

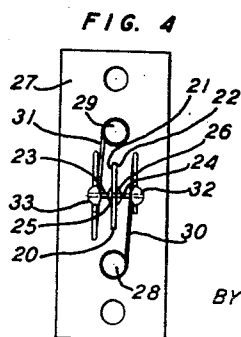
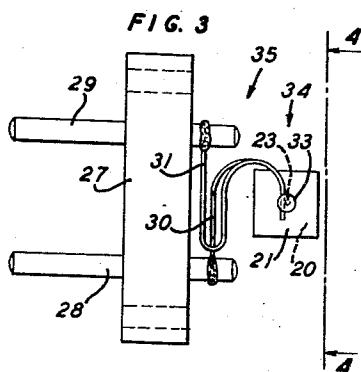
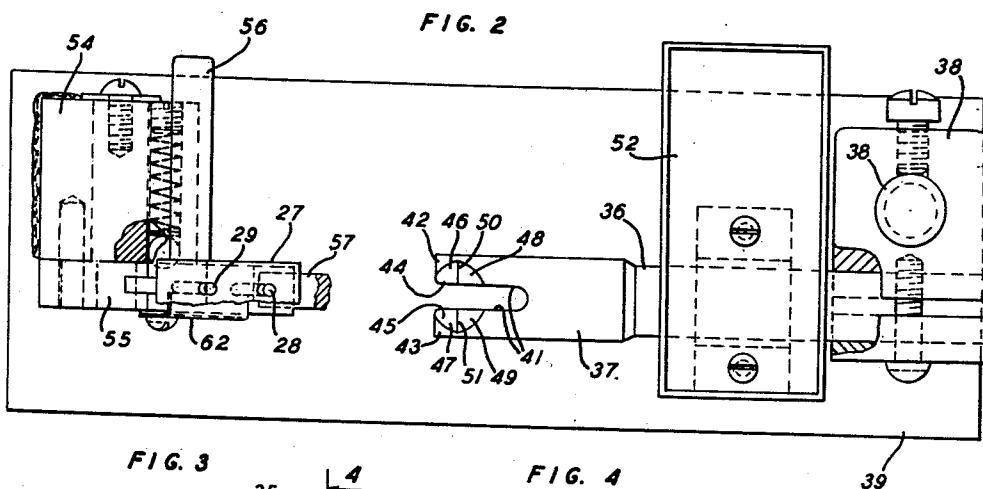
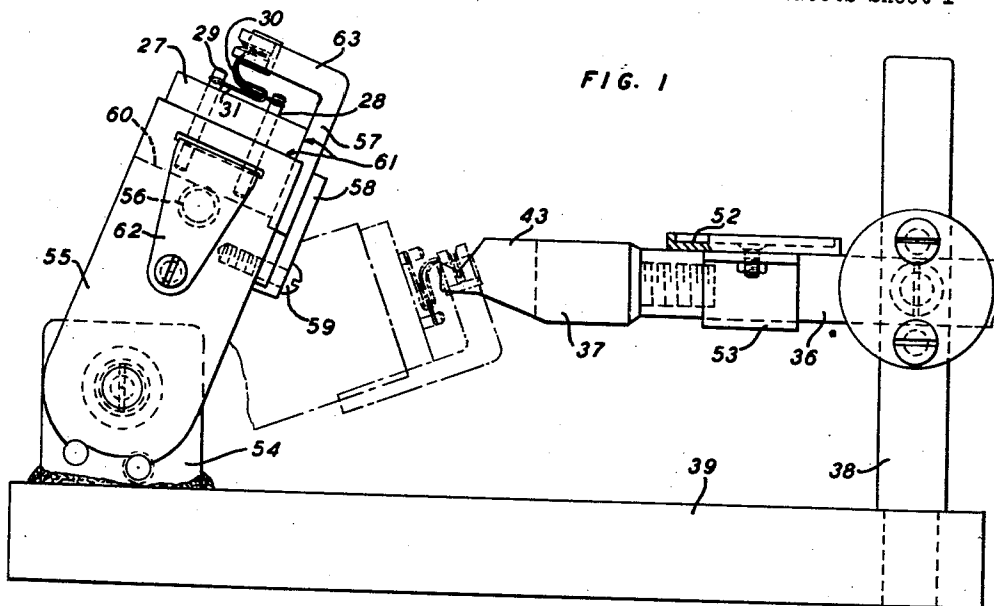
April 25, 1944.

