

May 13, 1941.

B. W. KINYON

2,241,602

HEATER WINDER

Filed March 30, 1940

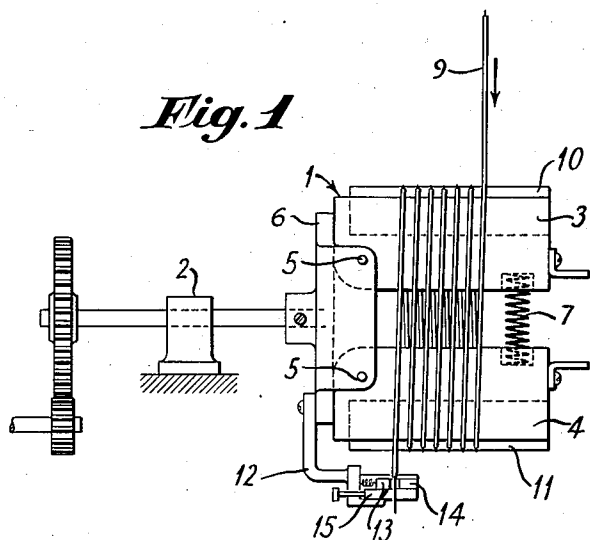


Fig. 2

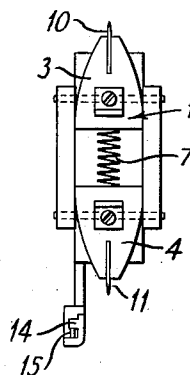


Fig. 3

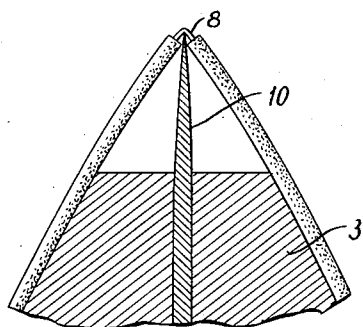
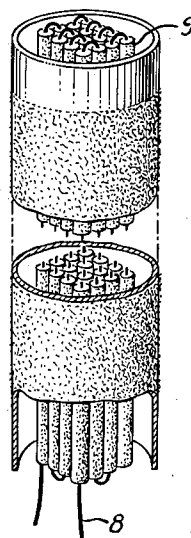


Fig. 4



INVENTOR.
BRICE W. KINYON
BY *Charles M. Clair*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,241,602

HEATER WINDER

Brice W. Kinyon, Bloomfield, N. J., assignor to
Radio Corporation of America, a corporation of
Delaware

Application March 30, 1940, Serial No. 326,844

4 Claims. (Cl. 140—71)

My invention relates to wire winding machines, particularly to machines for winding and folding strands of insulation coated heater wires for cathodes.

The heating element for an indirectly heated cathode sleeve often comprises a number of straight folds of insulation coated wire bundled into the sleeve with the two ends of the wire connected to an electrical heating source. The insulation on the wire is usually a brittle refractory insulating material, such as a ceramic of sintered aluminum oxide. The insulation is usually quite thick and in appearance resembles a solid ceramic cylinder with a fine wire along its center. As the tube is bent, it first cracks some place along the outside of the bend where the ceramic is under tension. The wire is then put under tension, and it must either break or the ceramic must crumble. If the ceramic crumbles it may shatter a considerable distance either side of the first crack and expose a long section of the wire. It is difficult to control the amount of insulation that may crumble away, and short circuits between the bare wire of adjacent folds are hard to prevent.

The object of my invention is to fold insulated wire and prevent breakage of the wire and short circuits between the wire at the bends.

Another object of my invention is an improved machine for winding and folding wire covered with brittle insulating material.

The characteristic features of my invention are defined in the appended claims and one embodiment of my improved machine is shown in the accompanying drawing in which Figures 1 and 2 are side and front elevations, respectively, of my novel wire winding mandrel for insulation coated wire, Figure 3 is an enlarged detailed view of insulated wire wound on my improved machine, and Figure 4 shows a cathode with a heater wound and folded according to my invention.

My wire winding or folding machine comprises a mandrel 1 rotatable in a journal 2 coaxial with the center line of the mandrel. The winding barrel of the mandrel is preferably lenticular in cross section and may comprise two jaws 3 and 4 hinged at 5 on the rotatable frame 6 so that the jaws may be collapsed to facilitate removal of wire wound on the mandrel. The jaws are biased outwardly by spring 7 against stops on the frame to hold the jaws in fixed spaced relation during winding. It is the purpose of the mandrel to make sharp bends in the wire as the wire is wound on the mandrel with uniform lengths of wire between the bends so that when a reel of the desired num-

ber of folds is removed from the mandrel the folds may be pressed together into a compact bundle and inserted in a cathode sleeve.

