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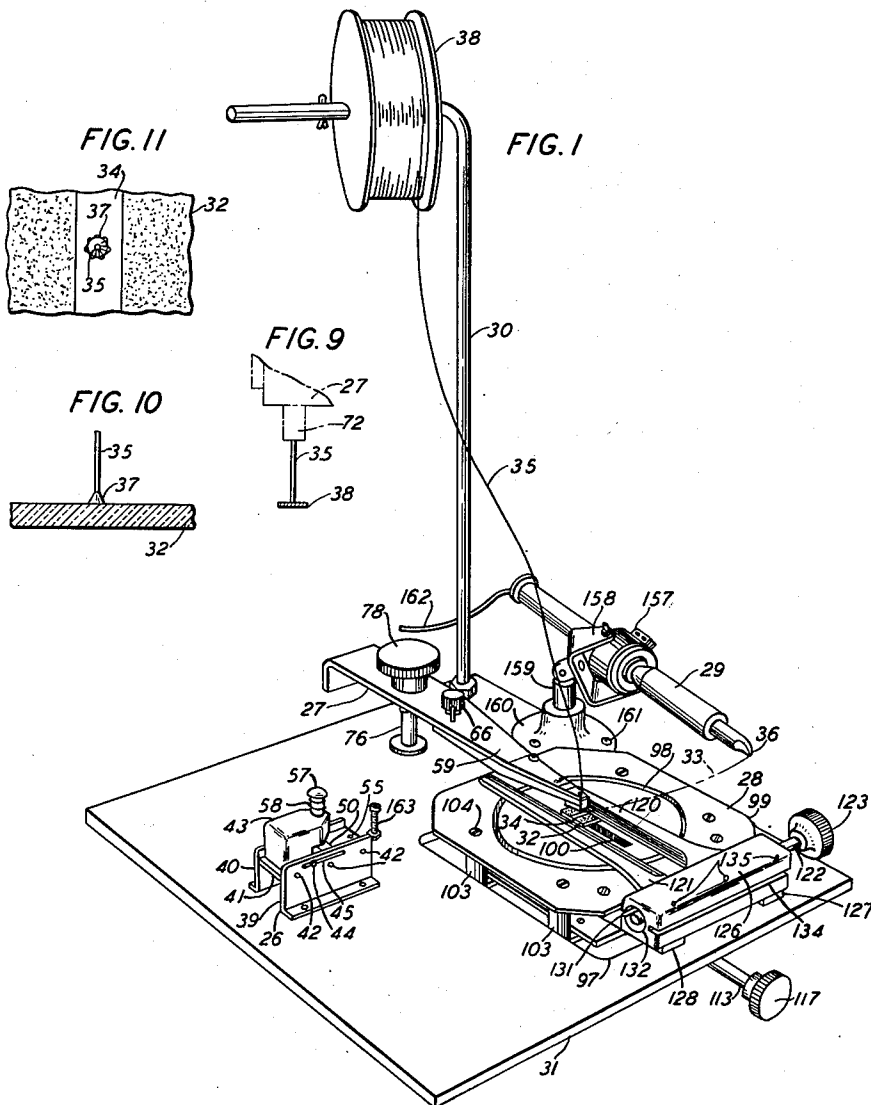
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2,327,715

PUNCH DEVICE

Original Filed May 8, 1941

2 Sheets-Sheet 1



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PUNCH DEVICE

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4 Claims. (Cl. 164—86)

This invention relates to a punch device suitable for stamping out discs from sheet material.

The punch device may be used in carrying out a method of making solder connections described in my copending application W. E. Ingerson, Serial No. 392,505, filed May 8, 1941, now Patent No. 2,308,606, issued January 19, 1943, and of which the present application is a division.

