to be brought up against a stop.

Actuation of the supports 7 is obtained at the front end by the rotation of the bending posts which obviously have to revolve about the pivotal mounting of the levers 8 at their lower ends. At the rear part of the supports 7 the same are actuated sidewise by means of a cam projection 18 on cam lever 15 which wedgingly introduced itself between the supports 7 at the same time it is operating the slide bar. Any suitable means, such as springs, may be employed for returning the supports 7 to their initial or normal position toward each other. In order that the supports 7 may spread apart sidewise and will provide a pivotal mounting for the cam member 15, the pivot 16 is preferably fast with respect to said cam member and slidable longitudinally of itself within the support. The cam member is prevented from lateral displacement by means of an arcuate ridge 19 along its lower edge, one portion of which is at all times within a groove 20 cut for the purpose in base 1. It is to be observed that the bending posts operate upon all but the center wire to give them an initial bond laterally.

In order to give the wires the secondary or final bend, the slide comes into play. Provided in the hinged member are a pair of holding members 21 which are normally retracted in the hinged member so as not to be in the way during the initial bending of the wires. Means are provided for ejecting the holding members 21, 21 after the initial bending and immediately before the secondary bending, said holding members being ejected so as to lie against the outside wires near where the bend is to be effected. Pivoted at the outside of the outside wires at substantially the point where the bend is to be made therein, are a pair of right angle bending members 22 having wire engaging surfaces 23. After the initial bend in the wire is made the wire projects laterally beneath the slide and hinged member and rests at one portion against the wire engaging surface 23 of the right angle bending member. At that time the retracting holding members 21 are ejected on the opposite side of the wire so that as the bending members are rotated from the position shown in Figure 1 to the position shown in Figure 5 the wire will be bent around the holding member in continued engagement with surface 23 of the bending member. In order to give the right angle bending member its rotary motion, I have shown the same slotted, as at 24 for receiving a pin 25 carried by the slide 2. The slot is open so that after the

pin has effected the required rotary motion of the bending member the bending member is held in position as the pin 25 passes along the outside wall of the bending member.

Simultaneous with the bending of the outside wires, I also bend the middle wire into a plane offset from the plane of the other wires. This is accomplished by means of a bending cam 26, pivoted as at 27, to the hinged member and adapted to project downwardly through the same. This cam is likewise operated by a pin 28 mounted in the slide and adapted to enter slot 29 in the cam. By this slot and pin engagement, the cam is rotated to the proper extent and thereafter the pin slides along the outside surface of the cam retaining the cam in its proper position. It is to be observed that the cam cooperates with a slot 30 in the top of the base portion 1 for forcing the wire downwardly into offset relation.

In order to operate the holding members 21 to be ejected and retracted as above described, I have shown said members slidably mounted, in Figure 6, in the hinged member with their inner ends projecting therethrough into engagement with the slide 2. The slide is provided with a slot 31 deep enough to permit the holding member to retract so the outer end will be flush with the hinged member. The end of the slot and the adjacent end of the holding member are both sloped so that when the two come together the ho'ding member will be forced out of the slot and thus slide so that its outer end will be ejected from the hinged member. When the slide is brought back so its slot registers with the holding member, the said holding member retracts under the influence of a spring 33.

In the operation of the device the wires are placed in the several bending posts 4, 5 and 6 clearly shown in Figure 1 after which the hinged member 3 is turned down which prevents the wires from coming out of the bending posts. A yoke 34 pivotally carried by the base is swung up to overlie the hinged member and prevent it from swinging up during the various manipulations upon the wire. Next handle 10 is swung all the way rearwardly which operates first to turn and spread the bending posts and thus obtain a righ' angle bend in the wires after which the handle comes into engagement with a cross pin 35 on a link 36 connected with the slide 2 of the hinged member 3. Continued swinging of handle 10 thereupon operates the bending devices of the hinged member which obtains a further bending of the outside wires and an offset bending of the middle wires. This completes operation upon the particular wires and the operator then draws forwardly on yoke 34 until the slide 2 returns to its initial position. It is to be observed that this operation does not return the handle 10 to its orignial position. The parts are so related that when the yoke is swung to its initial position and at such time only can the hinged member be swung upwardly past the yoke. After swinging the hinged member up the stem and wires are removed from the machine, which leaves the bending posts with their slots directed sidewise. The bending posts are now returned to their initial position by swinging handle 10 all the way forward thus preparing the machine to receive the next stem and wires.

