

April 15, 1952

A. FERMANIAN ET AL

2,593,286

PUNCHING AND APPLYING APPARATUS

Filed April 7, 1949

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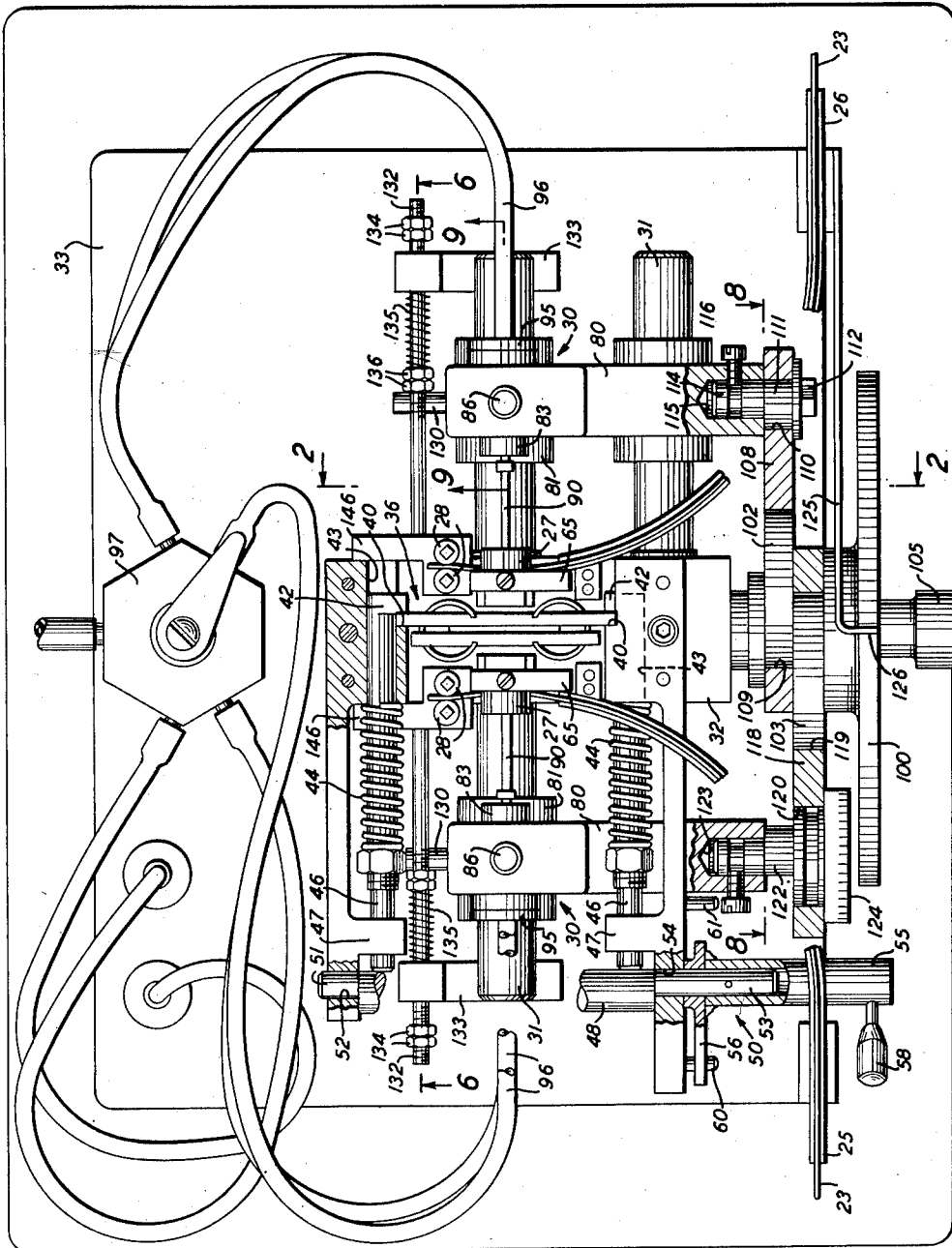


