Sept. 24, 1968 R. J. KINKAID 3,402,590

PRODUCING SLOTTED MATERIAL

Filed Aug. 11, 1965

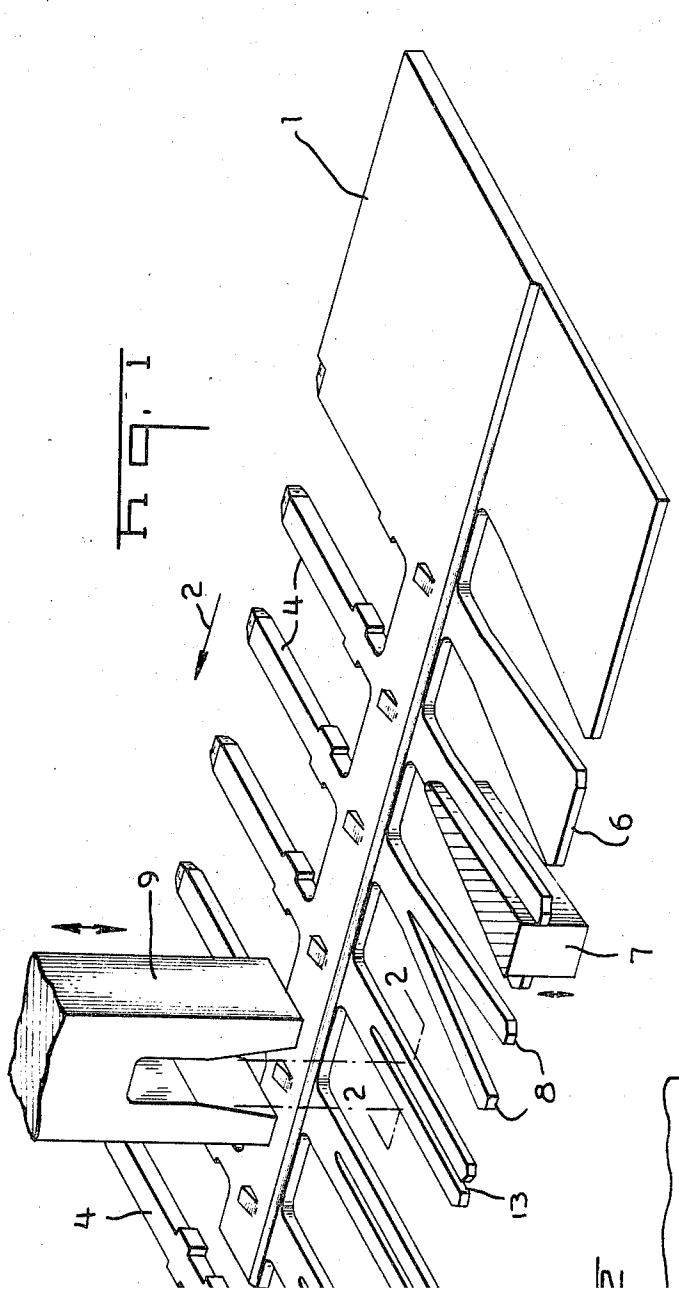


Fig. 1

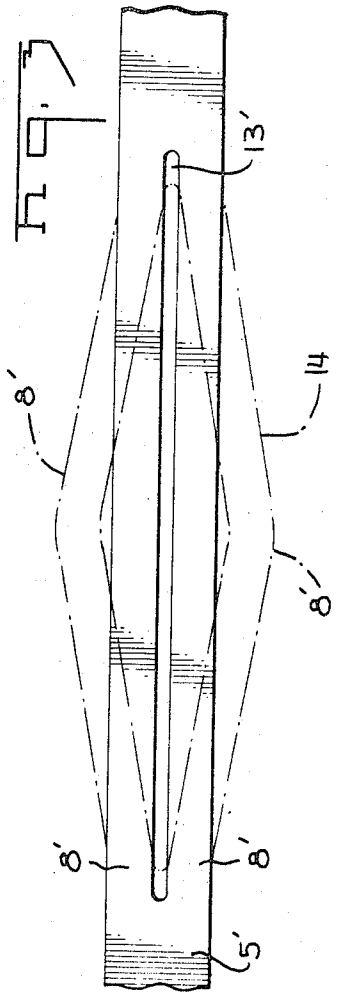


Fig. 3

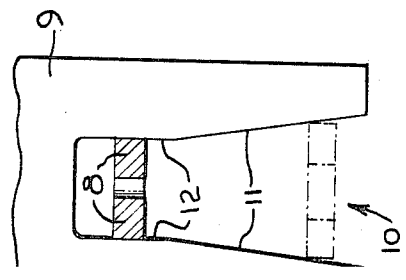


Fig. 2

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PRODUCING SLOTTED MATERIAL

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ABSTRACT OF THE DISCLOSURE

Slotted material is produced with a section of material being formed by the use of a blanking die to form a substantially triangular or diamond-shaped area, legs are blanked from the triangular or diamond-shaped area by a triangular or diamond-shaped blanking die with the legs extending outwardly from each other from one end in the case of the triangular-shaped area and from both ends in the case of the diamond-shaped area, and the legs are forced toward each until they are substantially parallel thereby forming a slot less than or equal to the thickness of the material.

This invention relates to an apparatus and a method of forming a narrow slot in material.

It is a standard practice in the metal blanking art to use punches at least one and a half times in width than the thickness of the material they are to penetrate. If the thickness of the material to be blanked exceeds the desired slot width, it becomes impractical to produce this width of slot, because the punches to blank the slot are incapable of performing such an operation in accordance with standard blanking practice.

It is a primary object of the invention to form a narrow slot in material.

Another object of the invention is to form a narrow slot in material having a thickness greater than the width of the slot.

A further object of the invention is to form a slot having an open end and a slot having closed ends in material.

An additional object of the invention is to provide means to form a narrow slot in material.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there are shown and described illustrative embodiments of the invention; it is to be understood, however, that these embodiments are not intended to be exhaustive nor limiting of the invention but are given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

