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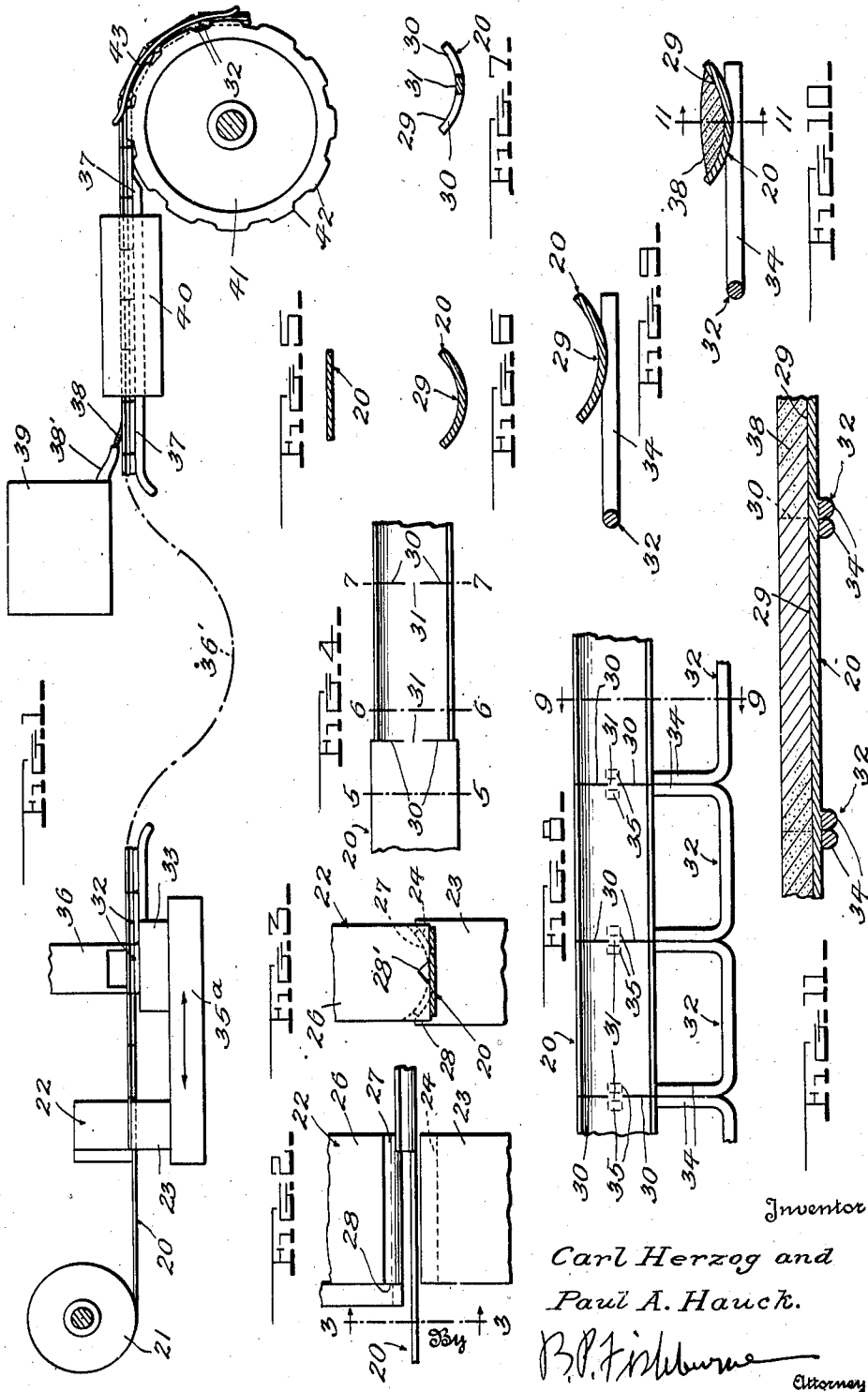
C. HERZOG ET AL