FIG. 1

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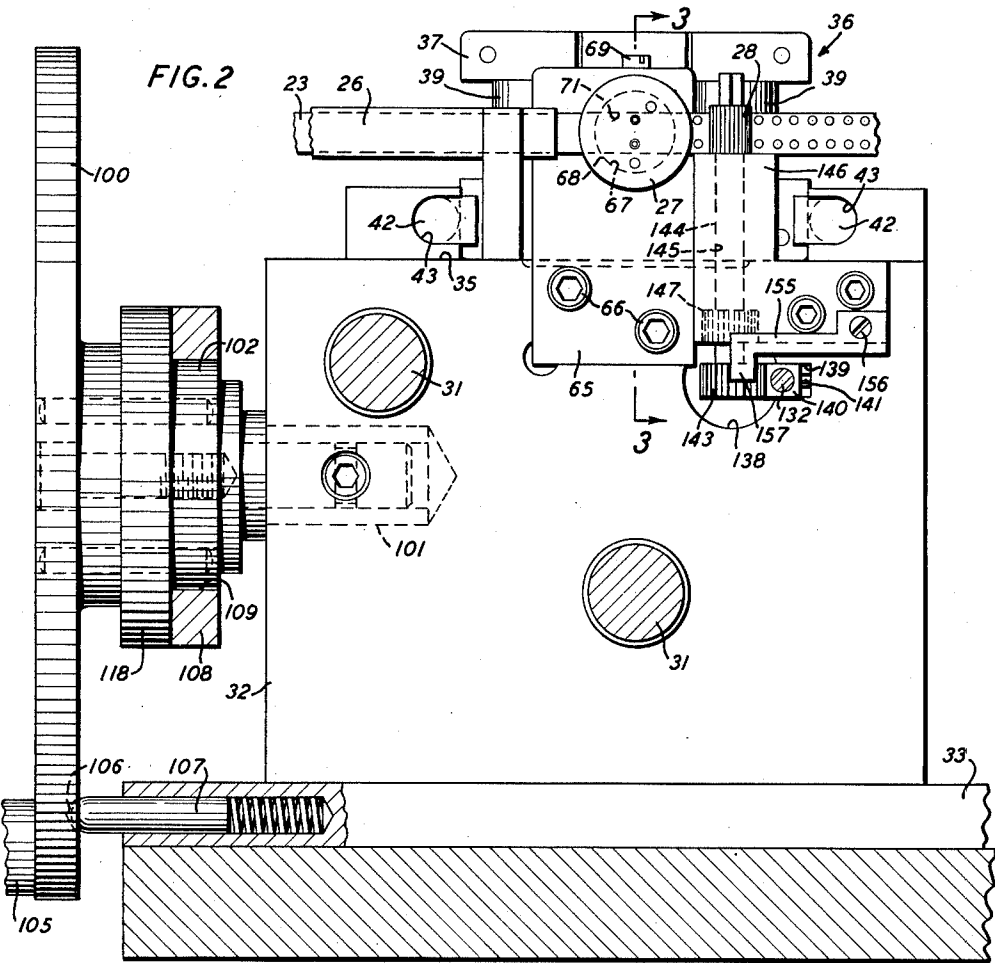
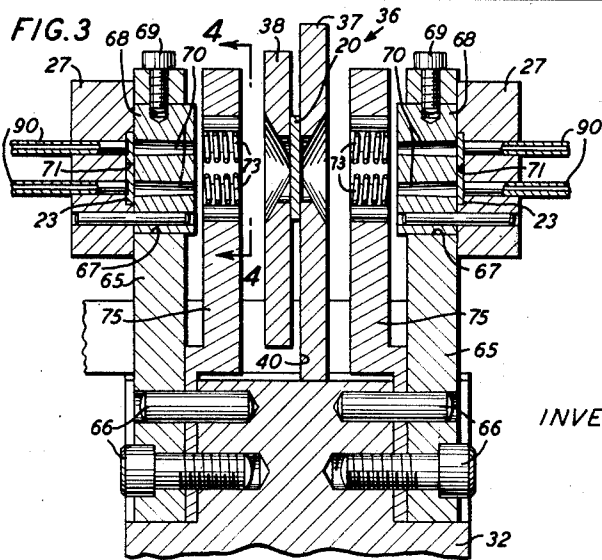
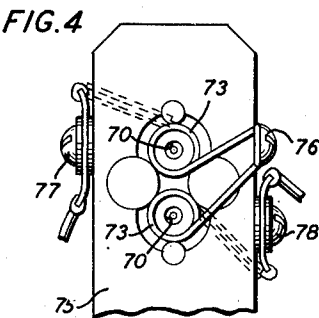
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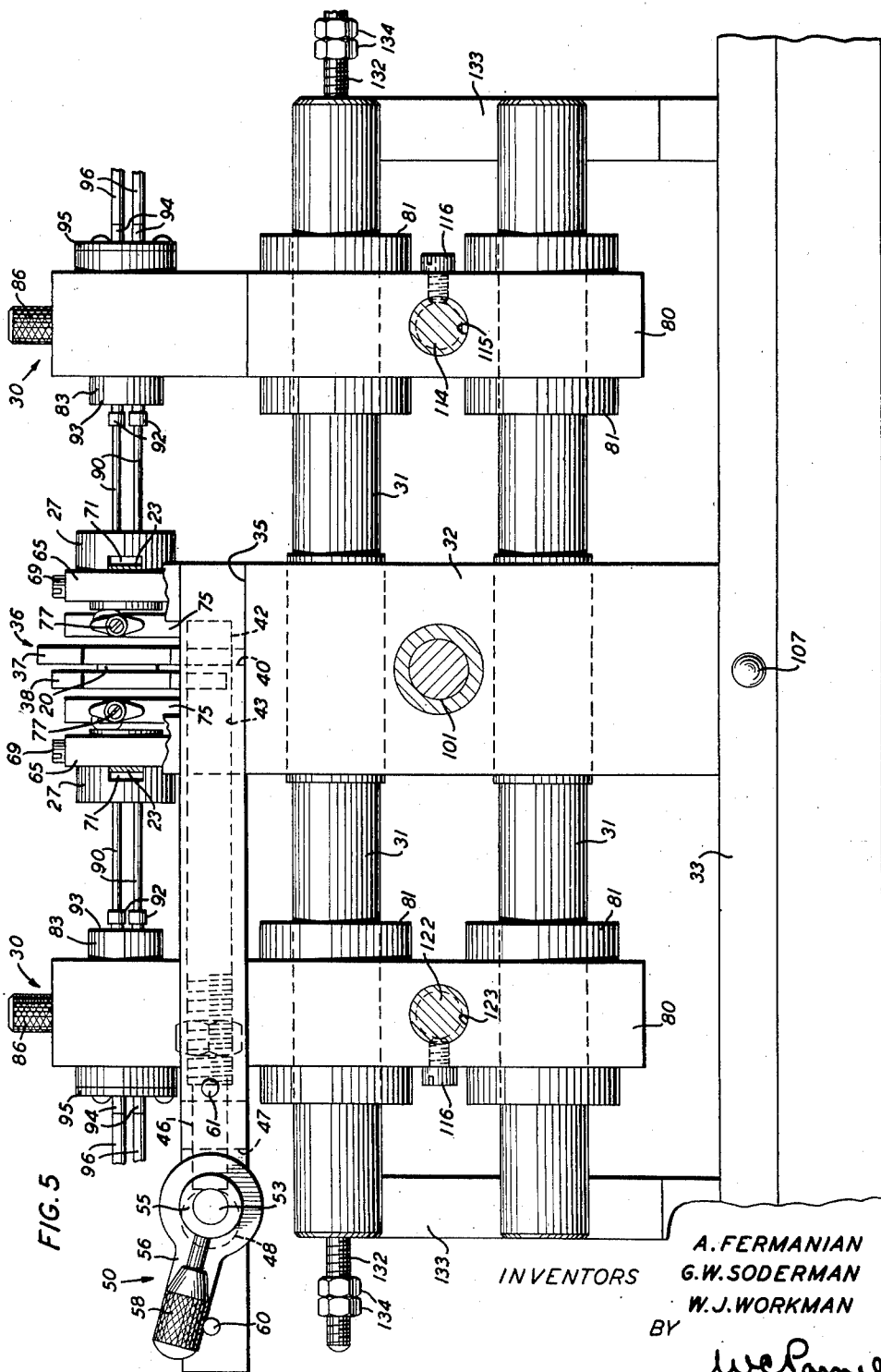
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5 Sheets-Sheet 5