P. W. CRIST ET AL

2,347,397

SOLDERING APPARATUS

2 Sheets-Sheet 1



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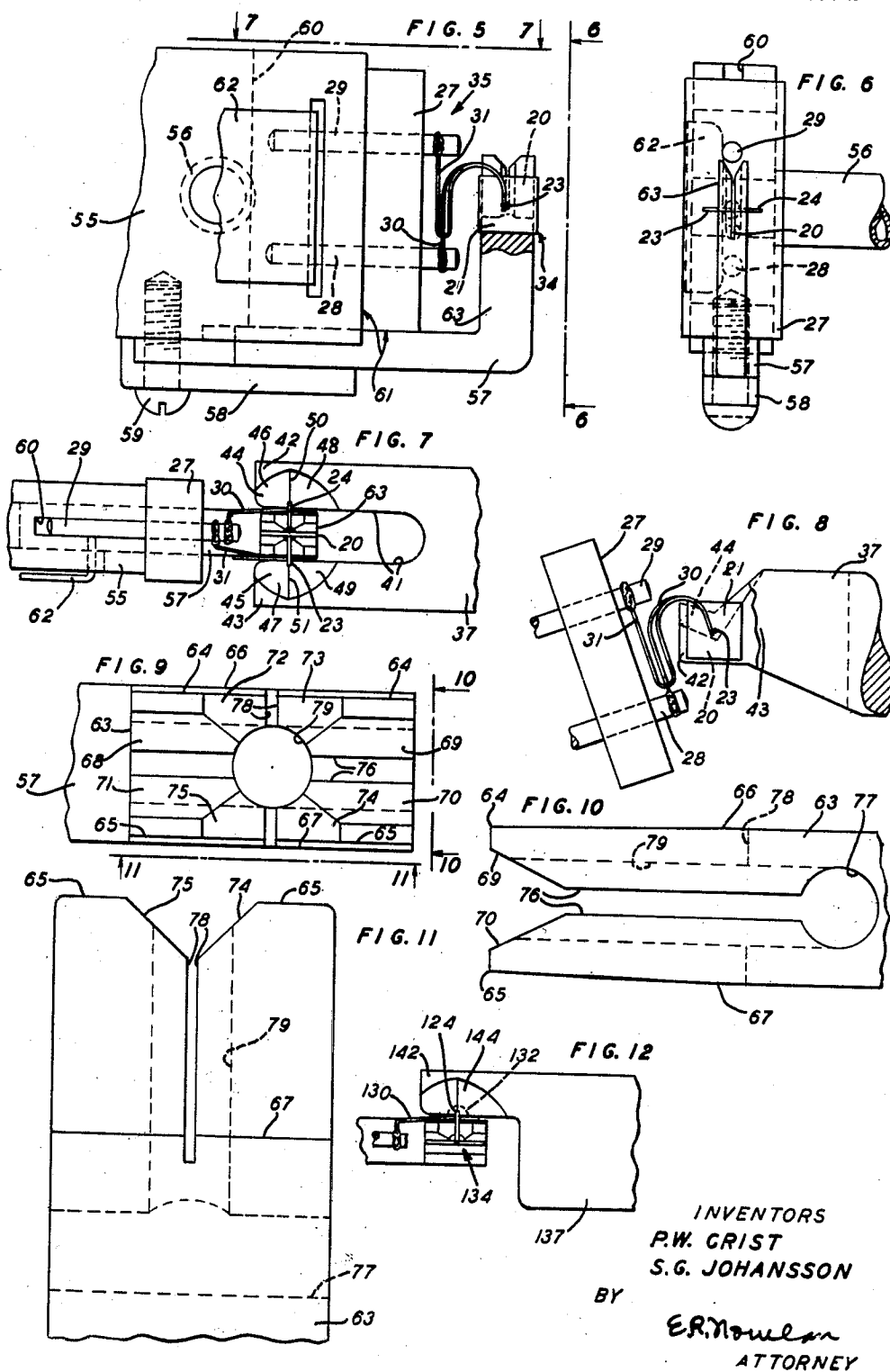
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Filed Dec. 31, 1942

