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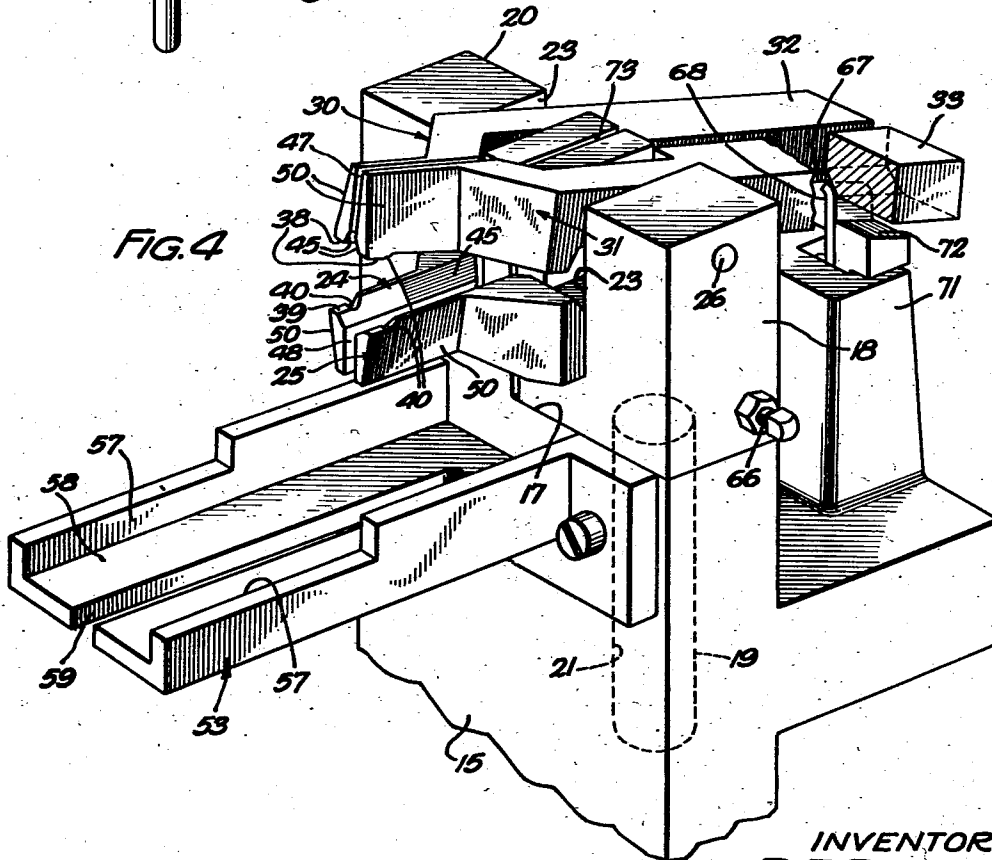
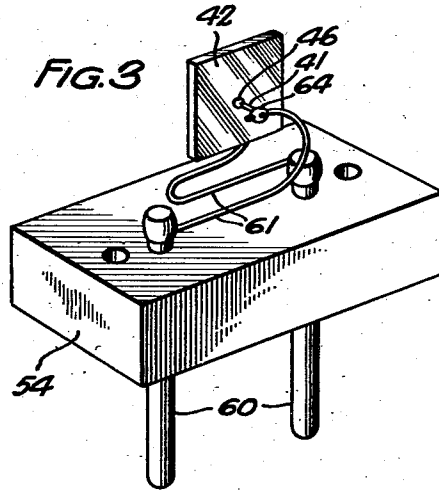
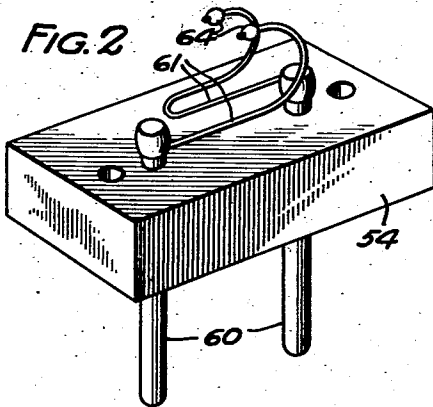
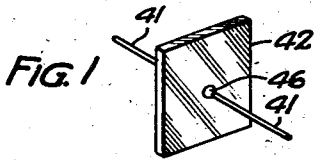
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2,364,689