2,344,931

METHOD OF PRODUCING GETTERS

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2 Sheets-Sheet 1



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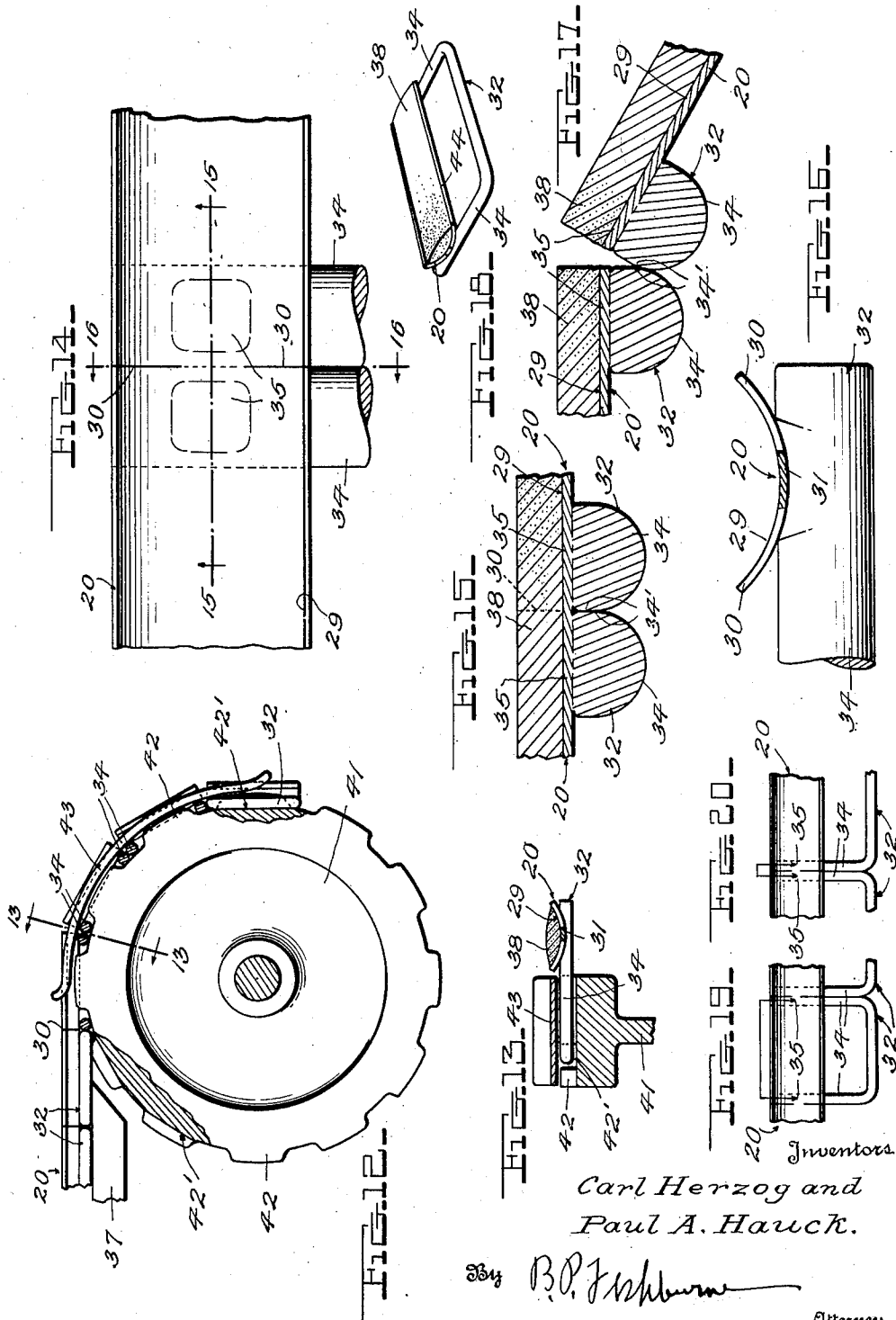
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2 Sheets-Sheet 2



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METHOD OF PRODUCING GETTERS

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16 Claims. (Cl. 29—25.13)

Our invention relates to a method of producing getters for use in connection with electronic tubes or the like.

An important object of the method is to weld the supporting elements to the metal ribbon before applying the getter material to such ribbon thereby avoiding improper combustion of the getter material during production.

A further object of the method is to apply the getter material in a continuous strip to the metal ribbon throughout a length of the ribbon embracing a plurality of getter cores.

A further object of the method is to continuously feed and apply the getter material to the ribbon during the travel of the ribbon.

A further object of the invention is to apply the getter material to the bases of the getters being produced throughout the entire length of such bases.

A further object of the method is to partly sever the ribbon at spaced intervals for determining the length of the getters while retaining the ribbon continuous for its proper manipulation in the practice of the steps of the method.

A further object of the method is to break the hardened getter material and tear the ribbon adjacent to the slit or slits, for separating the getters from the ribbon.