The foregoing objects are realized in the case of an open end slot by stamping the material to form a section having a substantially triangular configuration, removing a triangular portion of the triangular section to form a bifurcated section and forcing legs of the bifurcated section together to form a slot having the desired width. In the case of forming a slot in material having closed ends, the material is subjected to a blanking operation to form a section having a substantially diamond configuration, a diamond-shaped piece is blanked from the diamond-shaped section and opposite legs on respective sides of the apices are engaged to push the legs together thereby forming the narrow slot.

In the drawing:

FIGURE 1 is a perspective, exploded and partially sectioned view showing a progressively formed electrical connector member;

FIGURE 2 is a view taken along lines 2—2 of FIGURE 1; and

FIGURE 3 illustrates the formation of a narrow slot having closed ends.

The present invention is described in conjunction with the formation of electrical connector members and forming in the contact end of the electrical contact members a narrow slot to form a contact end having a bifurcated configuration; however, it is to be understood that where it is essential to form a narrow slot in material, the present invention is applicable thereto. Thus, a practical use of the invention is in bifurcating the contact sections of electrical connectors. Bifurcation doubles the number of contact surfaces at each connection, and the reliability of the electrical connector is substantially increased over that of an electrical connector having a contact section provided with a non-bifurcated contact section.

Turning now to the drawings and more particularly FIGURES 1 and 2, there is illustrated a sheet of metal **1** moving in the direction indicated by arrow **2** between blanking dies of a conventional blanking machine which has not been illustrated for purposes of simplicity. As can be discerned, sheet of metal **1** has been premilled to form a section that is thinner than the other section.