ASSEMBLING APPARATUS

Filed May 8, 1943

3 Sheets-Sheet 1



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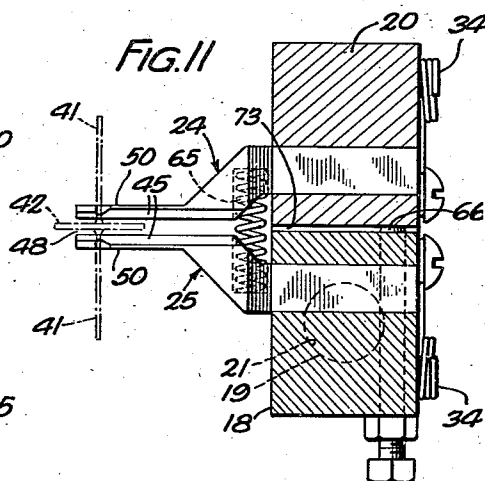
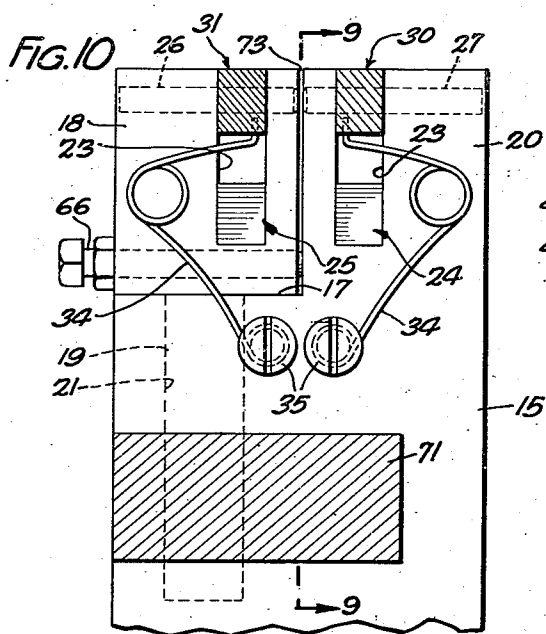
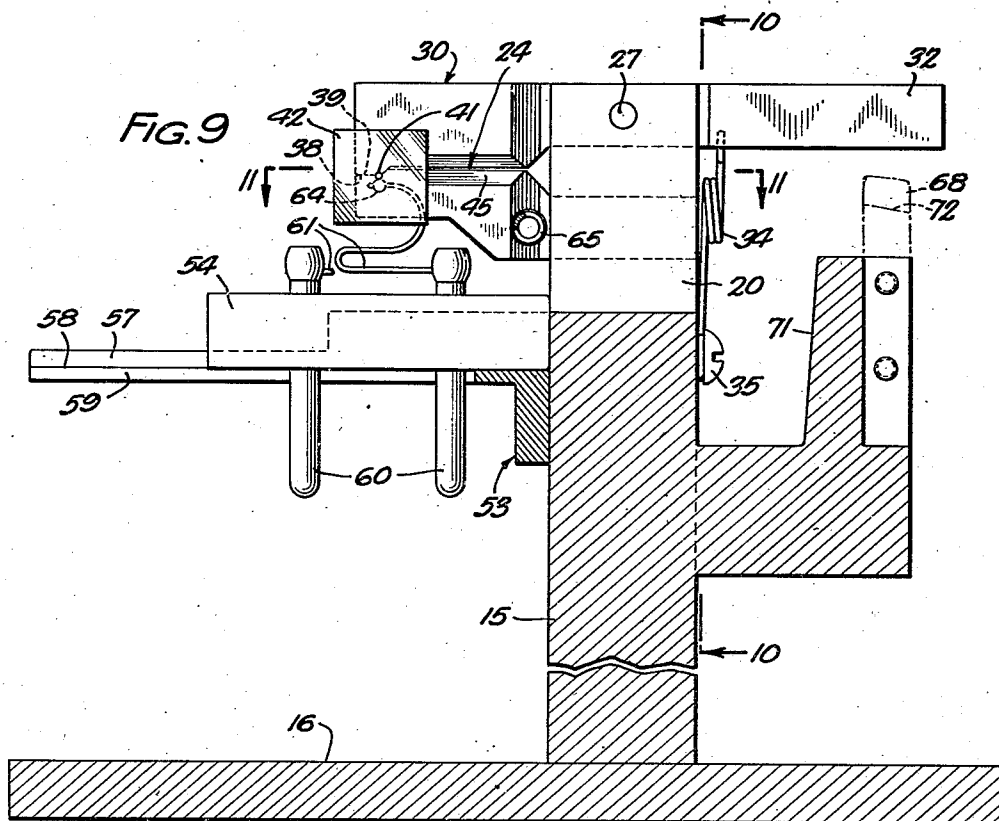
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ASSEMBLING APPARATUS