Obviously detail changes and modifications may be made in the manufacture and use of my improved bending machine, and I do not wish to be understood as limiting myself to the exact structure shown except as set forth in the following claims when construed in the light of the prior art.

Having thus described my invention, I claim:

1. In a machine of the character described, the combination with a block having a series of grooves for supporting a plurality of wires, of means for initially and permanently bending said wires, means to retain said wires in said initial bending means and secondary bending means adapted to bend certain wires in the plane of all of the wires and simultaneously bend one of the wires out of said plane.

2. In a machine of the character described, the combination with a stationary support for a plurality of wires, of means for bending a portion of said wires in one direction and simul aneously bending the remainder of said wires in the opposite direction, and a handle adapted to be swung in one direction for effecting all of the bends by a single movement of said handle.

3. A machine for forming the supporting wires for a vacuum tube comprising means for bending wires in a plane, and means for bending one of the wires out of said plane, said means operating contemporaneously to effect all the bends by the movement of a single operating member.

4. A machine of the character described having a plurality of bending posts each post having a notch in its end, and means for simultaneously rotating and revolving said bending posts.

5. A machine of the character described comprising a plurality of bending posts having slots in the ends thereof, means for moving said bending posts and means for temporarily retaining the wires in said slots while the said wires are bent.

6. A machine of the character described comprising a plurality of bending posts having slots in the ends thereof for receiving wires, means for temporarily holding the wires in said slots, and means for rotating and revolving said bending posts.

7. A machine of the character described

comprising a plurality of notched bending posts adapted to receive and bend a plurality of wires said notches extending entirely across the ends of the posts, and other bending means for bending wires after the same have been bent by the bending posts.

8. A machine of the character described comprising initial bending means, a clamping member adapted to engage wires while the same are bent by said initial bending means, means for engaging against certain wires after the initial bend has been made, and means for bending said wires around said engaging means for obtaining a further bend in the wires.

9. A machine of the character described comprising initial bending means, a hinged clamp for retaining wires in said bending means, means for engaging and obtaining a secondary bending of the wires, and a slide for operating said secondary bending means.

10. A machine of the character described comprising initial bending means, a hinged clamp adapted to retain wires in said bending means, and secondary bending means carried by the hinged member adapted to bend certain wires in the plane of all of the wires and simultaneously bend one of the wires out of said plane.

11. A machine of the character described comprising means for bending the wires of an electron discharge device laterally in a single plane and one of the wires transversely out of said plane, and a handle adapted to be swung in one direction for effecting all of the bends by a single movement of said handle.

12. A machine of the character described comprising initial wire bending means, a clamp for retaining wires in said means while bending the wires, and means for preventing removal of said retaining means until the bending of the wires is complete.

13. A machine for bending wires of the character described having a plurality of notched bending members, and means for simultaneously rotating and revolving said bending members.

14. A machine for bending wires of the character described having a plurality of notched bending members and means for eccentrically revolving said members in opposite directions and simultaneously rotating said members.

15. A machine of the character described including means for giving a double bend to a first wire to provide said wire with two offset portions extending in opposite directions from an intermediate portion, said offset portions being in substantially the same plane and means for doubly bending another wire with two opposite portions in a different plane from the offset portions of the first wire.

16. A machine according to claim 15 in which the secondary bending of the said wires in different planes is effected simultaneously.

17. A machine of the character described including means for simultaneously bending a plurality of wires with the bends thereof in nested formation in the same plane, means for giving a secondary bend to one of said wires to provide said wire with an offset portion.

18. A machine of the character described including means for providing a first wire with two reverse bends intermediate its ends, all the portions of said wire being in the same plane, and means for providing a second wire with two reverse bends intermediate its ends, all the portions of said second wire being in a plane substantially perpendicular to that of the first wire.

In testimony whereof, I hereunto affix my signature this 24th day of April, 1924.

VICTOR J. VERPENT.