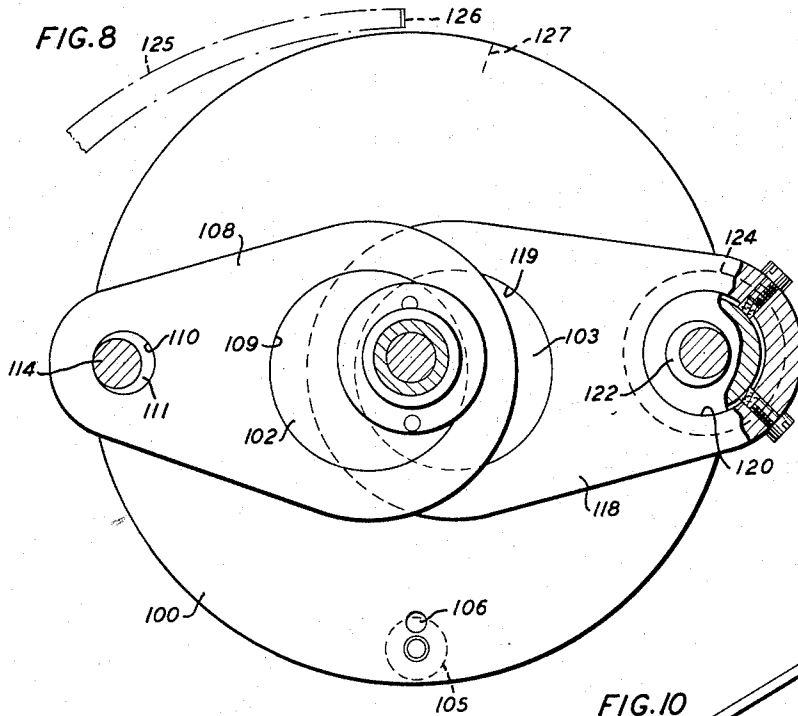
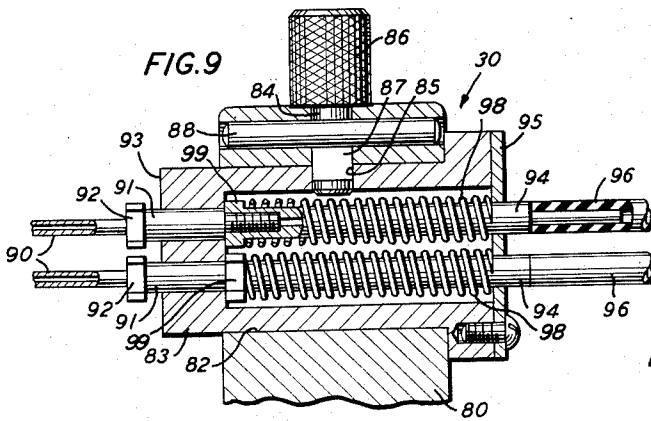