As sheet of metal **1** is being moved between the stamping dies of the stamping machine, blanking dies engage the sheet of metal at the various stations along the progressive die to blank out metal from the sheet of metal as well as to form the sheet of metal into the desirable configuration. As illustrated, sheet of metal **1** is blanked to form an electrical connector of the type illustrated in applicant's co-pending U.S. patent application Ser. No. 349,565, filed Mar. 5, 1964, now abandoned. Electrical connector **3** is formed to include a conductor receiving section **4** in the thickest section of the sheet of metal **1** and a contact section **5** in the thinner section of the metallic sheet. Contact section **5** is first formed at the initial blanking station as a substantially triangular-shaped section **6**. At the next blanking station, a triangular-shaped punch **7** engages triangular-shaped section **6** and blanks therefrom a piece of metal conforming in configuration to that of punch **7** and forming legs **8** which are directed away from each other from one end of the legs.

A forming punch **9** is disposed at the next station in line and includes a mouth **10** having tapered surfaces **11** which merge with parallel surfaces **12**. Forming punch **9** is moved downwardly toward legs **8** from the innermost portion of contact section **5** to about the mid-portion thereof. During the downward movement of forming punch **9**, tapered surfaces **11** engage legs **8**, and move along tapered surfaces **11** and parallel surfaces **12** as illustrated in FIGURE 2. This causes legs **8** to move toward each other and reach a final position wherein they are disposed parallel or substantially parallel with respect to each other and forming a slot **13** therebetween. At the next station, bifurcated contact section **5** is formed into a spoon-shaped configuration and the formed connectors can be sheared from metallic sheet **1** or left in strip form as desired.

The invention is useful in forming narrow slots in material wherein the width of the slots is less than or equal to the thickness of the material. If punching dies having a thickness less than or equal to that of the material upon which they are to operate are used to form slots therein, the life expectancy of the punching dies will be very short and the cost of replacing the punching dies will be prohibitive. The present invention obviates this drawback by using a blanking die in one station to blank out material from the section in which a narrow slot having a width less than or equal to the thickness of the material is to be

formed so as to form legs which are directed outwardly from each other in accordance with an angular disposition determined by the punching die, the legs then being shoved toward each other by means of a forming punch until the legs are disposed substantially in parallel relationship to form the narrow slot. The apex of triangular-shaped punch **7** is radiused so as to conform to the width of the slot. It is obvious that the present invention can be applied to other electrical connectors wherein the contact section is to have a bifurcated configuration.

FIGURES 1 and 2 are directed to forming a bifurcated contact section wherein the ends of legs **8** at one end of the slot are free. FIGURE 3 illustrates a bifurcated contact section **5'** wherein slot **13'** is closed at both ends. In this embodiment, section **14** in which the slot is to be made is initially formed in the shape of a substantially diamond configuration. Next, a diamond shaped blank is stamped out of the diamond-shaped section by means of a diamond-shaped punch similar to that of punch **7** leaving outwardly directed legs extending outwardly from both ends of legs **8'** as illustrated in phantom in FIGURE 3. A forming die, similar to forming die **9**, is then used to squeeze legs **8'** together until slot **13'** is formed having closed ends. The outer ends of the diamond-shaped punch are radiused to conform to the width of slot **13'**. Bifurcated contact section **5'** may be formed with one end having extensions extending outwardly to engage projections in a housing member to limit the movement of the contact section into the contact area of the housing member.

As can be discerned, there has been disclosed a unique method and apparatus for forming narrow slots in material wherein the width of the slots is less than or equal to the thickness of the material in which the slots are to be formed and the slots may have one end opened or both ends of the slots may be closed.

It will, therefore, be appreciated that the aforementioned and other desirable objects have been achieved; however, it should be emphasized that the particular embodiments of the invention, which are shown and described herein, are intended as merely illustrative and not as restrictive of the invention.

What is claimed is:

1. A method of forming a narrow slot in a sheet of material with the slot having a width less than or equal to the thickness of the sheet of material comprising the steps of feeding the sheet of material between die members defining blanking stations therealong, blanking the sheet of material at the blanking stations to form a member having a planar section, removing part of the planar section thereby forming leg members extending away from each other at an acute angle from one end thereof, and moving said leg members toward each other until they are substantially parallel to each other whereby said narrow slot is formed therebetween.