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3 Sheets-Sheet 3



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ASSEMBLING APPARATUS

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Application May 8, 1943, Serial No. 486,243

5 Claims. (Cl. 113-99)

This invention relates to assembling apparatus and particularly to apparatus combining means for assembling, locating and supporting parts relative to each other for attachment.

This invention is particularly applicable to the assembling, locating and supporting of sub-assemblies comprising piezoelectric crystals and their mountings relative to each other for attachment by soldering. Such a crystal and its mounting is shown and described in general in my co-pending application, Serial No. 471,884, filed January 9, 1943, to which reference may be had for further description. In such a crystal sub-assembly of the type referred to, an electrical lead wire extends perpendicularly from each of the opposed faces of the crystal which are coated with a metal film and are soldered to the center or nodal point of the crystal. The referred-to crystal mounting sub-assembly comprises a base carrying terminal members, to each of which is attached one end of a semi-circular mounting and electrical connecting spring, the opposite ends of the springs extending in the same direction in spaced relation and at their free ends each carry a mass of solder in the form of a bead, the two beads being in alignment. The final step in connecting the sub-assemblies is to solder the beaded ends of the springs to the lead wires extending from the crystal. In performing this last step, it is important and necessary to locate the solder beads attached to the springs so that the opposed inner sides of the beads and their centers of mass will be spaced from the respectively adjacent metal film covered faces of the crystal at accurately predetermined distances. These distances are such that mechanical vibrations travelling out the lead wires from the crystal will be absorbed in, i. e., damped out by, or will be totally reflected by the solder mass and thus not transmitted to the mounting springs. The predetermined mass and distance involved will, in each case, depend upon the frequency of the mechanical vibration in question, which, in turn, will depend upon the frequency of the potential applied across the crystal.

An object of this invention is to provide a practicable, efficient and reliable apparatus for accurately assembling, locating and supporting parts relative to each other for attachment.

In accordance with the above object, this invention contemplates, in one embodiment thereof as applied to the assembling of and attachment by solder of the above-referred-to types of sub-assemblies of piezoelectric crystals and

their mountings, an apparatus comprising a base, cooperating sets of jaw members thereon for holding and locating the crystal with its lead wires and a support on the base for guiding the crystal mounting with its solder beaded springs into predetermined position relative to the crystal lead wires for subsequent soldering thereto. One set of jaw members is horizontally aligned and pivotally mounted so that, upon movement away from the other set of jaw members, the crystal and lead wires may be mounted in predetermined position therebetween and, upon return movement of the pivotal jaw members, to hold and laterally position the crystal relative to the companion set of horizontally aligned jaw members. Vertically aligned jaw members, one of each set, are mounted for slight lateral movement whereby, upon completion of the soldering operations and a predetermined movement of the pivotal jaw members to release the assemblage, they are cammed slightly inwardly to insure that there will be no adhesion by solder flux of the soldered connection at one side of the crystal to the jaw members. One set of horizontally aligned jaw members is so arranged and shaped that, in guiding the mounting into position, the solder beads attached to the springs engage the jaw faces and are cammed outwardly from the plane of the respective adjacent metal film covered faces of the crystal predetermined distances. The outer faces of the jaw members are chromium plated surrounding the positions where the solder beads on the springs are located ready for the soldering operations to reduce any tendency of adhesion of solder thereto.