A further object of the method is to so manipulate the attached supporting elements that they act against each other to separate the getters from the ribbon.

A further object of the invention is to provide a method of the above mentioned character which may be practiced continuously and is economical.

A further object of the method is to provide a getter having the getter material applied to its base throughout the entire length of the base for reducing the all-over length of the getter.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a side elevation, partly diagrammatic, of apparatus used in the practice of the method, illustrating the steps of the method.

Figure 2 is an enlarged side elevation of the combined forming, slitting, and feeding device, the upper die being raised,

Figure 3 is a transverse section taken on line 3—3 of Figure 2, the upper die being lowered,

Figure 4 is a fragmentary plan view of the ribbon, showing the forming and slitting steps,

Figure 5 is a transverse section taken on line 5—5 of Figure 4,

Figure 6 is a similar view taken on line 6—6 of Figure 4,

Figure 7 is a similar view taken on line 7—7 of Figure 4,

Figure 8 is a fragmentary plan view of the ribbon after the forming and slitting steps and showing the supporting elements welded to the same,

Figure 9 is a transverse section taken on line 9—9 of Figure 8, before the getter material is applied to the ribbon,

Figure 10 is a similar view showing the getter material applied to the ribbon,

Figure 11 is a central vertical longitudinal section through the ribbon, having the getter material and the supporting elements applied thereto, parts broken away,

Figure 12 is a side elevation of the means which separates the completed getters from the ribbon,

Figure 13 is a transverse section taken on line 13—13 of Figure 12,

Figure 14 is a greatly enlarged fragmentary plan view of the ribbon and attached supporting elements, showing the legs of different supporting elements in contact,

Figure 15 is a longitudinal section taken on line 15—15 of Figure 14,

Figure 16 is a transverse section taken on line 16—16 of Figure 14,

Figure 17 is a view similar to Figure 15, showing the leg of one supporting element rolled against the leg of the next supporting element,

Figure 18 is a perspective view of the completed getter,

Figure 19 is a fragmentary plan view of the ribbon illustrating the welding step, and,

Figure 20 is a similar view illustrating a slightly different form of welding step.

In the practice of the method, a continuous refractory metal ribbon or band 20 is employed, preferably formed of molybdenum, although other metals or alloys may be employed. The metal ribbon is wound upon a spool 21 which pays out the ribbon. This metal ribbon is continuous and is originally transversely flat. The trailing portion of the ribbon 20 is fed forwardly longitudinally in an intermittent manner, while its leading portion is fed forwardly longitudinally continuously, and there is an intermediate por-

tion having a permanent slack, which permits of the intermediate and continuous feeding.

The ribbon 20 is passed longitudinally through a combined forming, slitting, and feeding device 22. This device 22 transversely arches the ribbon, transversely slits it, and feeds the ribbon longitudinally intermittently for one step equal to the length of the getter core or completed getter. This device 22 may include a lower die 23, having an upper transversely curved concave channel or recess 24. The device 22 further comprises an upper die 26 having a lower transversely curved convex face 27, to enter the channel or recess 24, and having a transverse shearing blade 28 to act against the end of the die 23. The blade 28 has a center notch 28'. The ribbon 20 in its normal transversely flat condition is passed between the dies 26 and 23, and the die 26 is then moved downwardly toward the die 23, whereby the convex face 27 will force the ribbon into the concave recess or channel 24, and this action will bend and form the ribbon, so that it is transversely curved or arched, and will have an upper channel or recess 29. At the same time, the blade 28 will form a pair of transverse slits 30 in the ribbon. The slits in each pair are in transverse alignment, extend through the opposite edges of the ribbon, and have their inner ends spaced to provide a connecting web 31, which retains the ribbon continuous for the purpose of feeding and the like. When the die 26 is clamping the ribbon to the die 23, both dies are moved forwardly to feed the ribbon longitudinally in a forward direction for a step equal to the length of the getter to be formed. After this feeding operation, the upper die 26 is raised and the two dies are shifted rearwardly in unison to their original starting position. This cycle of operation is repeated, and the ribbon is fed intermittently in a step-by-step manner.

