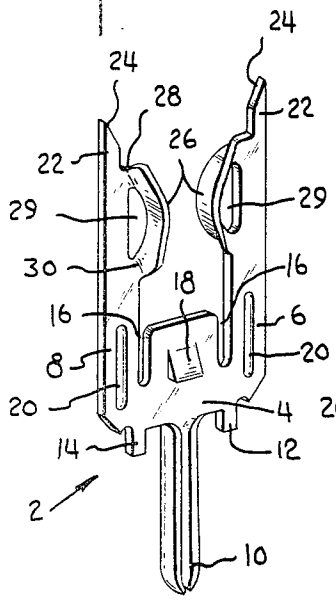
March 24, 1970 T. D. DESSO ET AL 3,503,036

CONTACT TERMINALS AND MANUFACTURING METHOD

Filed March 27, 1968 2 Sheets-Sheet 1

Fig. 1



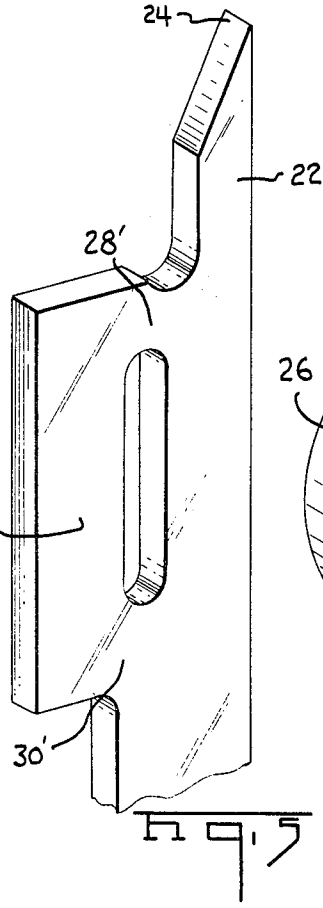


Fig. 5

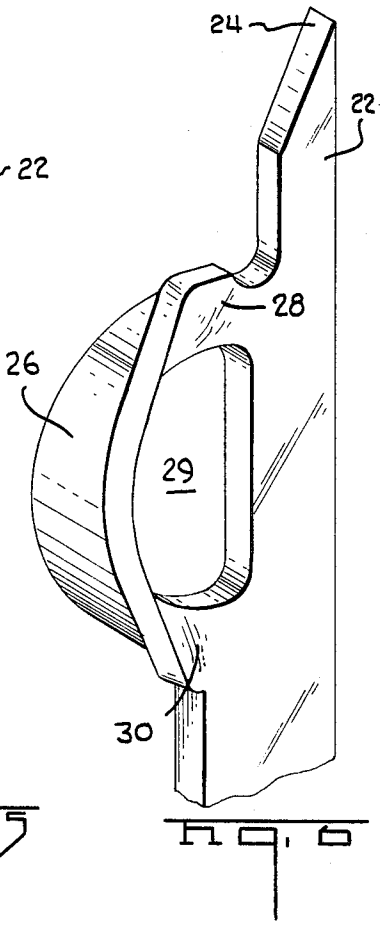


Fig. 6

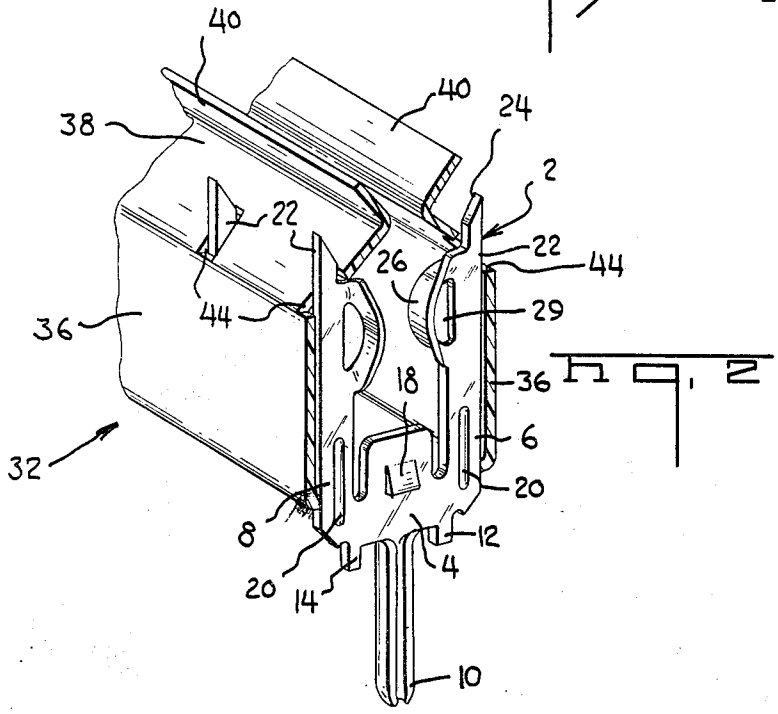
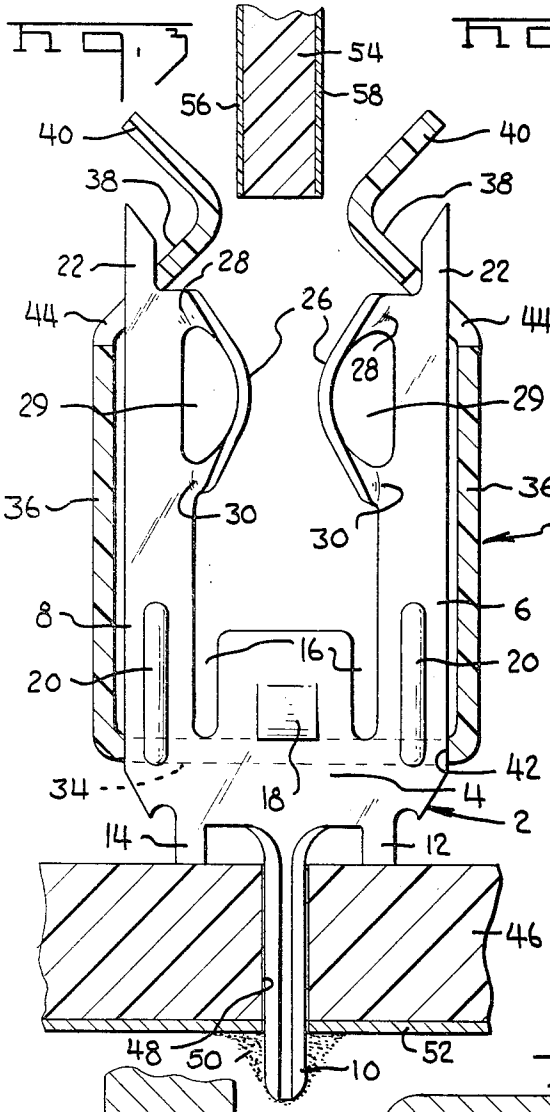