FIG. 10

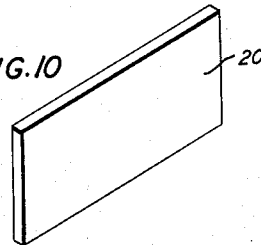


FIG. 11

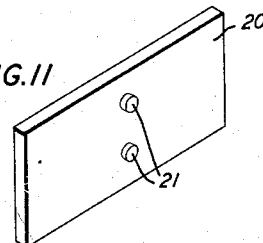
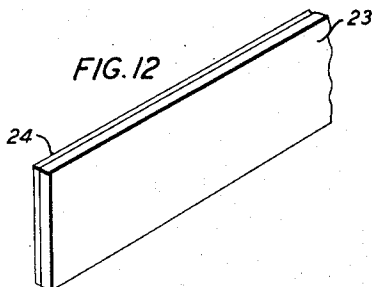


FIG. 12



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2,593,286

PUNCHING AND APPLYING APPARATUS

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Application April 7, 1949, Serial No. 86,074

7 Claims. (Cl. 154—1)

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This invention relates to punching and applying apparatus and more particularly to apparatus for punching solder discs from strips of solder having an adhesive material on one surface thereof and applying the discs to articles such as crystals.

In the manufacture of crystals for use in the communication arts, whether the crystals be produced from quartz or synthetic structures they are of an inherently brittle nature requiring considerable care to avoid damage thereto. The small crystal wafers before they are embodied in electrical units of which they are to become parts of the main structures are provided with one or more lead wires secured to opposing surfaces thereof. The lead wires are secured to the surfaces of the crystal by the process of soldering requiring initially, the securing of a solder disc to the crystal wherever it is desirable to secure a lead wire.

An object of the invention is to provide an apparatus which is simple in structure and highly efficient in punching a part from a supply of material and applying the part to an article.

With this and other objects in view, the invention comprises a punching and applying apparatus embodying means to hold an article in a given position with respect to a die which co-operates with a punch capable of punching a part from a material fed to the die and to move the part on to the article.

More specifically the apparatus includes a hollow punch connected with a mechanism to create a vacuum in the punch during and subsequent to the punching operation whereby the part punched from the material may be held on the end of the punch for movement into and through a heating element which will heat an adhesive material disposed upon one surface of the part for adherence to the surface of the article wherever the part is applied through continued movement of the punch. In the present embodiment of the invention the article is a synthetic crystal disposed in a holder and heated to a given temperature before it is placed in the apparatus whereby the application of the heated part will not damage the crystal. Furthermore, the punches are disposed in aligned pairs carried by units which include cushioning springs to avoid damage to the crystal during the application of the parts, cut from their respective solder strips, to the opposing surfaces of the crystal.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawings, wherein

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Fig. 1 is a top plan view of the apparatus, portions thereof being shown in section;

Fig. 2 is a vertical sectional view taken along the line 2—2 of Fig. 1;