Other objects and advantages of this invention will more fully appear from the following detailed description taken in conjunction with the accompanying drawings, in which

Figs. 1 and 2 are greatly enlarged perspective views of a piezoelectric crystal and its mounting, respectively, before assembly and attachment by soldering;

Fig. 3 is a greatly enlarged perspective view of the crystal and its mounting after being assembled and attached;

Fig. 4 is a greatly enlarged fragmentary perspective view, partly in section, of an apparatus embodying the features of this invention for assembling, locating and supporting the crystal and its mounting, the crystal holding jaw members being operated to receive a crystal;

Fig. 5 is a view similar to Fig. 4 showing the jaw members in their operated positions holding

a crystal and its mounting in position on the apparatus, the soldered beaded mounting springs for the crystal being predeterminedly located along the crystal lead wires and from the faces of the crystal ready for the soldering operations;

Fig. 6 is an enlarged fragmentary end view of the jaw members, looking in the direction of the arrow indicated in Fig. 5;

Fig. 7 is a view similar to Fig. 6 showing the apparatus rotated 90° and elevated to bring one of the solder beads into engagement with a fixed soldering iron indicated fragmentarily in broken outline, the apparatus thereafter being reversed to engage the opposite solder bead with the iron;

Fig. 8 is a view of the jaw members as shown in Fig. 6 after the soldering operations, one set of horizontally aligned jaw members being raised to permit the removal of the attached assemblies and the right hand vertically aligned jaw members being moved laterally inwardly to free the lower right hand jaw member from the solder flux;

Fig. 9 is an enlarged fragmentary vertical section taken on the line 9—9 of Fig. 10;

Fig. 10 is a fragmentary vertical section taken on the line 10—10 of Fig. 9; and

Fig. 11 is a horizontal section taken on the line 11—11 of Fig. 9.

Referring to the drawings in detail, 15 indicates a standard or support for the operating parts of the apparatus having an attached foot member 16 upon which the apparatus freely rests during the assembling operation on a bench or table top (not shown). At its upper end, the standard 15 is notched at 17 (Fig. 10) and vertically pivoted therein is a block 18 provided with a depending integral pin 19 rotatably fitted in an aperture 21 in the standard 15. The block 18 and a portion 20 of the standard 15 at the right of the block (Fig. 10) are each notched at 23 and suitably secured in the notches at their lower ends are irregularly shaped jaw members 24 and 25, one in each notch, which are similar in detail except that the member 24 is left-hand and the member 25 is right-hand, as viewed in Fig. 4. Pivoted horizontally at 26 and 27 on the block 18 and standard portion 20, respectively, and arranged in the notches 23 above the jaw members 24 and 25, are jaw members 30 and 31, which are similar in detail except that the member 30 is left-hand and the member 31 is right-hand, as viewed in Fig. 4. The right ends of the pivotal jaw members 30 and 31 terminate in hand levers 32 and 33, respectively, for withdrawing the latter jaws from the jaws 24 and 25, as shown in Figs. 4 and 8. Torsion springs 34 (Fig. 10), each having one end thereof bearing against their associated levers 32 and 33 and their opposite ends anchored at 35 to the standard 15, function to return the jaw members 30 and 31 to their lower operative positions (Figs. 5, 6, 9 and 10) upon release of the levers 32 and 33. The return movement of the jaw members 30 and 31 is limited by relatively short depending horizontal faces 38 at the outer free ends of the jaw members engaging aligned recessed faces 39 on the similar ends of the jaw members 24 and 25. No contact between any of the adjacent horizontal and vertical faces of the four jaw members occurs except as described above at 38 and 39.