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UNITED STATES PATENT OFFICE

2,347,397

SOLDERING APPARATUS

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Application December 31, 1942, Serial No. 470,890

2 Claims. (Cl. 113—59)

This invention relates to soldering apparatus, and more particularly to apparatus for soldering to an elongated member another member in such fashion that the mass of solder used will be accurately located in a predetermined position on the elongated member.

In the electrical arts and particularly in the communications arts, use is made in a variety of apparatus of small slabs, slices or plates of crystalline substance, especially crystalline quartz, having a metallic film on each of the broadest flat sides of the plates. Such a slab or plate is known, for short, in the art as a "crystal"; and the word "crystal" will be used hereinafter and in the appended claims to mean such a slab, slice or plate of crystalline dielectric substance having a closely adherent metal film on each of its two broadest opposed faces. To support mechanically such a crystal and to afford electrical connection to its metal films, metal wires, perpendicular to the film faces, may be butt-welded to the films as primary connector supports. To locate and support such a unit in an apparatus, in some instances, and to provide electrical connections thereto, the primary connector supports may be conveniently soldered to other mechanically supporting and electrically connecting wires, as secondary connector supports. Such a secondary support may be a wire having one end thereof abutted endwise against or laid laterally against a primary connector support of the crystal and soldered thereto. Such crystals when in use are frequently subjected to alternating potentials applied across their films. One effect of this is that the crystal is given a mechanical vibration which may be transmitted out through both primary and secondary outputs and affect the apparatus undesirably. To obviate such effects, the soldered connection of the secondary support to the primary support may be made with a bulk of solder of such predetermined mass and located at such predetermined distance from the adjacent crystal face that mechanical vibrations traveling out the primary support 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 secondary support. 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 the present invention is to provide an apparatus or device whereby a member may be quickly, efficiently and accurately soldered to an elongated member with an accurately predetermined mass of solder located at a precisely predetermined site on the elongated member.

With the above and other objects in view, the

invention may be embodied in an apparatus comprising a horizontally disposed soldering iron tip, made of metal, such as aluminum, unwettable by molten solder, and formed in its upper surface with a cup-like recess or hollow opening from one side face of the tip, in combination with a removable fixture member also of material unwettable by molten solder dimensioned to be applied against the said side face of the tip and formed to receive and hold transversely thereto an elongated member to extend into the cup-like hollow and to hold another member in contact with the elongated member at the side opening of the hollow.

Other objects and features of the invention will appear from the following detailed description of one embodiment thereof taken in connection with the accompanying drawings, in which the same reference numerals are applied to identical parts in the several figures and in which

Fig. 1 is a view in side elevation of an apparatus constructed in accordance with the invention;

Fig. 2 is a plan view thereof;

Fig. 3 is a view in side elevation of an article to be soldered in the apparatus of Fig. 1 on an enlarged scale;

Fig. 4 is an end view thereof;

Fig. 5 is an enlarged view in side elevation of the article holding means of Fig. 1;

Fig. 6 is an end view of the parts shown in Fig. 5 with the secondary supports omitted;

Fig. 7 is a plan view thereof with the tip of the soldering iron added;

Fig. 8 is a side elevation to show the relation of the article to the soldering iron tip in operative position;

Fig. 9 is a much enlarged plan view of the article holding member;

Fig. 10 is an end view of the showing of Fig. 9;

Fig. 11 is a front elevation thereof; and

Fig. 12 is a view similar to Fig. 7 of a modified form.

