

Description

Brief Summary of the Invention

This invention relates to forming presses, and in particular to a forming press for bending the electrical conducting leads extending laterally from semiconductor packages or similar electrical or electronic components.

Electronic components such as small and large scale integrated circuits, memories, logic arrays and the like, are conventionally housed in moulded packages. These packages have outwardly extending metal leads for conducting operating power and signals to and from the internal elements. In the initial formation of such a package, the leads typically extend laterally from both sides of the package, and must be bent downward so that they can be plugged into sockets or soldered directly to printed circuit boards.

A number of machines have been devised in the past for bending the leads of electronic component packages. However, prior bending machines have a number of drawbacks. For example, in one form of bending machine, a bending punch is arranged so that it applies a bending force perpendicular to the direction in which the lead initially extends from the component package. Such a bending machine is disclosed in FR-A-2 244 277 upon which the pre-characterising portion of the main claim is based. During bending, a shear force is applied, which tends to weaken or damage the lead. In this prior bending machine, the punch also tends to move in sliding contact with the lead causing damage, for example the peeling of plating on the surface of the lead. In another type of bending machine, a bending punch is arranged to rotate about an axis in order to effect the desired deformation of the lead. The rotary bending punch is not suitable for small semiconductor packages, since a relatively large and complex mechanism is needed to effect rotation of the punch.

US-A-4 780 950 discloses a component lead cutting and forming apparatus in which the leads of the components are bent by vertically moving rollers which engage and bend the leads by rolling over the leads.

The principal object of this invention is to provide a forming press for leads of semiconductor packages and the like which, in contrast with prior machines used for the same purpose, is less likely to cause damage to the leads during the bending operation. It is a further object of the invention to provide a lead forming press which is comparatively simple and inexpensive, and which is durable and reliable.

The present invention provides a forming press having the features of Claim 1.

The invention addresses the above mentioned problems encountered in the use of prior art lead

bending machines by a forming press structure which comprises a die for supporting a package having at least one lead extending from at least one side thereof, and a punch for holding the package and bending the lead. The punch is supported for movement along a first line of movement toward and away from the die and comprises a package securing component movable along the first line of movement for temporarily securing the package to the die, and at least one lead bending component, movable, relative to the package securing component, along a second line of movement, for contacting the lead and bending the lead in cooperation with the die. The lead bending component is guided so that the first and second lines of movement are oblique with respect to each other and converge in the direction of movement of the punch toward the die.

In the preferred form of the invention, suitable for use with packages having leads extending laterally from both sides, an additional lead bending component is located on the opposite side of the package securing component, for contacting and, in cooperation with the die, bending, a lead extending from the opposite side of the package. The additional lead bending component is movable relative to the securing component along a third line of movement, and the second and third lines of movement converge in the direction of movement of the punch toward the die.

When a semiconductor package or similar component is placed on the die, the punch begins to descend toward the die. The package securing component and the lead bending component move together toward the die, but are relatively movable so that, after the package securing component comes into contact with the package on the die, further descending movement of the punch causes the lead bending component of the punch to move downward and inward. Consequently, the lead bending component applies an obliquely directed bending force to the lead, resulting in a bending moment causing the lead to bend downward and inward.

After completion of the formation of the lead, the punch begins to ascend. As the punch ascends, the lead bending component retreats from the die while the package securing component remains in contact with the package. Thereafter, upon further upward movement of the punch, the package securing component separates from the package, allowing the package to be discharged from the die. Thereafter, a new package having one or more leads requiring bending is placed onto the die, and the bending operation is repeated.

Further objects, details and advantages of the invention will become apparent from the following detailed description, when read in conjunction with the drawings.

Brief Description of the Drawings

FIG. 1 is a vertical section of a preferred form of lead forming press in accordance with the invention;

FIG. 2 is a left side elevation of the press of FIG. 1;

FIG. 3 is an enlarged fragmentary sectional view showing a typical semiconductor package held in a die of the press of FIGS. 1 and 2, and showing the package securing component of the punch in contact with the package, while a pair of lead bending components have not yet begun their oblique downward movement against the leads of the package; and

FIG. 4 is a view similar to FIG. 3, but showing the lead bending components in their fully descended condition.