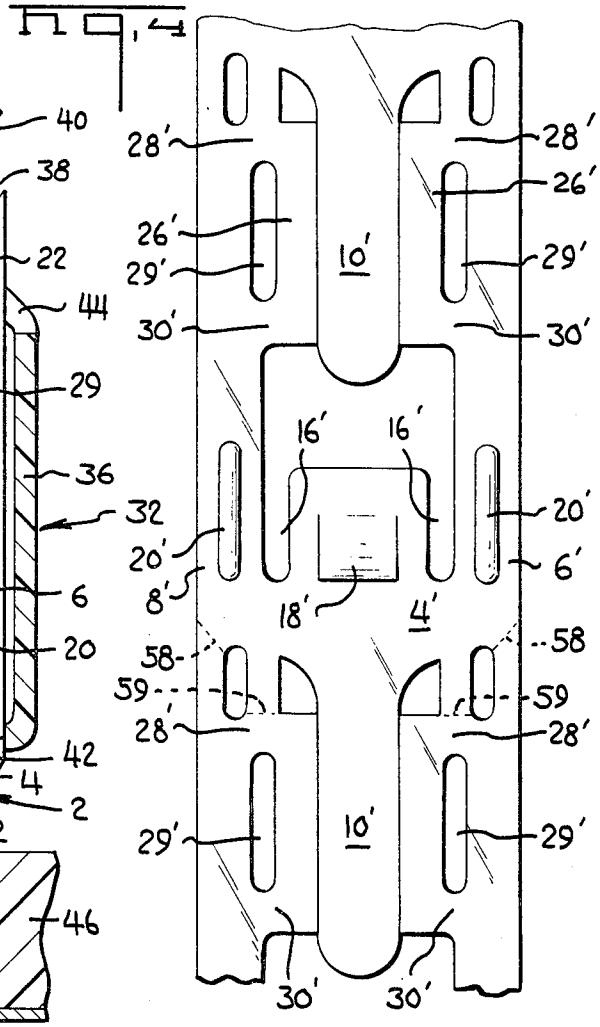
Fig. 2

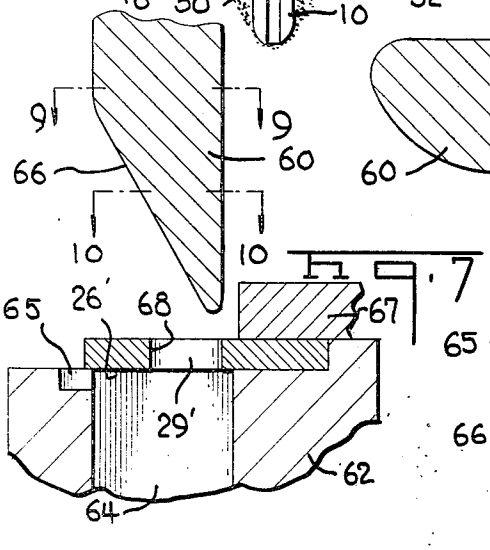
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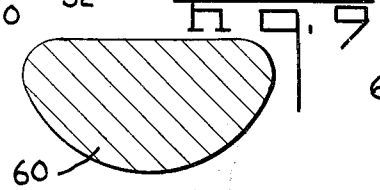
CONTACT TERMINALS AND MANUFACTURING METHOD

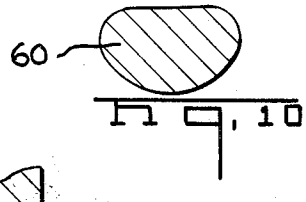
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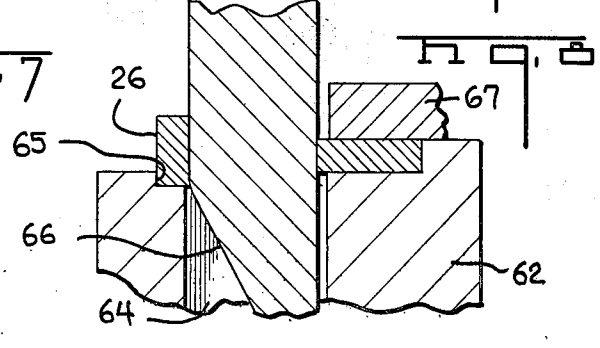












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CONTACT TERMINALS AND MANUFACTURING METHOD

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Int. Cl. H01r 11/22
U.S. Cl. 339—258 6 Claims

ABSTRACT OF THE DISCLOSURE

Electrical contact terminal for printed circuit board or the like is of stamped and formed construction and has contact surfaces disposed in a plane extending normally of the plane of the terminal. Contact surfaces are provided by punching elongated opening in the terminal and then forcing semi-circular punch through the opening. During movement of the punch through the opening, the stock material on one side of the opening is deformed in a manner such that surface portions of the terminal face laterally of the plane of the terminal after deformation. Connecting straps which connect to the contact surface portions to the body of the terminal are deformed to provide compound connecting straps extending in several planes. These straps are extremely stiff and do not flex substantially when the terminal is forced against the printed circuit board.

BACKGROUND OF THE INVENTION

The instant invention relates to low cost printed circuit board contact terminals of the general type used in domestic radios or television sets or under similar circumstances where costs must be kept to a minimum level. The invention is particularly directed to a contact terminal which can be manufactured from extremely thin stock metal without the sacrifice of electrical characteristics or physical strength.