The apparatus herein disclosed and described as an embodiment of the invention and generally illustrated in Figs. 1 and 2, is particularly constructed and adapted to deal with the article illustrated in Figs. 3 and 4. A description and discussion of this latter, as a preliminary, will simplify the description of the apparatus and render clearer the problems, purposes and operations involved, although the article is not in itself a part of the present invention, being disclosed and claimed in copending application Serial No. 470,759, filed by Irvin E. Fair on December 31, 1942.

The article illustrated in Figs. 3 and 4 is a "crystal" mounted to be assembled as part of an electrical apparatus. It comprises a thin, square, slice, slab or plate 20 sawn from crystalline

quartz and ground to predetermined dimensions, each of the two large faces 21 and 22 of the plate 20 being provided with a tightly adherent film of metallic silver, too thin to be represented in the drawings but covering the whole face on which it is applied. To the center of each of these film covered faces 21 and 22, is soldered or welded one end of a straight bit of wire 23 and 24, preferably bronze, which extends out perpendicularly to the plane of the face on which it is secured. These are secured to their respective metal films by small convex beads 25 and 26 of solder or of added welding metal. The structure thus far described is called a "crystal" for the purposes of this application. The wires 23 and 24 are the primary connector supports. The article now under consideration also comprises a base member 27 of suitable insulating material in which are rigidly mounted two metal connector pins 28 and 29 extending through the base 27 to form plug terminals on the left side (Fig. 3) and mounting heads on the right side. To the mounting heads are soldered respectively two spring wire members 30 and 31. The member 30 is C-shaped and the member 31 is shaped like a figure 2; and these are so disposed that both arch in the same sense of curvature toward their outer ends which abut sidewise respectively against the primary support wires 24 and 23 near the outer ends of these and are secured there respectively by beads 32 and 33 of solder. The wires 30 and 31 are the secondary connector supports of the crystal.

In assembling the article shown in Figs. 3 and 4, the crystal, generally indicated at 34, and the mount, generally indicated at 35 in Fig. 3, are each assembled separately, the crystal 34 including the quartz plate 20 with its metal films on the faces 21 and 22, and the primary connector supports 23 and 24 secured to the films at 25 and 26, while the mount includes the base 27, pins 28 and 29, and the secondary connector support wires 30 and 31 soldered on the pins. The final step of the assembly is to solder the supports 23 and 31 together at 33 and the supports 24 and 30 together at 32.

In performing this last step of assembly it is importantly necessary to locate the solder beads 32 and 33 respectively on the primary supports 24 and 23 so that the inner sides of the beads and their centers of mass will be spaced from the respectively adjacent, film covered faces of the crystal plate at accurately predetermined distances. It is to the meeting of this particular requirement that the apparatus herein disclosed in detail is directed.

The apparatus comprises two principal cooperating units, a soldering means proper, shown at the right in Figs. 1 and 2, and a fixture to hold the units 34 and 35 in proper relation to each other and bring them so held into correct operative relation with the soldering means. The fixture unit is shown at the left in Figs. 1 and 2.

The soldering unit comprises an electrically heated soldering iron of which only the shank 36 and the tip 37 are shown. The heating means, handle, if any, power cable, etc. are not shown, being of ordinary and familiar construction. The shank 36 is rigidly and horizontally mounted in a suitable perpendicular pedestal 38 on a base 39. The tip 37 is specifically adapted and formed to the special purpose in hand. There is in the left end of it a vertical, central, parallel walled slot 41, so that the bifurcated tip has twin noses 42 and 43. Each nose is

formed on its upper surface with a hollow or recess 44 and 45 enclosed by upwardly slanting walls on all sides except toward the slot 41, where each of the two recesses is open to its bottom. In the particular device illustrated the recess 44 (45) is formed by two sloping planes 46 and 48 (47 and 49) meeting along a line 50 (51).

For convenience a shallow metal tray 52 is mounted on the shank 36 by a metal sleeve 53 to be kept hot by heat from the shank. Pellets of solder of predetermined mass are kept in this tray in a bath of stearic acid kept liquid by relatively gentle heat maintained from the shank 36, which bath serves to protect the solder pellets against atmospheric oxidation and also to act as a flux during the soldering operation.

