

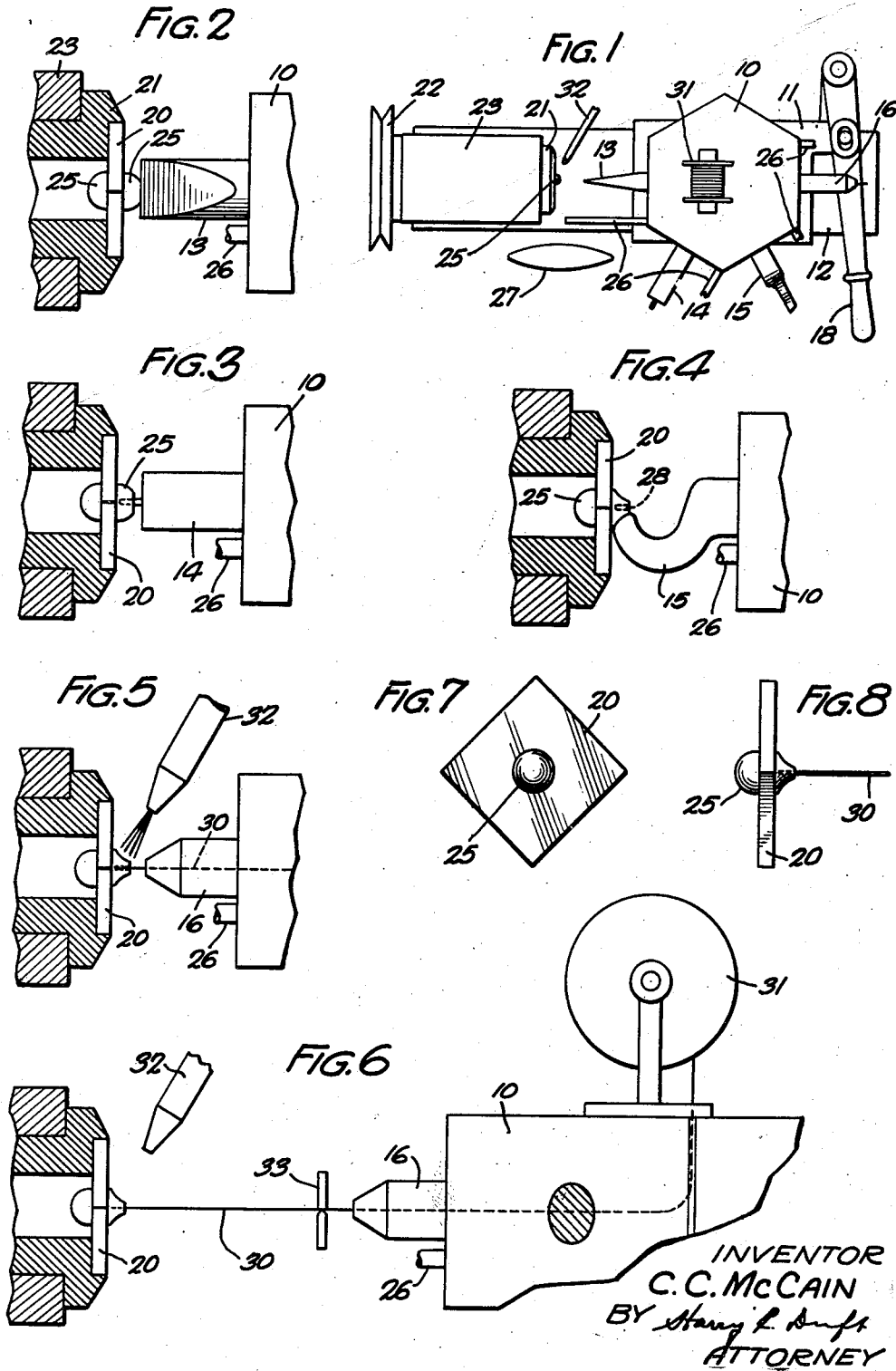
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METHOD OF WORKING AN ARTICLE

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METHOD OF WORKING AN ARTICLE

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This invention relates to a method of working an article, and more particularly to a method of attaching lead wires to quartz frequency control crystals.