Fig. 3 is an enlarged fragmentary sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary detailed view taken along the line 4—4 of Fig. 3;

Fig. 5 is a front elevational view of the apparatus portions thereof being removed;

Fig. 6 is an enlarged fragmentary sectional view taken along the line 6—6 of Fig. 1;

Fig. 7 is a fragmentary sectional view taken along the line 7—7 of Fig. 6;

Fig. 8 is a fragmentary sectional view taken along the line 8—8 of Fig. 1;

Fig. 9 is an enlarged fragmentary sectional view taken along the line 9—9 of Fig. 1;

Fig. 10 is an isometric view of the article to which the parts or solder discs are to be applied;

Fig. 11 is an isometric view of the article after the parts have been applied thereto; and

Fig. 12 is an enlarged isometric view of a strip of material from which the parts are to be punched.

Referring now to the drawings, attention is first directed to Fig. 10 which illustrates an article 20 to which parts 21, Fig. 11, are to be secured. The article 20 or synthetic crystal is much smaller and relatively thin as compared to the illustrations in the drawings.

Fig. 12 illustrates the material from which the parts 21 are to be produced. This material includes a strip 23 of solder having one surface provided with a heavy coating of adhesive material 24. As illustrated in Fig. 1, two arcuate troughs 25 and 26, U-shaped in cross-section, are supported to receive the strips of material 23 and guide them to dies 27. The strips of material when after passing through the dies extend between feed rollers 28 which are rotated intermittently to advance the strips of material after each punching operation. Punching units 30 are supported by parallel rods 31, which are supported adjacent their centers by a vertical bracket 32. The bracket 32 extends upwardly from a base 33, upon which it is mounted, and has its upper surface 35 positioned to support a holder indicated generally at 36. The holder 36 is the subject matter of a copending application of G. W. Soderman, Serial No. 55,577, filed October 29, 1948.

In general, the holder includes a main member 37 and a companion member 38 normally urged toward each other by split cylindrical springs 39

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disposed at the outer ends thereof to firmly hold the article or crystal 20 therebetween. The main member 37 is larger than the companion member 38 and when disposed upon the surface 35 the ends of the main member may rest against shoulders 40 of the clamping mechanism shown in Fig. 1. Movable jaws 42 are slidable longitudinally in apertures 43 of the bracket 32 and are normally urged toward the shoulders 40 by their respective springs 44 to firmly clamp the ends of the main member 37 of the holder 36 in a fixed position with respect to the units 30. The clamping jaws 42 have portions 46 which extend through apertured lugs 47 to be engaged by an eccentric member 48 of an actuating unit indicated generally at 50. An end portion 51 of the eccentric member 48 is journaled in a suitable bearing 52, while a similar portion 53 disposed in axial alignment therewith, is journaled in a bearing portion 54 and has a sleeve 55 mounted on the outer end thereof together with a control finger 56. A handle 58 mounted on the outer end of the sleeve 55 provides means for manual actuation of the eccentric member 48 between limits determined by the finger 56 striking spaced pins 60 and 61, constituting the open and closed positions for the clamping jaws 42. This mechanism as shown in Fig. 1 is in its closed position with the finger 56 engaging the pin 60. Movement of the handle 58 to rock the eccentric member 48 clockwise until the finger 56 strikes the pin 61, will cause the eccentric member to move the portions 46 of the clamping jaws 42 to move to the right simultaneously moving the clamping jaws 42 away from the shoulders 40 to free the holder 36.

The dies 27 shown in Fig. 3 are supported by vertical members 65 mounted on the vertical bracket 32 by suitable means 66 and having aligned apertures 67 to receive the inner portion 68 of the dies 27. The dies are held in place by the aid of screws 69 disposed in threaded apertures of the vertical members 65 whereby the cavities 70 will be disposed in alignment with each other and with the portions on the article or crystal 20 where the parts 21 are to be applied. Passageways 71 are provided in the dies 27 to guide the materials 23 in given paths through the dies.

Heating elements 73 in the form of electrical coils are supported in pairs by vertical members 75 parallel with their respective vertical members 65 and secured to the bracket 32 by the same means 66. Only the main portions of the heating elements 73 are shown in Fig. 3, the complete formation of the elements and their terminals being shown in Fig. 4. A central terminal 76 is electrically connected to both heating elements 73 of its respective pair, the opposite ends of the heating elements being connected electrically to their respective terminals 77 and 78. With this arrangement, either one or both of the heating elements may be employed depending upon whether or not one or two parts 21 are to be applied to each side of the article.