It is an object of the invention to provide an improved stamped and formed contact terminal for printed circuit boards or the like. A further object is to provide a terminal that can be manufactured from extremely thin stock metal. A further object is to provide a terminal which can be manufactured from preplated metal strip and which will have, in its finished form, plated surface portions as its contact surfaces instead of unplated edges. A still further object is to provide a stamping and forming manufacturing method for contact terminals by means of which a relatively strong and rigid terminal can be produced from thin metal stock.

These and other objects of the invention are achieved in a preferred embodiment thereof comprising a stamped and formed printed circuit board terminal having a generally cylindrical or arcuate contact surface of substantial width which is disposed in a plane extending normally of the plane of the terminal itself. The contact portion of the terminal is connected to the terminal by means of a pair of straps integral with the terminal body and with each of the contact portions. These straps are deformed in a generally helical fashion between the contact portion of the terminal and the body portion of the terminal so that they are extremely resistant to flexure or other deformation when the terminal is moved against the surface of a printed circuit board. Terminals in accordance with the invention are manufactured by forming an elongated opening in the body of the terminal and subsequently driving a semicircular punch through this opening so that the stock metal on one side of the opening is displaced out of its original plane (the plane of the stock metal of the terminal) and located in a plane extending transversely of the plane of the terminal. During such movement of the contact portion out of the plane of the terminal, the connecting straps which extend between the contact portion and the body of the terminal are twisted so that they are extremely rigid and are capable of firmly supporting the contact area relative to the body of the terminal.

In the drawing:

FIGURE 1 is a perspective view of a contact terminal in accordance with the invention;

FIGURE 2 is a perspective fragmentary view of a connector having terminals in accordance with the invention mounted therein;

FIGURE 3 is a sectional side view showing a connector having terminals in accordance with the invention mounted on a printed circuit mother board;

FIGURE 4 is a plan view of a section of metal strip from which blanks for terminals in accordance with the invention have been punched;

FIGURE 5 is a fragmentary perspective view on a greatly enlarged scale of the end portion of one of the arms of a terminal in accordance with the invention prior to a final forming step during which the contact portion of the terminal is formed;

FIGURE 6 is a view similar to FIGURE 5 but showing the end portion of the arm after the contact surface has been formed;

FIGURE 7 is a sectional side view showing a punch and die adapted to form the contact area on a terminal in accordance with the invention, this view showing the position of the parts prior to movement of the punch into the die;

FIGURE 8 is a view similar to FIGURE 7 but showing the positions of the parts after the contact area has been formed; and

FIGURES 9 and 10 are views taken along the lines **9—9** and **10—10** of FIGURES 7.

Referring first to FIGURE 1, a terminal **2** in accordance with the invention comprises a yoke or web **4** having a pair of arms **6, 8** extending from its upper edge. A mounting post **10** extends downwardly from the lower edge of the yoke **4** and a pair of supporting feet **12, 14** are provided on each side of this mounting post. The mounting post **10** has a U-shaped cross-section and is formed from material on each side of the center line of the connector as will be described more fully below.

Recesses **16** extend downwardly as viewed in FIGURE 1 into the yoke **4** and define a pair of spaced-apart arms **6, 8**. In the disclosed embodiment, ribs **20** are embossed on these arms to control their stiffness and to insure that the contact portions of the terminal will engage the conductors on an inserted printed circuit board with an adequate contact force. Additionally, and where the terminal is stamped from extremely thin stock metal, these ribs function to maintain the arms in the same plane as the body portion of the terminal and prevent their being flexed laterally of the plane of the body portion. The ends **22** of the arms are of reduced width and are pointed as shown at **24** to facilitate the insertion of the connector into a connector housing of the type shown in FIGURES 2 and 3.

The arms **6, 8** are provided with contact surfaces **26** integral with their opposed edges. The contact surfaces of these arms are generally cylindrical and are connected to the inner edges of the arms by connecting straps **28, 30**. The contact surfaces **26** are spaced from the body portions of the arms by generally semi-circular openings **29** which are formed in a manner described below. The connecting straps **28, 30** have compound surfaces which may be described as being generally helical,

that is, the type of surface which is generated if the ends of a relatively narrow strip of metal are grasped and twisted in opposite directions. As will be explained below, the contact surfaces **26** are provided by a forming operation which includes a degree of twisting of these straps. As a result, the straps are extremely strong, notwithstanding the thinness of the metal from which the terminal can be made and will function to support the contact surfaces **26** rigidly with respect to the arms **6**, **8**. It will be apparent from FIGURES 1 and 6 that the contact areas **26** are relatively wide and are formed from stock metal which was originally located in the plane of the body portion of the terminal. The contact areas **26** are thus of a much greater extent than would be the case if only the edges of the arms were utilized for contact purposes. Furthermore, these contact areas will be plated areas (when the terminal is formed from preplated stock) rather than sheared edges of exposed basis metal.