In the manufacture of quartz frequency control crystals for use in certain types of electric communication equipment, it is sometimes desirable that a lead wire be securely attached to either side of the crystal. It is sometimes the practice to solder this wire to the crystal and it is desirable then that the amount of solder be kept at a minimum and that the solder be centered perfectly with respect to the crystal so as not to impair the operating characteristics of the crystal. With small crystals some difficulty may be experienced in securely attaching the lead wire to the crystal due to the failure of the solder to engage a sufficient area of the lead wire.

An object of the present invention is to provide an efficient and effective method of attaching lead wires to quartz frequency control crystals.

In accordance with one embodiment of the present invention, a spotted and plated crystal, which has been provided with a pellet of solder fused to the spot on either side of the crystal, is placed in a rotatable collet mounted on a turret lathe. Shaping tools at the several stations of the turret form the solder to the desired shape and size, and drill a recess in the solder to receive the lead wire. Heat is then applied to fuse the solder to the wire and a knife actuated to sever the wire from the supply.

Other objects and advantages of the present invention will be apparent from the following detailed description taken in conjunction with the drawing, wherein:

Fig. 1 is a schematic plan view of an apparatus constructed in accordance with this invention.

Fig. 2 is an enlarged fragmentary view showing one of the shaping tools in contact with the solder pellet;

Fig. 3 is a view similar to Fig. 2 showing the drilling tool in contact with the pellet;

Fig. 4 is a view similar to Fig. 2 showing another shaping tool in contact with the pellet;

Fig. 5 is a view similar to Fig. 2 showing the lead wire feeding device;

Fig. 6 is a schematic side view showing the heating and severing means;

Fig. 7 is an enlarged view of a plated and spotted crystal having a pellet of solder fused thereto, and

Fig. 8 is a side view showing a lead wire attached to one side of a crystal.

It is particularly desirable that the minimum

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amount of solder be used in soldering the lead wire to the crystal which will securely fasten it thereto. Where a small pellet of solder is attached to the wire, the wire placed in contact with the crystal and heat applied, the pellet, because of surface tension, tends to assume a spherical shape, thus presenting a relatively smaller contact area to the crystal and to the wire proportionately to the amount of solder used than if the solder pellet is cone shaped. It will also be apparent that even though the base of the solder pellet tends to be flattened when in contact with the crystal, considerable excessive solder will be present over the amount that would be required to form a bond with the lead wire. By forming a cone of solder having a suitable recess formed therein to receive the lead wire in accordance with the present invention, a minimum amount of solder may be used, and the solder used is deposited over the lead wire and the crystal to serve as a bond therebetween to the best advantage.

Referring now to the drawing and particularly to Fig. 1, an apparatus is there shown for attaching a lead wire 39 to a crystal 20 comprising a turret 10 revolvably mounted on a base 11 which is in turn reciprocally positioned on a lathe base 12. The turret is provided with three shaping and forming tools 13, 14 and 15, which are rigidly fixed thereto, and a wire dispensing tool 16, also fixed thereto. The tools are moved into and out of operative position by a lever arm 18 which may be pivotally mounted on the lathe base and is attached to the base 11 of the turret. During the operation of the apparatus, the tools remain stationary while the crystal 20 is rotated in engagement with each of the tools successively. The crystal is clamped between the jaws of a square jawed collet 21, which is rotated by a pulley 22 associated therewith. The collet and the pulley are supported on a housing 23 which is fixed to the lathe base 12.

In the operation of this apparatus, a crystal 20, which has been previously spotted and plated and provided with a pellet of solder 25 on either side as shown in Fig. 2, is clamped between the jaws of the collet and the pulley rotating means (not shown) actuated. The first tool 13, which comprises a cutting tool designed to reduce the height of the solder pellet to the desired degree, is then moved into engagement with the pellet. Stop members 26, attached to each face of the turret, limit the forward motion of the turret, thus controlling the depth of cut of the tool 13 as well as of the other tools as they are used.

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The cutting tool 13 not only serves to reduce the height of the pellet but also provides the pellet with a somewhat flattened surface, as shown in Fig. 3, which facilitates the next operation in which the turret is rotated to move the drilling tool 14 into operating position. A recess 28 is formed by this tool in the pellet which extends almost through to the crystal and which is of sufficient size to receive the lead wire.