In advance of the device 22 is means to weld U-shaped metal supporting elements 32 to the ribbon. This means includes an electrode 33. Each U-shaped supporting element may be formed of wire and is fed in succession upon the electrode 33 beneath and transversely of the ribbon 20 and contacts with the bottom surface of the ribbon. The outer portions 34' of the circumferences of the legs 34 of adjacent supporting elements 32 are in contact and in alignment with the slits 30. With the parts thus arranged the legs 34 are welded to the ribbon at the points 35, by a descending electrode or welding jaw 36, the jaw 36 and the electrode being suitably connected with the opposite poles of the welding circuit. Either or both upper and lower electrodes 36 and 33 may be insulated from the machine. The welding occurs while the ribbon is at rest between the steps of the feed, but may also occur in whole or in part during the feeding step. After the first U-shaped supporting element is properly located with respect to the ribbon and welded thereto, the ribbon is fed for a step, brought to rest, the next U-shaped supporting element 32 is passed beneath the ribbon, and one leg of the same will contact with the leg of the next leading U-shaped element 32, and the last U-shaped element is welded to the ribbon. This cycle of operation is repeated. Each U-shaped supporting element has the free ends of its legs 34 in substantial alignment with one edge of the ribbon while its closed end projects outwardly beyond the opposite end of the ribbon, for a substantial distance. When the legs 34 are welded to the ribbon the upper portions

of the legs are somewhat flattened. Both legs of each supporting element 32 may be simultaneously welded to the ribbon, Figure 19, or the adjacent legs of the next different elements 32 may be simultaneously welded to the ribbon, Figure 20.

The unit including the die 23 and the unit including the electrode 33 are preferably mounted upon a common reciprocatory support 35^a, and these units are reciprocated in unison. It is preferred to have the welding unit reciprocated with the forming unit, as this will allow more time for welding and will also prevent buckling of the ribbon between the forming unit and welding unit.

The intermediate portion of the ribbon, having the slack therein, is indicated at 36'.

The ribbon now passes over a support 37, and is held horizontal with its channel or recess 29 uppermost and a getter material 38 is supplied to the channel or recess 29 of the ribbon from a tube or spout 38', receiving such material from a tank 39. This getter material may be supplied under suitable pressure, if desired. The getter material may be applied by any other suitable means, such as by rotating wheels, as shown in our copending application Serial No. 470,514. The getter material is preferably in the form of a thin paste, having about the consistency of molasses. We may employ any of the well known getter materials available upon the market, or we may use the getter materials recited in Patent No. 2,208,692, granted to D. H. Wamsley, under date of July 23, 1940. The getter material is ordinarily combined with a suitable binder. When the ribbon reaches the spout 38' it is being fed longitudinally forwardly in a continuous manner, and the getter material 38 is continuously fed from the spout 38' into the channel or recess 29, during the travel of the ribbon. This applies the getter material to the ribbon in the form of a continuous strip or layer and the getter material is thus applied to the getters being formed throughout their entire length. The ribbon having the pasty getter material thus applied thereto continues in its forward longitudinal continuous movement and passes through an oven 40, wherein the getter material is baked and rendered solid and breakable. The support 37 extends through the oven 40 and passes from its leading end.

The leading end of the ribbon 20 with the supporting elements 32 secured thereto and the baked or solid getter material applied thereto now travels with the periphery of a continuously rotating gear wheel 41. This gear wheel has teeth 42, of a shape and size to enter the closed ends of the U-shaped supporting elements 32 and to fit substantially snugly therein. The spaces between the gear teeth are sufficiently large to receive the adjacent pairs of legs 34 of adjacent supporting elements 32. Each tooth 42 has a recess 42', to receive the closed end of the supporting element 32. The ribbon 20 is disposed upon one side of the periphery of the wheel 41, while the U-shaped elements 32 have their legs 34 engaging the periphery of the wheel 41 between the teeth 42. The ribbon 20 travels horizontally upon the support 37 and the leading end of the ribbon is substantially horizontal when it reaches the wheel 41.

A stationary guide 43 is disposed upon the upper portion of the wheel 41, Figures 12 and 13, and is arranged to engage the legs 34 of the supporting elements, but does not engage the ribbon.

This stationary guide acts upon the legs, which in turn cause the ribbon to travel in a curved path with the wheel 41. Each getter, at the leading end of the ribbon is therefore forced downwardly with respect to the next trailing getter and assumes a downwardly inclined position with relation thereto, and the leg 34 of the supporting element of the leading getter is rolled downwardly about the adjacent leg of the supporting element of the next trailing getter. The bending or inclining downwardly of the leading getter, causes the hard getter material to break transversely, in alignment with the transverse slits 30, since these slits cause the ribbon to fold at the slits. The transversely arched or channeled ribbon is stiff when filled with the hard getter material and can only fold upon the webs 31 between the slits. The rigid getter material is therefore transversely broken along the lines of the slits 30, while the rolling action of the trailing leg of the leading getter downwardly about the leading leg of the next trailing getter, tears and severs the web 31. The leading getter is therefore separated from the ribbon. The supporting elements 32 are held at the wheel 41 and caused to travel in a curved path, and therefore the force which breaks the solid getter material and tears the web of the ribbon, is primarily applied to the U-shaped supporting elements 32.