The method above mentioned may be employed in solder-connecting a wire to a metal surface provided on a piezoelectric crystal. In practicing the method the crystal with a solderable metal surface thereon is placed on a hot plate device arranged to hold the crystal in a required position and heating the crystal to a required temperature. A disc of solder of predetermined size and form is punched out from sheet solder by means of the punch device and is held in a receptacle provided in the punch device. The end of the wire is thrust into the disc of solder so that the disc is impaled on the end of the wire. The disc of solder is carried by means of the wire from the punch device and to a required point of connection on the metal surface of the crystal, a suitable flux being applied to the wire, the disc of solder and to the metal surface on the crystal at the required point of connection. A heated tool is applied to the disc of solder to raise the temperature of the disc of solder to its melting point. The heated tool is then removed and the material in the disc of solder forms a solder connection which connects the wire to the metal surface on the crystal.

The present application covers the punch device employed in stamping out the disc of solder.

In the drawings:

Fig. 1 is a view in perspective of the apparatus employed in making the solder connection, the apparatus parts being mounted on a support in a convenient arrangement for use;

Fig. 2 is a side elevational view of the punch device used in making the disc of solder and shows two positions of a movable punch head;

Fig. 3 is an end view of the device shown in Fig. 2 and shows two positions of the plunger;

Fig. 4 is a top view of the punch device;

Figs. 5, 6 and 7 are enlarged views, partly in section, of portions of the punch device with a piece of sheet solder therein and showing three positions taken by the plunger;

Fig. 8 is an enlarged side view, partly in section, of a portion of a chuck device, a portion of the punch device and with a wire held in the chuck device and inserted in the punch device;

Fig. 9 shows a fragmentary portion of the

chuck device with a wire held therein and a disc of solder picked up by the end of the wire;

Fig. 10 shows a portion of a crystal with the wire solder-connected thereto; and

Fig. 11 is a top view of the parts shown in Fig. 10.

In solder-connecting a wire of relatively fine gauge to a metal surface provided on a piezoelectric crystal, it is important that the wire be connected at the particularly desired point on the crystal. Also that the solder connection made is of a predetermined size and form and is sufficiently strong to permit use of the wire as a supporting means for the crystal. It is also important that the wire be not sufficiently affected by the heat applied in making the solder connection as to cause embrittlement or annealing of the wire and that the crystal be not subjected to reactive forces or thermal gradients sufficient to cause fracturing of the crystal.

The apparatus shown in the drawings is constructed and arranged to make solder connections in accordance with the method covered in my copending application W. E. Ingerson, Serial No. 392,505, filed May 8, 1941, and as shown in Fig. 1 comprises the punch device 26, a chuck device 27, a hot plate device 28, a heated tool 29, and a reel support 30, all of which are mounted on a suitable support 31. The hot plate device 28 is shown as supporting a crystal 32. The wire 35 is held in the chuck device 27 so that the disc of solder on the end of the wire is in contact with the strip 34 of metal on the crystal, and the course of the heated tool 29 is shown by the dot-dash line 33.

In practicing the method briefly outlined above, a disc of solder of predetermined size and form is stamped out by means of the punch device 26 and is held in a receptacle formed in the punch device 26. The crystal 32 with the metal strip 34 thereon is placed on the hot plate device 28 and is adjusted on the hot plate device to a required position. An end portion of the wire 35 is threaded through jaws of the chuck device 27 and so that a required length of the wire 35 projects below the jaws of the chuck device. A suitable flux is applied to the downwardly projecting end portion of the wire and this end portion of the wire is then brought into contact with a predetermined point on the metal strip 34 and so that some of the flux will be deposited on the metal strip 34. The chuck device 27 is then rotated to bring the downwardly projecting end of the wire 35 in register with the receptacle provided in the punch device 26 con-