The fixture unit comprises a pedestal 54 on the base 39 in which is mounted a support 55 pivotable about a horizontal axis in the pedestal and having means as shown to hold the support yieldingly in either of the two extreme positions shown in Fig. 1, and movable from the one position to the other by means of a handle 56. In the right side of the support 55 is an L-shaped member 57 adjustably slidable in a corresponding slot in the support 55 and held therein in adjusted position by means of a clamp 58 and screw 59. The outer limb 63 of the member 57 stands across and adjustably spaced from the upper end of the support 55. The upper end of the support 55 is provided with a vertical central slot 60 dimensioned to receive the pins 28 and 29 respectively of the unit 35 of the article snugly but easily. Contact of the unit base 27 with the member 57 and against 55 as indicated at 61 positions the unit 35. A spring clamp 62 secured on the front of the support 55, enters through a slot in the support as shown to clamp the pins 28 and 29 yieldingly in place when inserted into the bores 61 and 60.

The tip end of the transverse limb 63 of the member 57 is shown in much enlarged detail in Figs. 9, 10 and 11, as well as on a smaller scale in Figs. 5, 6 and 7. This upstanding limb 63 is rectangular in cross-section and tapered slightly upwardly from front to back so that its width from front to back increases slightly from the top edges 64 and 65 to lines 66 and 67, from where on down this width is constant. The width of the slot 41 between the noses 42 and 43 of the soldering iron tip 37 is such as to receive the limb 63 easily at this constant width below the lines 66 and 67 and leave easy space between but no more for the ends of the wires 30 and 31. A V-shaped groove is cut longitudinally and centrally across the top end of 57 and a second V-shaped groove is cut centrally and transversely thereto, so that the four corners of the top present downwardly centrally slanting faces 68, 69, 70 and 71 formed by the first named groove and similar faces 72, 73, 74 and 75 formed by the second groove. From the bottom of the first groove a longitudinal central slot 76 extends down and terminates in a cylindrical bore 77. A similar slot 78 transverse thereto leads down from the bottom of the transverse groove. A vertical central bore 79 from the top down also terminates in the bore 77.

These various elements of the tip of the limb 63 are so formed, proportioned and related that a crystal 34 may be inserted, as shown in Figs. 5, 6 and 7, easily and removed easily and yet be held substantially immovably while the soldering operation is done. The slot 76 is wide enough to just receive the plate 20 easily, and the bottom

of the bore 77 is so located as to support the plate in the slot in the position shown in Figs. 5, 6 and 7. The slot 78 is wide enough to just receive the primary connector supports 23 and 24 easily. The bore 79 provides clearance for the weld blobs 25 and 26. The slot 78 is merely clearance for the wires 23 and 24 and extends down below these, the crystal unit including these wires being supported by the bottom edge of the plate 20 resting on the bottom of the bore 77. The wires or primary connector supports 23 and 24 then extend out through the front and rear faces of the member 63 at or just above the lines 66 and 67 where the member begins to taper. Hence after the soldering has been done and the solder blobs 32 and 33 formed, as hereinafter described, against the very slightly tapered faces of the fixture member 63, the soldered structure may be more easily lifted up out of the fixture because of the taper. In practise this taper is very slight, e. g., 0.003 inch taper per inch of length.

In operation, a crystal unit 34 is seated in the fixture member 63 in the position shown in Figs. 5, 6 and 7, the inclined plane surfaces 68—69 and 70—71 acting as guides to lead the edge of the plate 20 into the slot 76, and the surfaces 72—75 and 73—74 in like manner acting to guide the wires 23 and 24 into the slot 78, while the weld blobs 25 and 26 pass down the bore 79. A companion unit 35 is placed in the end of the member 55, as shown in the same figures, with the outer ends of the secondary connector supports 31 and 30 pressing gently to the right (Fig. 5) against the outer end of the primary connector supports 23 and 24 respectively just outside of the member 63. The wires 31 and 30 are formed to press themselves resiliently and lightly but firmly against the member 53 as well as against the wires 23 and 24.