The punch units 30, shown in detail in Fig. 9, have carriages 80 apertured to receive bearings 81 (Fig. 5) disposed concentric with the parallel rods 31 for sliding movement of the carriages 80 with their punch units on the rods relative to the dies 27. The upper end of each carriage has an aperture 82 therein to receive a housing 83 for removable mounting in the carriage where it is normally locked in place by a pin 84 receivable in an aperture 85. The pin 84 carries a handle

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86 at its outer end, by the aid of which it may be moved outwardly a given distance to be free of the aperture 85 should it be desirable to replace the present housing supporting two pistons for a housing supporting only one piston. The pin 84 has a flattened surface 87 to ride against a laterally projecting pin 88 to limit the distance the pin 84 moves outwardly.

Hollow pistons 90 (Fig. 9) which in the present embodiment of the invention are modified hypodermic needles, are supported in parallel positions by members 91 mounted for sliding movement in parallel apertures in the housing. The members 91 have collars 92 to abut against a surface 93 of the housing 83 during the punching operation. Inner members 94 are connected at their inner ends to the members 91 and extend through parallel apertures in a cover 95 for the housing where their outer ends are connected to flexible tubes 96, the tubes in turn being connected to a suction supply (not shown) a valve 97 (Fig. 1). The pistons 90 are in alignment with their respective cavities 70 of the dies 27, the ends of the pistons remaining in the outer portions of the dies during advancement of the materials 23. Springs 98 are disposed concentric with the inner members 94 (Fig. 9) between the cover 95 and enlarged ends 99 of the inner members to provide resilient cushions to compensate for variations in thickness of the articles and lack of perfect setting of the operating mechanism for the pistons 90.

The operating mechanism for the pistons 90 constitute means for simultaneously moving the carriages 80 toward and away from each other is shown mainly in Figs. 1, 2 and 8. This mechanism includes a wheel 100 supported at 101 for rotation in an aperture in the vertical bracket 32 and having eccentric members 102 and 103 fixedly mounted thereon. The members 102 and 103 are cylindrical in general contour with their centers equally spaced upon substantially diametrically opposite sides of the axis of the wheel 100. The wheel is rotated by the aid of a handle 105 and has a recess 106 disposed in its inner surface to register with the spring pressed plunger 107 when the wheel is in its neutral position. A connecting element 108 apertured at 109 to receive the eccentric member 102 extends beyond its respective carriage 80 where it is provided with an aperture 110 to receive an eccentric portion 111 of a connecting member 112. The inner shank 114 of the member 112 extends into an aperture 115 in the adjacent carriage 80 and the position of the carriage may be varied to vary the position of the punch unit 30 carried thereby relative to its die 27 by rotating the member 112 until the desired adjustment has been completed after which the member may be locked in place by a set screw 116.

A connecting element 118 similar in contour to the connecting element 108 is provided for the eccentric member 103 having an aperture 119 to receive the eccentric member and an aperture 120 adjacent its outer end to receive a variable connecting mechanism including an eccentric member 122. The inner end of the member 122 extends into an aperture 123 of its respective carriage 80 while the outer end of the eccentric member supports a dial 124 movable relative to a pointer on the connecting element 118 and provided with indications whereby the carriage 80 with its punch unit 30 may be moved measured distances from its punch or the article to compensate for variations in the thicknesses of

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the articles disposed in the apparatus. There are numerous sizes of articles or crystals which may receive the parts 21 in this apparatus. The various known sizes of crystals vary also in thickness, plus or minus given limitations. Adjustment of the eccentric member 124 is made to condition the apparatus for crystals of various sizes and thus various thicknesses, while the springs 98 in the punch units 30 compensate for the plus or minus variations in the thickness of each crystal. A pointer 125 has its upper end 126 positioned to register with a mark 127 on the wheel 100 whereby the ends of the pistons 90 supporting the parts 21 may be located in the heating elements 73 prior to their movement on to the article 20.