taining the disc of solder. The jaws of the chuck device 27 are operated to hold the wire and the end of the wire is thrust into the disc of solder so that the disc of solder is impaled on the wire and frictionally held and centrally located on the end of the wire. The chuck device 27 is then rotated back to a position over the crystal 32 and the disc of solder is brought into engagement with the flexed portion of the metal strip 34. The heated tool 29 to which solder will not adhere is then operated to bring its hot point 36 into contact with the disc of solder. The heat from the tool 29 melts the disc of solder so that the disc of solder will form a solder connection between the end of the wire 35 and the metal strip 34. Since the end of the wire 35 was previously treated with a suitable flux, the molten material obtained by heating the disc of solder will have a tendency to flow upwardly along the wire 35 and will solidify on the end of the wire 35 in the form of a cone 37, when the heat is removed. The cone-shaped solder connection 37 obtained is shown in Fig. 10. Fig. 9 shows the disc 38 of solder impaled on the end of the wire 35 before the disc is melted to obtain the solder connection 37. The hot plate device 28 is equipped with heating means and is maintained at a temperature slightly below the melting point of the solder disc 38 so that the crystal 32 will be maintained at an elevated temperature during the making of the solder connection. This prevents fracturing the crystal 32 when the solder connection is being made, since maintaining the crystal at the elevated temperature reduces the reactionary effect upon application of the heated tool 29 to the crystal 32. After the solder connection is made, the wire 35 may be severed at a predetermined point to leave a portion of the wire solder connected to the crystal as shown in Fig. 10.

A suitable supply of the wire 35 is contained on the spool 38 which is rotatably mounted on the reel support 30.

Punch device

The punch device 26, as shown in drawings 1 to 8, comprises a pair of spaced upright supports 39 and 40, a horizontal plate 41 supported between the plates 39 and 40 by means of the screws 42 and a reciprocating punch head 43 slidably supported on the horizontal plate 41. The punch head 43 may be manually slid along the plate 41 to required positions and is held against dislodgement from the plate 41 by means of screws 44 which extend through elongated apertures 45 in the plates 39 and 40. Two extreme positions taken by the punch head 43 are shown in Fig. 2, the full line position being the position taken by the punch head 43 when the punch device is used in punching out a disc 38. The punch head 43 is apertured at 46 to accommodate a plunger device 47 on the lower end of which is supported a punch 48. The punch 48, as shown in Figs. 3 to 8, is adapted to punch out a disc 38 of predetermined size and form from a sheet 49 of solder foil. The punch head 43 may be made in the form of a block and is transversely slotted at one end to provide an operating space 50 in which the strip 49 may be fed under the punch 48. A die 51 is supported in the punch head 43 directly below and in register with the punch 48, the die 51 having an aperture 52 provided therein to slidably receive the punch 48 so that the die 51 and the punch 48 may be used in cooperation to punch out the disc 38 from