FIGURES 2 and 3 show contact terminals in accordance with the invention mounted in relatively thin walled channel-shaped housings of the general type disclosed more fully in application Ser. No. 701,365, filed Jan. 29, 1968. Such housings, as explained in the above-identified application, may be formed of relatively thin plastic material or of insulating paper and have a base portion **34** from which sidewalls **36** extend. The sidewalls **36** are inwardly directed at **38** and then outwardly directed at **40** adjacent to their upper ends to facilitate the insertion of a printed circuit board as shown in FIGURE 3. A plurality of spaced-apart transverse openings **42** are provided in the base of the housing and openings **44** are provided in the sidewalls. The terminals are assembled to the housing by insertion through the openings **44** until the pointed ends **24** of the arms project through the openings **44** and the latches **18** lodge against the inside surface of the base portion **34** of the housing. The latches **18** are, in the disclosed embodiments, rigid and the base **34** of the housing flexes to permit passage of the latches therethrough. As fully explained in the above-identified application Ser. No. 701,365, the terminals thus function to hold the sidewalls of the housing in spaced relationship to each other and the housing, in turn, functions to support the terminals in parallel side-by-side relationship.

As shown in FIGURE 3, the connector **32** will, in normal use, be mounted on a printed circuit mother board **46** by inserting the post portions **10** of the terminals through openings **48** in the board **46**. Thereafter, the ends of the post portions are electrically connected to conductors **52** on the underside of the board **46** by solder as shown at **50**. The connector is thus adapted to receive a printed circuit daughter board **54** which is inserted between the sidewalls of the housing so that the conductors **56**, **58** on the board **54** will be engaged by the contact portions **26** of the terminals contained in the housing.

Terminals in accordance with the invention are manufactured by stamping and forming relatively thin metal stock as shown in FIGURE 4 and twisting or bending the contact portions of the terminals out of the plane of the stock as illustrated in FIGURES 7 and 8. In FIGURE 4, the portions of the blank are identified by the same reference numerals, differentiated by prime marks, as are used to identify the structural features of the finished terminal of FIGURE 1. Thus, in FIGURE 4, the U-shaped post **10** is formed from the tongue **10'**, the pointed ends **24** of the arms **6**, **8** are formed by severing the leading terminal from the strip along the severing lines **58**, and the supporting feet **12**, **14** are similarly formed by severing along the lines **59**.

It will be noted that the openings **29'** adjacent to the portions **26'** of the blank which eventually become the contact portions **26** are elongated slots rather than the semi-circular openings **29** of the finished terminal.

Referring to FIGURES 7 and 8, the contact surface portions **26** of the finished terminal are positioned in a plane extending normally of the plane of the original blank by means of a die **62** having a generally semi-circular opening **64** therein for the reception of a punch **60**. A shallow depression **65** is provided on the lefthand side of the opening as viewed in FIGURE 7 to permit controlled twisting of the contact portion in a manner described below and a clamping member **67** is provided to clamp the opposite side of the arm during twisting. The punch **60** has a generally semi-circular cross-section as shown in FIGURE 9 which tapers to a point which is sufficiently small to enter the slot **29'** of the blank. As this punch moves downwardly from the position of FIGURE 7 to the position of FIGURE 8, the divergent surface portions **66** of the punch move against the lefthand edge **68** (as viewed in FIGURE 7) of the slot **29**. The lateral stresses imposed on the blank, and particularly on the strap portions **28'**, **30'** of the blank, cause the contact section **26'** to be moved leftwardly in FIGURE 7 and the strap portions to be twisted, stretched, and somewhat elongated. Concomitantly, the tapered surface portion **66** of the punch cause the contact portion **26** to be swung out of the original plane of the blank and located, as shown in FIGURE 8, in a plane extending substantially normally of the original blank. The lower portions of the contact section of the arm lodge in the recess **65** as shown in FIGURE 8 so that the medial plane of the terminal extends medially through the reoriented contact portion of the arm. It will be understood that FIGURE 8 is a section taken through the center of the contact portion and that on each side of FIGURE 8, the surface of the contact portion will slope towards the strap portions **28**, **30** which provide the twisted transition surfaces by means of which the contact surface is connected to the arm of the terminal.