The pellet is then formed into a conical shape by a second cutting tool 15, shown in Fig. 4. This tool cuts away the solder to form a cone shaped pellet having sides curving slightly inwardly. The depth of cut of this tool is adjusted to leave a small raised portion 28 on the crystal at the point at which it engages the crystal rather than to level the solder even with the crystal. In this way, a somewhat stronger bond is obtained and the possibility of the tool injuring the surface of the crystal is eliminated.

In the next step, the wire feeding tool is moved into operating position and the end of a lead wire 30 inserted in the recess 28 formed in the pellet by the tool 14. As shown in Fig. 6, the lead wire may be supplied from a reel 31 mounted on the top of the turret 10. No wire advancing means is necessary since the wire is not severed close to the end of the feeding tool 16, but rather is severed a sufficient distance from the end to leave a sufficient length of wire extending therefrom to be easily inserted in the recess in the solder pellet. When the wire feeding tool has been advanced to the position shown in Fig. 5, heat is applied by means such as a hot air jet 32 to fuse the solder to the lead wire. The operation is observed through a magnifying glass 27 and only sufficient heat is applied to fuse to solder without causing it to lose shape. The turret 10 is then withdrawn, withdrawing the feeding device. However, since the wire is now attached to the pellet, it will be apparent that as the turret is withdrawn, wire will be pulled through the feeding tool 16.

As a final step, a knife 33 is actuated to sever the lead wire attached to the crystal from the wire supply. The crystal is then removed from the collet, turned around and the several operations just described performed on the second pellet of solder, and then the lead wire attached thereto.

While but one embodiment of this invention has been shown and described, it will be understood that many changes and modifications may be made therein without departing from the spirit or scope of the present invention.

What is claimed is:

1. A method of attaching a lead wire to a crystal comprising fusing a pellet of solder to a crystal, shaping said pellet to the desired height,

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drilling a recess in said pellet to receive a lead wire, forming said pellet into a substantially conical shape, inserting a wire in said recess, and fusing said pellet to said wire.

2. A method of attaching a lead wire to a crystal comprising fusing a pellet of solder to said crystal, forming said pellet into a substantially conical shape having a recess therein, inserting a lead wire in said recess and fusing said lead wire to said pellet.

3. A method of attaching a lead wire to a crystal comprising fusing a pellet of solder to said crystal, flattening the pellet a predetermined distance from the crystal, forming said pellet into a substantially conical shape having a recess therein, inserting a lead wire in said recess, and fusing said lead wire to said pellet.

4. A method of attaching a lead wire to a crystal comprising fusing a pellet of solder to a crystal, forming a recess in said pellet to receive a wire, shaping said pellet to a substantially conical form, inserting a wire into said recess, and fusing the pellet to the wire.

5. A method of attaching a lead wire to a crystal comprising bonding a pellet of solder to a crystal, forming a recess in said pellet of solder, removing a portion of the solder around said recess to form a pellet of substantially conical shape, inserting a wire into said recess, and fusing the pellet to the wire.

6. A method of attaching a lead wire to a crystal comprising fusing a pellet of solder to a crystal, forming a recess in said pellet of solder, forming said pellet into a substantially conical shape, inserting one end of a length of wire into the recess, fusing said pellet of solder to the wire, and severing the wire at a predetermined spaced distance from the crystal.

7. A method of attaching a lead wire to a crystal comprising fusing a pellet of solder to a crystal, removing the end portion of the solder to provide a flat surface parallel with the crystal, forming a recess in said pellet of solder, removing a portion of the solder around the recess to shape the pellet into a substantially conical form, inserting a wire into said recess, and fusing said pellet to said wire.

8. A method of attaching a lead wire to a crystal comprising fusing a pellet of solder to a crystal, removing the end portion of the solder to provide a flat surface parallel with the crystal, forming a recess in said pellet of solder, removing a portion of the solder around the recess to shape the pellet into a substantially conical form, inserting one end of a wire into said recess fusing said pellet of solder to the wire, and severing the wire at a predetermined spaced distance from the crystal.

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