the strip 49 of solder. The upper end of die 51 extends upwardly within the space 50 so that a portion of the sheet 49 must be slightly elevated to pass over the upper portion of the die 51 as shown in Figs. 3 to 8. Two guide pins 53 are mounted in the punch head 43 and extend into the operating space 50, the guide pins 53 being mounted in spaced relation and having downwardly extending ends 54 extending below the upper level of the die 51. The horizontal plate 41 is apertured at 55 directly below the lower end of the die 51. The aperture at 55 is of such form and dimensions that it will accommodate the disc 38 stamped out from the sheet 49. A plug 56 is provided in the aperture 55 and in order to form a receptacle for the disc 38 the upper end of the plug 56 is spaced below the upper surface of the plate 41, a sufficient distance to accommodate the thickness of the disc 38. As shown in Fig. 2, the punch head 43 may be manually slid along the plate 41 from the dot-dash line position to the full line position shown in this figure, the extent of travel being limited by the screw 44 operating in the slot 45. When the punch head 43 is in the full line position, the punch 48 and the die 51 are directly over and in register with the aperture 55 provided in the plate 41. In this position the plunger 47 may be manually operated to press the punch 48 through the sheet 49 and the die 51 to punch out a disc 38 from the sheet 49, the disc 38 being deposited in the aperture 55 and resting on the top of the plug 56 in the horizontal plate 41. After the disc 38 has been punched out and pressure is released from the knob 57 provided on the top of the plunger 47, and the plunger 47 has been returned to its elevated position by means of the spring 58, the punch head 43 may be slid along the plate 41 to the dot-dash line position shown in Fig. 2. Fig. 5 shows the punch 48 in its elevated position; Fig. 6 shows the punch 48 thrust through the sheet 49 and carrying the disc 38 downwardly within the die 51; Fig. 7 shows the disc 38 deposited on top of the plug 56 where it will remain during the sliding back of the punch head 43 and until it is picked up on the end of the wire 35 shown in Figs. 1, 8, and 9. It will be seen by looking at Figs. 3 and 5 that the sheet material 49 passes over the upper edges of the supports 39 and 40 and under the portions 54 of the pins 53 and then over the upper end of the die 51 and that by reason of the frictional engagement of the sheet material 49 with the parts mentioned, the sheet material 49 is held in sufficient tension across the upper end of the die 51 to permit punching out of the disc 38 by means of the punch 48. After a disc 38 has been punched out from the sheet material 49, the sheet material 49 may be moved across the upper end of the die 51 to obtain a new area for punching out another disc 38.

When the disc 38 has been punched out from the sheet material 49 and is resting on the plug 56 and the punch head 43 is moved to the dot-dash line position shown in Fig. 2, the disc 38 may be picked up on an end of the wire 35 held in the chuck device 27 as shown in Fig. 8 by bringing the end of the chuck device 27 and the wire 35 over the disc 38 and then by pressing downwardly on the free end of the chuck device 27 to thrust the wire 35 into the disc 38.

Reference may be had to my copending application W. E. Ingerson, Serial No. 392,505, filed May 8, 1941, for an explanation of parts shown

in the drawings and not specifically described in the present application.

What is claimed is:

1. A punch device comprising a plate, a punch head, a plunger type punch and die, mounted in said punch head, adapted to be used in cooperation to punch out a disc from sheet material, a receptacle provided in said plate to receive the disc, said receptacle being of such form and dimensions that it will hold the disc in a required precise position in said plate and said punch head being movable along said plate to carry said punch and die into and out of registry position relative to said receptacle.

2. A punch device comprising spaced upright supports, a plate supported between said supports, a receptacle formed in said plate, a punch head supported on said plate, a punch and a die supported in said punch head and cooperatively operable to punch out a disc from sheet material and deposit the disc in said receptacle, said receptacle being of a form closely corresponding to that of the disc and so that the disc will be held in a required position in said plate and said punch head being movable along said plate to carry said punch and die into and out of registry position relative to said receptacle.

3. A punch device comprising spaced upright supports, a plate supported between said supports and disposed below the upper ends of said supports, a receptacle formed in said plate, a punch head supported on said plate, a punch and a die

supported in said punch head and operable in cooperation to punch out a disc from sheet material, spaced fingers supported in said punch head and extending below the upper ends of said supports and below the upper end of said die and on opposite sides of said die and in spaced relation with said upright supports, said fingers and the upper edges of said supports cooperating to frictionally hold the sheet material from movement across said die when said punch is being operated against the sheet material, said receptacle being of such form and dimensions that it will hold the disc in a required position in said plate and said punch head being movable along said plate to carry said punch and die into and out of registry position relative to said receptacle.

4. In a soldering apparatus of the type described, a punch device comprising spaced supports, a plate supported on said supports, a punch head slidably supported on said plate, a plunger type punch and a die mounted in said punch head and adapted to be used in cooperation to punch out a disc of solder from a sheet of solder placed across said die, a receptacle provided in said plate to receive the disc of solder and said punch head being adapted to be moved along said plate to carry said punch and die into and out of registry position relative to said receptacle.

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