At their right ends, each of the aligned sets of jaw member faces 38 and 39 is formed with a semi-circular depression 40. The depressions 40 cooperate to form spaced sets of apertures when the jaw members are closed and in which are

lodged electrical lead wires 41 extending from opposed faces of a crystal 42 of the type hereinbefore described (Figs. 1 and 2), when the crystal is correctly supported in the apparatus (Figs. 5, 6 and 9). The inner opposed faces of the jaw members 24, 25, 30 and 31 at each side of the meeting line of the faces 38 and 39 thereof are beveled, as indicated at 45, to provide clearance for a solder mass 46 resulting from the attachment of the lead wires 41 to the crystal 42 and, in the case of the beveled faces 45 on the upper jaw members 30 and 31, to guide the crystal 22 into a space 47 between the jaw members and thus accurately laterally positioning the crystal relative to the lower jaw members 24 and 25. The inner opposed faces of the upper jaw members 30 and 31 are spaced apart such a distance, as clearly shown in Figs. 6, 7 and 8, at 47, that the crystal 22, after being supported by means of its lead wires 41 resting in the depressions 40 of the lower jaw members 24 and 25, may be freely entered therebetween as the jaw members 30 and 31 are lowered from their positions shown in Fig. 4 to that shown in Figs. 5, 6 and 9. The inner opposed faces of the lower jaw members 24 and 25 have a considerably greater spacing 48 therebetween than that between the jaw members 30 and 31, which permits the jaw member 25 to move laterally (Fig. 8) toward the adjacent face of the crystal 42 when its pivotal mounting block 18 is operated in a manner and for a purpose to be described hereinafter.

Outer faces 50 of each of the vertically arranged sets of jaw members 24 and 30 and 25 and 31 are inclined inwardly toward their upper and lower longitudinal edges from vertical faces 51 at each side of the faces 38 and 39 (Fig. 6). The inclined faces 50 have a tendency to prevent the flow of solder from the immediate points of soldering and further to provide more clearance for a soldering iron tip 52, shown fragmentarily in broken outline in Fig. 7 and also to increase the visibility of the operator in performing the soldering operations.

Secured to the left side face of the standard 15, below the jaw members (Figs. 4, 5 and 9), is a horizontally extending guide and support 53 for a crystal mounting base or block 54 of the type heretofore described, the support having vertical side walls 57 and a bottom wall 58 upon which the block 54 is mounted and slid into position against the left face of the standard 15, the bottom wall having a slot 59. The block 54 carries depending terminal members 60, which extend through the support slot 59. Free ends of crystal mounting and electrical connecting yieldable springs 61 soldered to the terminal members 60 each carry a mass of solder in the form of a bead 64, the two beads being in horizontal alignment and initially spaced apart with their supporting spring ends such a distance that as the block is slid into locating position on the support 53, the opposed inner faces of the beads engage the junctures of the outer faces 50 and 51 of the lower jaw members 24 and 25 and are cammed slightly outwardly to space them from the adjacent metal film covered faces of the crystal 42 similar accurate predetermined distances which, as hereinbefore described, is an important factor in the operation of the crystal 42 when in use. The distance between the inside faces of the solder beads 64 before the block 54 is mounted on the apparatus is generally slightly less than the distance between the junctures of the faces 50

and 51 of the jaw members 24 and 25 and thus the latter faces serve as gauge faces.

As hereinbefore described, the block 18, upon which is horizontally pivoted at 26 the jaw member 31 and to which is fixed the jaw member 25, is vertically pivoted on the standard 15 by means of the pin 19. A coiled expansion spring 65, having its opposite ends bearing in recesses in the jaw members 24 and 25, acts to maintain the block 18 in its normal position (Figs. 4, 5 and 6) and thus the space 47 between the jaw members 30 and 31 and the space 48 between the jaw members 24 and 25 will normally be held fixed. An adjustable stop screw 66, threaded through the block 18 and bearing against the portion 20 of the standard 15, limits the movement of the block in a counterclockwise direction, as viewed in Fig. 11, under the action of the spring 65.