Detailed Description

As seen in FIG. 1, semiconductor packages S_1 , S_2 and S_3 are held on a die 14, which is supported on a transfer mechanism 16 by a die holder 12. The transfer mechanism 16 moves the die to the right to effect indexing movement of the packages, and thereafter returns the die to a starting position. The semiconductor packages S are initially as shown in FIG. 3, having their leads R extending horizontally from both sides of the packages.

The die 14 may be replaced by different dies, depending on the nature of the packages to be handled and on the desired lead configuration. Preferably, the die is capable of carrying a plurality of packages simultaneously, although many of the advantages of the invention can be realized with a press in which the die is capable of holding only one package at a time.

The principal components of the punch assembly are a holder 22, a package securing component or holding punch 20, and a pair of lead bending components or bending punches 24. The package securing component 20 is guided for vertical sliding movement on a guide post 18, shown in FIG. 2. A stripper 26 is secured at the lower end of package securing component 20 by a bolt 28, which permits replacement of the stripper with another stripper designed to accommodate a different semiconductor package.

The lead bending components 24 are held by the package securing component 20, as shown in FIG. 1. Lead bending components 24 are slidable in oblique slots formed in component 20 so that they are constrained to move, relative to component 20, along lines which converge in the downward direction toward each other and toward the line of movement of component 20. The oblique slots have rectangular cross-sections. One such slot 30 is seen in FIG. 2. The oblique slots are defined in part by plates 32, which are removable from component 20 to allow re-

placement of the lead bending components 24. An internally located coil spring 34, as seen in FIG. 1, is held in compression between a flange formed on right-hand plate 32, and a plug threaded into the upper part of right-hand lead bending component 24. This spring urges the lead bending component in the retracting direction, i.e. away from die 14. The opposite lead bending component has a similar spring (not shown). In the fully retracted positions, the lower parts 36 of the lead bending components 24 are flush with the lower face of stripper 26, as shown in FIG. 3, or preferably, slightly above the lower face of the stripper. Unless an external force is applied, bending components 24 will not project beyond the face of stripper 26.

As shown in FIG. 1, the two lead bending components 24 of the punch are arranged one following the other in the direction of indexing movement of packages S . This arrangement makes it possible take advantage of the converging movements of the lead bending components, while improving efficiency by working on more than one package at a time. To this end, the lower ends of each lead bending component are formed with a plurality of lower parts capable of projecting beyond the lower face of the package securing component 20. In the embodiment illustrated in FIG. 1, each lead bending component 24 is bifurcated into two lower parts 36. Of course, it will be possible to provide more than two such lower parts on each lead bending component. The lower parts 36 are shorter as the distance from the central axis of the package securing component increases, so that the tips of parts 36 are all simultaneously flush with the lower face of stripper 26. This allows all parts 36 to operate on leads of packages S_1 , S_2 and S_3 simultaneously.

Suspension bolts 38 are used to hold the package securing component 20 to the punch holder 22. They are threaded into component 20 as seen in FIG. 1, and allow the punch holder to slide downward relative to component 20. A compression spring 40, disposed between component 20 and holder 22 urges these elements apart. However, enlarged portions 42 formed on the upper ends of sleeves surrounding bolts 38 engage the punch holder 22, restrict relative movement of the punch holder 22 and component 20, and prevent punch holder 22 from separating from component 20.

A recess 44, provided in the upper part of the punch holder 22 and best seen in FIG. 2, accommodates a roller 48, which serves as a cam to effect up and down movement of the punch holder. The roller is preferably provided at the end of a swinging arm (not shown), or may be operated by any of a variety of forms of actuator.

Rollers 50, provided on both sides of the punch holder, as shown in FIG. 1, contact smooth upper surfaces of lead bending components 24, and move the

bending components 24 downward and inward along their oblique paths when punch holder 22 moves downward relative to package securing component 20 against the force of compression spring 40. The lead bending components 24 follow oblique paths, and rollers 50 move laterally along the smooth upper surfaces of components 24, thereby insuring smooth operation of the apparatus.