2. A method of forming a narrow slot in a sheet of material with the slot having a width less than or equal to the thickness of the sheet of material comprising the steps of feeding the sheet of material between die members defining blanking stations therealong, blanking the sheet of material at the blanking stations to form a member having a planar section, removing prat of the planar section thereby forming leg members extending away from each other at an acute angle from one end thereof with the other ends thereof being free, and moving said leg members toward each other until they are substantially parallel to each other whereby said narrow slot is formed therebetween.

3. A method of forming a narrow slot in a sheet of material with the slot having a width less than or equal to the thickness of the sheet of material comprising the steps of feeding the sheet of material between die members defining blanking stations therealong, blanking the sheet of material at the blanking stations to form a member having a planar section, removing part of the planar section thereby forming leg members extending away from each other at an acute angle from each end of the leg members, and moving said leg members toward each other until they are substantially parallel to each other whereby said narrow slot is formed therebetween.

4. A method of forming a narrow slot in a sheet of material with the slot having a width less than or equal to the thickness of the sheet of material comprising the steps of feeding the sheet of material between die members having blanking stations therealong, blanking the sheet of material at the blanking stations to form a member having a planar section of substantially triangular configuration, removing a triangular piece of material from the planar section thereby forming leg members extending outwardly from each other from one end of said leg members, and moving the leg members toward each other until they are substantially parallel whereby said narrow slot is formed therebetween.

5. A method of forming a narrow slot in a sheet of material with the slot having a width less than or equal to the thickness of the sheet of material comprising the steps of feeding the sheet of material between die members having blanking stations therealong, blanking the sheet of material at the blanking stations to form a member having a planar section of substantially diamond configuration, removing a diamond-shaped piece of material from said planar section thereby forming leg members extending outwardly from each end of said leg members, and moving said leg members toward each other until they are substantially parallel whereby said narrow slot is formed therebetween.

6. An apparatus for forming a narrow slot in a sheet of material with the slot having a width less than or equal to the thickness of material comprising blanking-die means for operating on said sheet of material to blank out a member having a planar section, one of said blanking-die means being of a configuration to blank out a piece of material from said planar section thereby forming leg members of said planar section with the leg members extending outwardly from each other at an acute angle from at least one end thereof, and a forming-die means having a mouth for receiving said outwardly-extending leg members within said forming-die means and surfaces for engaging said outwardly-extending leg members and moving said outwardly-extending leg members toward each other until they are substantially parallel whereby said narrow slot is formed therebetween.

7. An apparatus according to claim **6** wherein one end of said one of said blanking-die means has a radius conforming to the width of the narrow slot.

8. An apparatus for forming a narrow slot in a sheet of material with the slot having a width less than or equal to the thickness of material comprising blanking-die means for operating on said sheet of material to blank out a member having a planar section of substantially triangular-shaped configuration, one of said blanking-die means being triangular-shaped for blanking out from said planar section a triangular piece of material thereby forming leg members of the planar section with the leg members extending outwardly from each other at an acute angle from one end thereof, and a forming-die means having a mouth for receiving said outwardly-extending leg members within said forming-die means and surfaces for engaging said outwardly-extending leg members and moving said outwardly-extending leg members toward each other until they are substantially parallel whereby said narrow slot is formed therebetween.

9. An apparatus for forming a narrow slot in a sheet of material with the slot having a width less than or equal to the thickness of material comprising blanking-die means for operating on said sheet of material to blank out a member having a planar section of substantially diamond-shaped configuration, one of said blanking-die means being diamond shaped for blanking out from said

planar section a diamond-shaped piece of material thereby forming leg members of said planar section with the leg members extending outwardly from each other at an acute angle from each end thereof, and a forming-die means having a mouth for receiving said outwardly-extending leg members within said forming-die means and surfaces for engaging said outwardly-extending leg members and moving said outwardly-extending leg members toward each other until they are substantially parallel whereby said narrow slot is formed therebetween.

10. An apparatus according to claim **9** wherein opposite ends of said one of blanking-die means have a radius conforming to the width of the narrow slot.

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