A pivotal movement of the block 18 in a clockwise direction is effected, referring to Fig. 4, when a cam face 67 on the hand lever 33 is pressed against a curved face of a stationary stiff spring blade 68 secured to an extension 71 on the standard 15. As shown in Fig. 4, the levers 32 and 33, with the jaw members 30 and 31, have been rocked clockwise about their pivots 26 and 27 only a sufficient distance to permit the mounting of a crystal 42 between the jaw members 24 and 25, but upon a slight continuing movement, which is effected at the completion of the soldering operations, it will be obvious that the lever 33 will be given a slight clockwise movement which is transmitted to the block 18 and thus to the jaw member 25. This latter movement of the jaw member 25, as indicated in Fig. 8 by the broken and full line positions of the jaw member, is for the purpose of freeing the assemblage from the jaw members 24 and 25 in case of any solder flux adhesion therebetween. An adjustable stop member 72 carried on the standard extension 71 limits the clockwise movement of the hand lever 33, as viewed in Fig. 4, and thus the similar movement of the jaw member 25, as viewed in Fig. 11. A suitable space 73 is provided between the opposed inner faces of the block 18 and the standard position 20 to permit the necessary pivotal movement of the block.

The use and operation of the apparatus, it is believed, will be understood from the above detailed description without a general description of operation. In using the apparatus, the jaw members 30 and 31 are first swung away from the jaw members 24 and 25 by depressing the hand levers 32 and 33, as shown in Fig. 4, and a crystal 42 is mounted in position by means of its lead wires 41 resting in the spaced depressions 40 of the jaw members 24 and 25. The release of the hand levers 32 and 33 permits the jaw members 30 and 31 to move downward and the beveled faces 45 thereon engage opposite faces of the crystal to guide the crystal into the space 47 between the jaw members and shifting the crystal laterally between the jaw members 24 and 25 if it is not accurately positioned therebetween. As the faces 38 and 39 of the two sets of jaw members engage, the lead wires 41 of the crystal will be lodged in the cooperating depressions 40 of the jaw members. This latter position of the jaw members 30 and 31 with the crystal 42 in correct position is shown in Figs. 5, 6, 7 and 9. The crystal mounting block 54 is then mounted on the support 53 and slid into position against the left face of the standard 15 (Figs. 5 and 9). As the block 54 is moved into position, the inside faces

of the spaced aligned solder beads 64 attached to the springs 61 ride into engagement with the junctures of the outer gauge faces 50 and 51 of the lower jaw members 24 and 25 and are cammed outwardly to provide similar accurate distances between the metal film covered faces of the crystal 42 and the inside faces of the solder beads for the purpose hereinbefore referred to.

With the piezoelectric crystal 42 and its lead wires 41 thus assembled with and accurately located relative to the mounting block 54 and its solder beaded springs 61 on the apparatus, the operator, after clipping the lead wires 41 at the points indicated at 74 in Fig. 6, bodily lifts the apparatus with its attached foot member 16, swings it 90° and engages one solder bead 64 with the heated soldering iron tip 52 (Fig. 7) and then reverses the apparatus to engage the opposite solder bead 64 with the tip. The solder beads thus fused embrace the lead wires 41 and fully engage the vertical faces 51 of the jaw members, as clearly shown in Fig. 7. To remove the completed assemblage from the apparatus, the operator, after supporting it again on the attached foot member 16, which rests on the supporting bench or table top, depresses the hand levers 32 and 33 until the cam face 67 on the lever 33 operatively engages the spring blade 68, which, in the manner hereinbefore described, causes the jaw member 25 to be slightly rotated away from the engaged solder bead 64 to its full line position (Fig. 8), thus breaking any flux adhesion between the bead and the jaw member. Any adhesion between the jaw member 24 and its engaged solder head 64 will readily be broken when the operator grasps the mounting block 54 and slides the assemblage from the support 53. While the jaw members 30 and 31 are still raised, another crystal 42, with its lead wires, is mounted on the jaw members 24 and 25 and the assembling operation is repeated.