The mechanism for intermittently feeding the material 23 to the dies 27 is shown in Figs. 1, 2, 6 and 7. This mechanism is directly responsive to the actuation of the punch units 30 or their carriages 80 by the aid of arms 130 extending rearwardly from the carriages and having notches 131 therein to receive actuating rods 132. The rods 132 have their outer ends extending through apertures in vertical members 133 which cooperate with the arms 130 in supporting the rods, the vertical members being mounted upon the base 33. Nuts 134 mounted on the outer threaded ends of the rods 132 and adjustable thereon to vary the strokes of the rods in their reciprocable movements are positioned to abut against the outer surfaces of their vertical members 133. Springs 135 disposed concentric with the rods between the vertical members 133 and nuts 136, threadedly disposed on the rods, normally urge the rods inwardly toward the vertical bracket 32. The bracket 32 has an aperture 138 therein including a groove 139 in one wall of the aperture to slidably support pawl-like members 140 mounted on the inner ends of the rods 132. Spring pressed plungers 141 are positioned to engage flat surfaces of the pawl members 140 normally urging the pawl members into engagement with their respective ratchets 143. The ratchets 143 are mounted upon vertical shafts 144 which are journaled in bearing-like apertures 145 of their bearing brackets 146. Pinions 147 are mounted on the shafts 144 adjacent their sprockets 143 while one of the feed rollers 28 of each pair is mounted on the outer end of its respective shaft, the feed rollers having their peripheries serrated for positive engagement with the materials 23. The other serrated feed rollers 28 are mounted on the outer ends of shafts 151 parallel with the shafts 144 and journaled in bearing-like apertures 152 of the bearing brackets 146. Pinions 153 mounted on the lower ends of the shafts 151 interengage the pinions 147 to be driven thereby in opposite directions whereby the driving rollers 28 in each pair will cooperate to advance their materials 23 a given distance during each operating cycle of the feeding mechanism. Retaining springs 155 mounted at 156 (Fig. 2) on their respective bearing brackets 146 have downwardly extending portions 157 positioned to engage the teeth of their ratchets 143 to hold the ratchets against movement in the reverse directions, but to allow the ratchets to be rotated intermittently by their pawls to feed the materials to their dies.

Considering now the operation of the apparatus, let it be assumed that materials 23 constituting strips of solder having coatings of adhesive materials 24 on the inner surfaces thereof, are initially fed through the dies and between

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the feed rollers 28. In the present embodiment of the invention, the synthetic crystal 20 and its holder 36 is heated to a predetermined temperature in an oven prior to being placed in the apparatus whereby the application of the heated parts 21 to the opposing surfaces thereof will not damage the crystal. The holder with the crystal is placed in its proper position on the vertical bracket 32, with the main member 37 of the holder disposed against the shoulders 40 (Fig. 1). The handle 58 is moved counterclockwise (Fig. 5) to move the control finger 56 from engagement with the pin 61 into engagement with the pin 60 causing the eccentric member 48 to free the portions 46 and the movable jaws 42 to move to the left (Fig. 1) under the forces of their springs 44 until the holder is clamped against the shoulders 40. During the loading of the holder with the crystal in the apparatus, the wheel 100 is in its neutral position with the plunger 107 (Fig. 2) entering the recess 106. The operator then rotates the wheel causing the eccentric members 102 and 103 to move their connecting elements 108 and 118 inwardly moving the carriages 80 with their punch units 30 inwardly simultaneously causing the punches 90 to punch the parts 21 from the materials 23 and move the parts inwardly, supported by the inner ends of the punches due to the existence of suction in the hollow pistons. The pistons 90 are moved inwardly toward the article until they are positioned in the heating elements 73 where they remain a given interval of time until the adhesive material 24 is heated sufficiently to become softened so that it will adhere to the article. The position of the parts 21 on the ends of the pistons within the heating elements is determined by the rotation of the wheel 100 (Fig. 8) until the mark 127 registers with the pointer 126. After the length of time has elapsed to heat the adhesive material on the parts, continued movement is applied to the wheel 100 causing continued inward movement of the carriages with their piston units to move the parts into engagement with the opposing surfaces of the crystal or article. The particular structure of each piston unit 30 is such that when the ends of the pistons 90 engage the material 23 the springs 98 will be compressed until the shoulders 22 engage their surfaces 93 of the housings 83 providing positive supports for the pistons while punching the parts 21 from the material. This positive action is desirable and necessary during the punching of the parts whereas it is preferred that the pistons be cushioned during the application of the parts to the article. The cushioning means is embodied in the springs 98 which enable satisfactory application of the parts to the article without damaging the article. The pistons are limited in their movement toward the article whereby the carriages 80 will not move toward each other or toward the article sufficient distances to cause the surfaces 93 of the housings 83 to engage the shoulders 92.

After the parts 21 have been applied to the article, a reverse movement is applied to the wheel 100 or if desired, the wheel is continued in the same direction to complete one revolution returning the recess 106 to the plunger 107, thus returning the carriages 80 and the piston units 30 to their normal positions moving the pistons 90 free of their materials 23 for advancement of the material. During outward movement of the piston units 30 the arms 130 will engage the nuts 136 of the rods 132 to move the rods desired dis-

tances to cause the pawls 140 to rotate the ratchets 143 the distance of one tooth of each ratchet, causing rotation of the shafts 144 and 151 through their connecting pinions 147 and 153 simultaneously rotating the said feed rollers 28 given distances to advance the materials. 23. The apparatus may be made ready to receive another article with its holder after the present holder and article are removed therefrom through the actuation of the handle 58 to move the control finger 56 from engagement with the pin 60 into engagement with the pin 61.