In Figure 18 the completed getter is shown, comprising a metal core 44, formed from the ribbon 20, and having its channel filled with the baked getter material 36, which extends throughout the entire length of the core 44. The legs 34 of the U-shaped supporting element 32 are at the extreme ends of the getter and the getter material extends over these legs. We are therefore enabled to eliminate the tabs at the ends of the core, which tabs are uncoated with the getter material, thus reducing the all-over length of the getter.

It is to be understood that the forms of our invention herewith shown and described are to be taken as preferred examples of the same, and that various changes may be made in the steps of the method and the order of such steps, and different getter materials employed, and various changes made in the getter, without departing from the spirit of our invention or the scope of the subjoined claims.

Having thus described our invention, what we claim is:

1. The method of producing getters, comprising forming a continuous metal ribbon to produce a channel, partly severing the ribbon at spaced points to define the length of the bases of the getters, welding metallic supporting elements to the bases, then feeding getter material into the channel of the ribbon, rendering the getter material hard, and severing the getters at the points where the ribbon was previously partly severed.

2. The method of producing getters, comprising forming a continuous metal ribbon to produce a channel, transversely partly severing the ribbon at spaced points to define the length of the getter bases, welding metallic supporting elements to the getter bases, then introducing getter material into the channel, causing the getter material to harden, breaking the hard getter material and tearing the ribbon at the points where the ribbon was previously partly severed.

3. The method of producing getters, comprising forming a continuous metal ribbon to produce a channel, intermittently transversely part-

ly severing the ribbon at spaced points in succession to define the length of the bases of the getters, then welding metallic supporting elements to the bases, then continuously feeding a portion of the ribbon thus treated, then feeding getter material into the channel of the portion of the ribbon when it is being fed continuously to produce a continuous layer, causing the getter material to harden, and severing in succession the leading getter at the point where the ribbon was previously partly severed.

4. In the method of producing a getter having a base and getter material extending throughout the entire length of the base, the steps of forming a continuous ribbon to produce a channel, transversely slitting the ribbon to partly sever the same and to define the lengths of the bases of the getters, welding metallic supporting elements to the bases, after the welding operation introducing getter material into the channel to provide a continuous layer which extends throughout the entire length of the bases, and severing the ribbon and getter material at the ends of the bases.

5. The method of producing getters, comprising forming a continuous metal ribbon to produce a channel, transversely slitting the ribbon at spaced points to partly sever the same and leave connecting webs and defining the length of the bases, welding substantially U-shaped supporting elements to the bases and causing the leg of each supporting element to contact with the leg of the next supporting element, supplying a continuous filling of getter material to the channel, causing the getter material to harden, and effecting the angular movement of each successive leading getter with relation to the next trailing getter to break the hard getter material and cause the leg of the leading supporting element to turn against the leg of the next trailing supporting element and tear the web between the leading getter and the next trailing getter.

6. The method of producing getters, comprising forming a continuous metal ribbon to produce a continuous channel, transversely slitting the ribbon at spaced points to partly sever the ribbon and define the length of the bases of the getters, supplying the getter material in the channel, and subjecting the ribbon to a pulling action to tear and sever the ribbon adjacent to the slits.

7. In the method of producing getters, as a sub-combination the steps of feeding a continuous metal ribbon longitudinally in a substantially straight path, transversely slitting the ribbon at spaced points to partly sever the same, arranging supporting elements transversely of the ribbon upon opposite sides of the slits, welding the supporting elements to the ribbon, and then causing the ribbon having the supporting elements welded thereto to travel in a curved path so that one supporting element in contact therewith travels about the next supporting element and a pulling action is exerted upon the ribbon to tear the same adjacent to the slit.

8. In the method of producing getters, as a sub-combination the steps of transversely slitting a metal ribbon to partly sever the same, arranging supporting elements transversely of the ribbon substantially upon opposite sides of the slit and causing the supporting elements to substantially contact, welding the supporting elements to the ribbon, and then turning one element about the other element in contact therewith in

a direction from the slit for producing a pulling action to tear the ribbon adjacent to the slit.