It will be understood that the embodiment herein described is merely illustrative of the invention and one application thereof and that other modifications can be made and it is capable of other applications.

What is claimed is:

1. In an apparatus for assembling and locating parts of an article relative to each other for attachment by soldering wherein a first part includes members extending therefrom for attachment to solder on the ends of yieldable members carried on a second part, a support, cooperating sets of jaws mounted on said support, one set being pivotally mounted for movement to and from the other set, each set having cooperating depressions for receiving and locating the members of and said first part in one direction, said first set adapted to freely engageably receive therebetween said first part to locate the same and its members in another direction relative to said other set of jaws, said other set of jaws having predeterminedly spaced gauge faces at their outer sides, and means for guiding, supporting and locating said second part and its members relative to said first part and its members, the solder on the ends of the yieldable members engaging the gauge faces of said other set of jaws for locating the same relative to the members on said first part.

2. In an apparatus for assembling and locating parts of an article relative to each other for attachment by soldering wherein a first part includes members extending perpendicularly from opposite outer faces thereof for attachment to

solder on the ends of yieldable members carried on a second part, a support, cooperating sets of jaws mounted on said support, one set being pivotally mounted for movement to and from the other set, each set having cooperating depressions for receiving and locating the members of and said first part in one direction, said first set adapted to freely engageably receive therebetween said first part to locate the same and its members in another direction relative to said other set of jaws, means for guiding, supporting and locating said second part relative to said first part and thereby the yieldable members on said second part relative to the members on said first part, said other set of jaws having predeterminedly spaced outer side gauge faces engaged by the solder on the ends of the yieldable members on said second part while locating the latter part on said supporting means effective to move said soldered ends to space the engaged solder faces similar predetermined distances from the outer faces of the first part, and means for operating said movable set of jaws.

3. In an apparatus for assembling articles, a support, a pivotally mounted block thereon, a pair of cooperating jaws for supporting one portion of an article, one of said jaws being fixed on said support and the other jaw fixed to said block, a second pair of jaws cooperating with said first jaws for positioning and holding said one portion relative to a second portion carried on said support, one of said latter jaws being pivotally mounted on said support and the other of said jaws pivotally mounted on said block and having an extension, and camming means on said support engaged by said latter jaw extension during a disengaging pivotal movement of said second pair of jaws from the assembled article to laterally move said jaws mounted on said pivotal block toward their companion jaws.

4. In an apparatus for assembling articles, a support, a pivotally mounted block thereon, a pair

of cooperating jaws for supporting one portion of an article, one of said jaws being fixed on said support and the other jaw fixed to said block, a second pair of jaws cooperating with said first jaws for positioning and holding said one portion relative to a second portion carried on said support, one of said latter jaws being pivotally mounted on said support and the other of said jaws being pivotally mounted on said block and having a rearwardly extending extension, and camming means on said support arranged in the path of said latter jaw extension effective during a disengaging pivotal movement of said second pair of jaws from the assembled article to laterally move said jaws mounted on said pivotal block toward their companion jaws to break any adhesion between the portions and the jaws.

5. In an apparatus for assembling articles, a support, a pivotally mounted block thereon, a pair of cooperating jaws for supporting oppositely extending members of one portion of an article, one of said jaws being fixed on said support and the other jaw fixed to said block, a second pair of jaws cooperating with said first jaws for positioning and holding an intermediate member of said one portion relative to a second portion carried on said support, means on said support and engaging said second pair of jaws for urging them into operative positions with said intermediate member of the article, one of said latter jaws being pivotally mounted on said support and the other of said jaws being pivotally mounted on said block for movement at an angle to the pivotal movement of said block, said latter jaw having an extension, and camming means on said support engaged by said jaw extension during a disengaging pivotal movement of said second pair of jaws from the assembled article to laterally move said jaws mounted on said block toward their companion jaws.

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