By virtue of the hardening which takes place in the strap portions **28**, **30** and also by virtue of the twisting of these strap portions, these strap portions are extremely rigid and strong and are capable of supporting the contact surfaces **26** without flexure relative to the arms **6**, **8** to which the contact surfaces are connected. The arms **6**, **8** flex as units when the printed circuit board **54** is inserted between the terminals in FIGURE 3 so that a controlled amount of contact force is applied against the surfaces of the board and the contact surfaces **26** remain in their original planes.

Terminals in accordance with the invention can be manufactured from material of any desired stock thickness and in any desired size. Regardless of the size of the terminal being manufactured, substantial material savings can be realized if the contact area is formed in the manner illustrated in FIGURES 7 and 8. For example, terminals having a length of about 0.60 inch have been manufactured from stock metal having a thickness of 0.008 inch without sacrifice of strength or contact area. The particular embodiment of the invention shown in the drawing offers further advantages, as regards material costs as a factor in overall terminal costs, because of the extremely low scrap losses as will be apparent from FIGURE 4. Thus, in FIGURE 4, the only scrap losses encountered in the strip are the material punched out adjacent to the web portion of the terminals, the material punched out of slots **29'**, and the additional material punched out on each side of the posts of each terminal. Substantial scrap losses on each side of each post are avoided by virtue of the fact that the post portion **10'** of each terminal is formed from material or metal stock of the next adjacent terminal of the strip.

It will be understood that the disclosed embodiment of the invention is intended for use with printed circuit boards having a substantial thickness, say 0.050 inch and that the contact surfaces **26** are, therefore, spaced-apart by an amount only slightly less than the thickness of such boards. Terminals in accordance with the invention can

also be made for use with extremely thin boards or substrates having a thickness of 0.020 inch or less. In the manufacture of terminals for such thin boards, the blank would differ from the blank of FIGURE 4 in that the arms **6**, **8** would be substantially against each other so that the contact surface of the finished terminal would be spaced-apart by about 0.015 inch or less. Under these circumstances, the post portions of the individual terminals would not be formed from material between the arms of the next adjacent terminal.

While the principles of the invention have been herein disclosed with reference to a fork-type terminal having a pair of spaced-apart arms, it will be apparent that the method, disclosed in FIGURES 7 and 8, of forming the contact area in a stamped and formed terminal can be applied to other types of printed circuit board terminals.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only.

What is claimed is:

1. A stamped and formed sheet metal terminal having a body portion and at least one contact portion, substantially all of said body portion lying in a single plane, each said contact portion extending transversely of said plane, each said contact portion being connected to said body portion by a pair of spaced-apart straps, said straps being twisted along their lengths and supporting each said contact portion rigidly relative to said body portion.

2. A terminal as set forth in claim **1** of the fork-type, said body portion having a pair of spaced-apart arms, each of said arms having a contact portion thereon.

3. A terminal as set forth in claim **1** wherein said contact portion has an arcuate surface extending between said straps.

4. A stamped and formed sheet metal terminal having a body portion and at least one contact portion, each said contact portion being connected to said body portion by connecting means, said connecting means comprising a pair of spaced-apart straps, said straps being twisted relative to said body portion whereby each said contact portion provides a contact surface in a plane extending transversely of the plane of said body portion, each said contact surface being of stock material which was coplanar with the stock material of said body portion prior to twisting of said connecting means.

5. A device as set forth in claim **4** wherein said contact surface is generally arcuate in cross-section.

6. A device as set forth in claim **4** wherein said body portion has a pair of spaced-apart arms, each of said arms having a contact portion thereon.

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