The member 55 is then swung down from the loading position shown in full lines in Fig. 1 to the soldering position shown in dotted lines. A pellet of solder of predetermined mass is picked from the tray 52 and laid in each of the cups or recesses 44 and 45. The soldering iron tip 37 and particularly its twin noses 42 and 43 in which the cups 44 and 45 are, is kept at soldering temperature; and thus the solder pellets, covered with stearic acid flux from the bath in the tray 52, are melted in the bottom of each cup and around the cross contact of the wires 23 and 31 and of 24 and 30 respectively. The special relation of these contacts to the cups is shown in Fig. 8, from which it will be noted that the various parts are so adjusted that in the soldering position shown, the ends of the wires 23 and 24 project horizontally into the cups 45 and 44 respectively sufficiently above the lowest points of the concave cup bottoms to allow the molten solder to flow under the wires 23 and 24 and thus form a solid union of the crossed soldered elements. As soon as the solder is fairly melted and has thus run wholly around the horizontal wires, the member 63 is again lifted out of the slot 41. The molten solder by then is held in place, where put, by adhesion to the crossed wires and by its own surface tension, and sets in this position to form the accurately positioned blobs 32 and 33.

The fixture unit of the apparatus holds the contact points of the wires to be soldered in a predetermined position relatively to the plate 20 and, by forming a removable temporary wall for each of the cups in which the solder is melted,

also determines the distance between each face of the plate and the nearest surface of the solder blob adjacent thereto.

If the solder masses in question are too large to permit of depending upon internal forces of adhesion, cohesion and surface tension to hold the molten solder accurately enough in situ when the fixture is raised out of the soldering unit to cool the solder, the parts may be left in the soldering position, the power supply to the soldering iron cut off, and the combined members 63 and 37 chilled by a blast of cold air or other suitable means, to cause the solder to set, and the members 63 and 37 be then separated to unload the one and reheat the other.

It is to be noted that the members 63 and 37 must each be of some material not wetted by molten solder, e. g., aluminum, iron or steel with its surface phosphatized, stainless steel, aluminum bronze, chromium plated other metal or the like.

Fig. 12 is presented to illustrate the fact that it is not necessary to have the soldering iron bifurcated or to perform two solderings at one operation in order to embody the invention. In this arrangement some generally T-shaped unit 134 is to be soldered at 132 to a wire 131. The soldering iron tip 137 has only one nose 142.

If, in Fig. 12, the wire 131 and its support be omitted, the device serves to place a predetermined mass on the wire 124 at a predetermined distance from the adjacent face of the plate 134.

Other modifications and variations of embodiment may be made without departing from the spirit and scope of the invention as particularly pointed out and described in the appended claims.

What is claimed is:

1. In a soldering apparatus, a vertically slotted heatable member of material unwettable by molten solder and having two recesses in the top surface thereof opening respectively also from the two side surfaces of the slot, in combination with a fixture unit comprising a support movable into and out of the slot and proportioned to substantially close laterally the two recesses, means on the support to hold an element to be soldered with a part projecting horizontally into each of the two recesses when the support is in its recess closing position, and means on the support to hold another element to project vertically into each recess adjacent to the part of the first named element therein when the support is in recess closing position.

2. In a soldering apparatus, a vertically slotted heatable member of material unwettable by molten solder and having two recesses in the top surface thereof opening respectively also from the two side surfaces of the slot, in combination with a fixture unit comprising a support movable into and out of the slot and proportioned to substantially close laterally the two recesses, the support having a slot therein to reach from recess and recess and dimensioned to receive the primary support wires of a crystal unit and having a second slot at right angles thereto and dimensioned to receive and support the plate of the crystal unit, and means on the support to hold a crystal mount unit having secondary support wires thereon with the ends of the said wires adjacent to the primary support wires of a crystal unit in the said slots.

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