It is to be understood that the above described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. An apparatus for punching a part from a material, having an adhesive coating on one surface thereof, and applying the part to an article, the apparatus comprising a die formed to receive the material, means to support an article adjacent the die, a punch movable through the material and the die to the article to punch a part from the material and place it on the article with the adhesive surface adjacent the article, and a heating unit interposed between the die and the article adjacent the path of the punch to heat and thus soften the adhesive coating on the part prior to its application to the article.

2. An apparatus for punching parts from materials having adhesive surfaces and applying the parts to opposing surfaces of an article, the apparatus comprising means to singly hold articles of various thicknesses at a receiving position, dies, to receive materials having adhesive surfaces, disposed at opposite sides of the receiving position, punches for the dies movable through their materials and their dies to their respective sides of the article to punch parts from their materials and place them on the adjacent surfaces of the article, and a mechanism to cause movement of the punches including relatively adjustable elements to vary the positions of the punches relative to each other to compensate for the varying thicknesses of the articles whereby the parts punched from the materials will be disposed on the opposing surfaces of the article substantially simultaneously.

3. An apparatus for punching parts from materials having adhesive surfaces and applying the parts to opposing surfaces of an article, the apparatus comprising means to support an article at a given position, dies, to receive the materials, disposed at opposite sides of the article, punches for the dies movable through their materials and their dies to their respective sides of the article to punch parts from their materials and place them on the adjacent surfaces of the article, a mechanism operable to simultaneously actuate the punches to cause them to punch the parts from the materials and apply the parts singly to articles of various thicknesses, and an eccentric element in the operable mechanism movable to vary the relative movement of the punches to compensate for variations in the thicknesses of the successive articles.

4. An apparatus for punching parts from materials having adhesive surfaces and applying the parts to opposing surface of articles of various thicknesses disposed in like holders each having

a main member and a companion member urged toward each other to hold an article therebetween, the apparatus comprising means to successively clamp the holders with their articles whereby the main members with the adjacent surfaces of the articles will be singly held at a given position while the companion members and the other surface of the article will be disposed varied distances from the given position depending upon the varied thicknesses of the articles, dies to receive the materials disposed at opposite sides of the given position, punches for the dies, a mechanism operable to actuate the punches to cause them to punch the parts from the materials and apply them to the article, and an eccentric element included in the mechanism movable to cause variation in the position of one of the punches relative to the said given position to compensate for the thickness of the article whereby the punches will apply their parts to their respective surfaces of the article simultaneously.

5. An apparatus for punching parts from a strip of solder having an adhesive material on one surface thereof and applying the solder parts to articles whereby terminals may be soldered to the articles, the apparatus comprising a die, means to guide the solder strip adjacent the die, means to support the articles singly at a given position relative to the die, a hollow punch movable through the solder and adhesive material and through the die to punch a part from the solder and material and force it into close engagement with the article to cause the material of the part to adhere thereto, means to create a suction in the punch to hold the part on the end thereof until it is disposed in engagement with the article, and a heating element interposed between the die and the article adjacent the path of the punch to heat and thereby soften the adhesive material before it reaches the article.

6. An apparatus for punching parts from strips of solder having adhesive materials on given surfaces thereof and applying the parts to opposing surfaces of articles whereby terminals may be soldered to the said surfaces of the articles, the apparatus comprising spaced dies, means to feed the strips to the dies, means interposed between the dies to support the articles at given positions relative to the dies, hollow punches, means to create a suction therein, and a mechanism operable to move the punches through the solder and adhesive materials of the strips and through the dies to punch parts from the strips and force them into close engagement with the opposing surfaces of the supported article to cause the materials of the parts to adhere thereto.

7. An apparatus for punching parts from strips of solder having adhesive materials on given surfaces thereof and applying the parts to opposing surfaces of articles of varying thicknesses whereby terminals may be soldered to the said surfaces of the articles, the apparatus comprising spaced dies, means to feed the strips to the dies, means interposed between the dies to support the articles at given positions relative to the dies, hollow punches, means to create a suction therein, a mechanism operable to move the punches through the solder and adhesive materials of the strips and through the dies to punch parts from the strips and force them into close engagement with the opposing surfaces of the supported article to cause the materials of the parts to adhere thereto,

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and resilient elements in the operable mechanism to cause movement of the punches varied distances toward the article to compensate for articles of varied thicknesses.

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