9. In the method of producing getters, as a sub-combination the steps of arranging supporting elements transversely of a metal ribbon and causing the supporting elements to contact, welding the supporting elements to the ribbon, and then turning one element about the other element in contact therewith in a direction from the ribbon for producing a pulling action to tear the ribbon between the elements.

10. The method of producing a device to serve only as a getter, comprising welding metal supporting elements to a continuous metal ribbon for attaching the supporting elements to the bases to be formed, after the welding applying a continuous strip of getter material to the ribbon and causing the strip to extend throughout the entire length of the bases and forming the strip in a width substantially equal to the width of the bases and causing the strip to pass across the points of welding, and severing the strip and ribbon at the ends of the bases and between the supporting elements to separate the devices.

11. The method of producing a device to serve only as a getter, comprising welding metallic supporting elements to one face of a continuous metal ribbon for attaching the supporting elements to the bases to be formed, after the welding applying a continuous layer of plastic getter material to the opposite face of the ribbon and causing the layer to extend throughout the entire length of the bases and pass across the points of welding and forming the layer in a width substantially equal to the width of the bases, causing the plastic layer to harden, and severing the hardened layer and ribbon at the ends of the bases and between the supporting elements to separate the devices.

12. The method of producing a device to serve only as a getter, comprising forming a metal ribbon for providing a continuous longitudinal channel which extends throughout the entire length of the bases to be formed and causing the channel to extend substantially to the longitudinal edges of the bases, welding metal supporting elements to the face of the formed ribbon remote from the channel for attaching the supporting elements to the bases, after the welding introducing a plastic getter material into the channel for providing a continuous layer which extends throughout the entire length of the bases and across the points of welding and to substantially the longitudinal edges of the bases, causing the plastic material to harden, and severing the layer and ribbon at the ends of the bases and between the supporting elements to separate the devices.

13. The method of producing getters, comprising forming a metal ribbon for providing a continuous longitudinal channel extending throughout the major portion of the width of the formed ribbon and extending longitudinally throughout the entire length of the bases to be formed, welding metal supporting elements to the formed ribbon for attaching the supporting elements to the bases, after the welding introducing a plastic getter material into the channel for providing a continuous layer which extends throughout the entire length of the bases and adjacent to the points

of welding and substantially to the longitudinal edges of the channel, rendering the plastic getter material hard, and severing the hard layer and ribbon at the ends of the bases and between the supporting elements to separate the getters.

14. The method of producing a getter having a base and getter material extending substantially throughout the entire length of the base, comprising forming a continuous metal ribbon to produce a continuous channel which extends throughout the major portion of the width of the formed ribbon, supporting the formed ribbon so that the channel is arranged uppermost, passing metal supporting elements beneath the formed ribbon, welding the supporting elements to the ribbon so that they are attached to the bases to be formed, after welding introducing a plastic getter material into the channel to produce a continuous layer which extends throughout the entire length of the bases and across the points of welding, rendering the plastic getter material hard, and severing the hard getter material and ribbon at the ends of the bases and between the supporting elements.

15. The method of producing getters, comprising forming pairs of transverse slits through the longitudinal edges of a metal ribbon for defining the length of the bases to be produced and leaving intermediate connecting webs between the slits in the pairs, forming the ribbon to produce a continuous longitudinal channel extending throughout the entire length of the bases and having substantially the same width as the bases, supporting the formed ribbon so that the channel is arranged uppermost, passing metal supporting elements beneath the formed ribbon to contact with the lower face of the ribbon, welding the supporting elements to the lower face of the ribbon so that they are attached to the bases, after the welding introducing a plastic getter material into the channel to produce a continuous layer extending throughout the entire length of the bases and substantially filling the channel, rendering the plastic getter material hard, severing the bases by tearing the intermediate webs, and breaking the hard getter material adjacent to the ends of the bases.

16. The method of producing getters, comprising forming a metal ribbon for producing a continuous longitudinal channel extending throughout the entire length of the bases to be formed, welding metal supporting elements to the formed ribbon for attaching the supporting elements to the bases, after welding effecting the longitudinal travel of the formed ribbon and the movement of the attached supporting elements with the ribbon, introducing a plastic getter material into the channel during the longitudinal movement of the ribbon so that a continuous layer of the getter material is produced extending throughout the entire length of the bases and arranged in close relation to the points of the welding, causing the plastic getter material to harden, and severing the hard layer and ribbon at the ends of the bases and between the supporting elements to separate the getters.

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