The heater wire 8 must be embedded in a rather thick coating or tube of insulating material 9. The insulating material of necessity must be refractory to withstand the high operating temperatures of the heater and is usually made of fused aluminum oxide or magnesium oxide particles sintered into a hard brittle mass on the wire. If the wire is bent on a fairly large radius of curvature the tube may crack any place along the bend and hence cause difficulty in locating the precise position of the bight in the folds. As the legs of the wire, on either side of the place where the tube first opens, are pressed together the pie-shaped opening in the break widens and stretches the wire. If the coating does not crumble away the wire is placed under such tension as to break the wire. Often large pieces of the coating are broken off, exposing a considerable length of the heater wire. A long length of exposed heater wire at the bight permits the two legs of the fold to spread and to interleave with other folds and hence short circuit the folds.

I propose according to my invention to bend the coated wire over a sharp edged ridge on the surface of the mandrel. The tension of the wire as it is reeled on to the mandrel is adjusted so that substantially no stress is placed on the coating except at the point where the coating comes in contact with the sharp edged ridges. In the particular machine shown the sharp edged ridges 10 and 11 are placed at the ends of the lenticular shaped mandrel so that the wire, as it passes over the mandrel, rides over the sharp cutting edge of the ridge. A knife blade may be set into the mandrel with its straight edge extending slightly beyond the winding surface of the mandrel. The blades should be sharp enough to nick or notch the insulation, yet must not be so sharp as to cut the wire pulled onto the mandrel at the reeling tension. A razor blade suitable for shaving may be used, but to prevent cutting of the wire, the blade should be dulled slightly. The extent of dullness or width of the face of the blade should not exceed approximately the diameter of the wire.

One typical insulated heater wire is a tungsten or molybdenum wire about 1.5 mils in diameter embedded in the center of a rather solid aluminum oxide tube 10 to 12 mils in diameter. It appears the knife or cutting edge nicks the ceramic tube and accurately determines the place where the ceramic will first break when the side of the

ceramic cylinder first comes in contact with the sharp edge. As the thick walled ceramic tube is bent over the edge the ceramic crumbles away against the side of the blade leaving the end of the ceramic tube substantially flat and normal to the axis of the tube. Sufficient of the ceramic is removed and wire exposed to permit the two legs of the fold to be pressed together without stretching the wire. The exposed wire on the other hand is short enough to pull the legs snugly together as they are folded and to hold them together and prevent interleaving of the legs of the several adjacent folds. The exposed wire of each fold, as shown in Figure 4, is a short rigid loop that will not move into contact or short circuit other folds in the sleeve. The clean square break in the insulation distinguishes the bight from the non-uniform ragged break in the insulation of wire wound on the conventional square cornered drum. It is my belief that the sharp edge of the bending ridge slightly nicks the refractory coating and localizes the break, much in the manner a glass rod may be broken at a given point, by notching the rod with a file.

According to another feature of my novel winding machine, a clamp is provided for holding the end of the wire as it is wound on the mandrel. The bracket 12, shown in Figures 1 and 2, carries a spring pressed jaw 13 in registry with an anvil 14 for gripping the end of the wire. When the jaw 13 is withdrawn and allowed to snap against the coated wire on the anvil the coating is crushed and the wire effectively cleaned for welding or brazing purposes. The wire may be cut with a shearing tool 15 guided along the side of the jaw 13. The movement of the wire holding jaws, the shear, and the jaws of the mandrel may for automatic winding be actuated by levers driven in synchronism with the mandrel. For simplicity of illustration, however, manual

actuating means for the various moving parts has been shown.

My improved wire winding and folding machine is simple to operate and effectively folds brittle insulated wire without breakage and with uniform evenly spaced folds.

I claim:

1. A wire winder comprising a cylinder rotatable on its own axis, a plurality of sharp-edged ridges above the winding surface of the cylinder extending lengthwise of the cylinder, said ridge having a cutting edge of a width less than approximately the diameter of the wire to be wound, and said ridges being spaced predetermined distances apart to accurately place spaced bends in wire wound on the mandrel.

2. A winder for wire comprising a mandrel, said mandrel being lenticular in cross section in a plane transverse to the axis of the mandrel, the mandrel at the places of minimum radii of curvature being sharpened to a cutting edge longitudinally along the side of the mandrel to make accurately placed sharp bends in wire wound on the mandrel.

3. A winding machine for wire covered with a ceramic coating comprising a mandrel, means on the surface of the mandrel for bending the wire at spaced points and for accurately predetermining the extent of breakage and shatter of said coating at said points comprising a knife-edged ridge on the winding surface of the mandrel.

4. A machine for bending wire covered with a brittle coating, comprising a mandrel, a ridge along the side of said mandrel, said ridge being sharp enough to notch said coating and localize the shatter of the coating as the wire is drawn over the ridge.

BRICE W. KINYON.