In the operation of the apparatus described above, it should be understood that the semiconductor packages S_1 , S_2 and S_3 are just three packages of a long series of packages to be operated upon by the lead bending mechanism. During operation of the mechanism, the packages are indexed to a position in which one of the packages, for example S_2 , is centered underneath the securing component of the punch. Then, the cam roller 48 is operated, causing the punch holder 22 to descend. Package securing component 20 and lead bending components 24 move together with the punch holder. Spring 40 holds component 20 in its lowermost position relative to punch holder 22. Springs 34 hold the lead bending components 24, against rollers 50, in their uppermost positions relative to component 20 so that the lower ends of the lead bending components do not project beyond the face of stripper 26. The stripper engages semiconductor components, holding them in fixed relationship to the die 14. As shown in FIG. 3, for example, stripper 26 engages the roots of leads R, holding them firmly against the die.

If package S_2 is centered underneath the punch, it is held as shown in FIG. 3, while the adjacent package S_1 is held in a similar manner by stripper 26 underneath the space between elements 36 of the left-hand lead bending component 24. Another package S_3 is similarly held by stripper 26 underneath the space between elements 36 of the right-hand lead bending component.

As the punch holder continues to descend, the lead bending components 24 project beyond the face of the stripper 26, moving downward and inward along their oblique paths. As shown in FIG. 4, the inner elements 36 of the lead bending components come into contact with the leads R, producing a moment which acts upon the leads, forcing their free ends into contact with die 14. Assuming that the leads are to be bent into the form of the letter Z, the lead R begins to deform as soon as it is contacted by the end of the bending component 24. As the bending component advances, lead R contacts the horizontal surface of die 14, and is bent in the outward direction at a location between the root and the free end, thereby assuming the desired form in a single pass of the punch. Since the lead bending components 24 move in oblique paths, shear forces applied to the leads are negligible.

The fact that the ends of the lead-forming components are divided into two parts 36 makes it possi-

ble for the obliquely moving lead-forming components to operate on the leads of multiple packages simultaneously. In FIG. 3, for example, with the packages S_1 , S_2 and S_3 positioned as shown, it will be appreciated that elements 36 of the left-hand lead bending component 24 operate on the left leads of packages S_1 and S_2 , while elements 36 of the right-hand lead bending component operate on the right leads of packages S_2 and S_3 . Thus, when the packages are initially positioned as shown, only the left lead or leads of package S_3 will have been bent. Operation of the punch will bend the left lead of package S_1 , both leads of package S_2 , and the right lead of package S_3 . Packages S_1 and S_2 will have been completed, while only the left lead or leads of package S_3 will have been bent. Following the bending operation, the punch is withdrawn, and the die is indexed to the right two steps so that package S_1 is now underneath the space between elements 36 of the right-hand lead bending component 24. Further unfinished packages are positioned in the spaces formerly occupied by packages S_1 and S_2 , and, upon downward movement of the punch, the right lead or leads of package S_1 are formed, and leads on both sides of the center package and the left lead or leads of the leftmost package are formed.

It is, of course, possible to form each lead bending component with three or more elements similar to elements 36. If the lead bending components have three such elements, then five packages can be operated upon simultaneously. Indexing should then take place through three steps between each forming operation, rather than two steps. If the lead bending components have four or more elements similar to elements 36, indexing should take place through a number of steps corresponding to the number of lead bending elements on each lead bending component.

By virtue of the oblique movement of the lead bending components, the invention accomplishes bending of leads on semiconductor packages or the like with reduced sliding contact between the bending components and the leads, thereby reducing the likelihood of damage to the leads caused by peeling of the plating on the leads. Oblique movement of the lead bending components also makes it possible to produce relatively complicated bends, such as a bend in the form of the letter Z, in a single punching operation.

Various modifications can be made to the apparatus disclosed. For example, instead of using post 18 to guide component 20, a similar post can guide punch holder 22. Many other modifications can be made to the apparatus described without departing from the scope of the invention as defined in the following claims.



Claims

1. A forming press (10) for bending the leads of electronic components comprising: a die (14) adapted to carry an electronic component having a lead extending therefrom; a punch holder (22) arranged to be forced toward said die (14); a holding punch (20) carried by said punch holder (22) and arranged to project from said punch holder (22) against the body of a component on said die (14); and a lead bending punch (24) carried by the punch holder (22) and arranged to protrude from said holding punch (20) as said punch holder (22) descends after said holding punch (20) is positioned to hold the component in fixed relationship to the die (14), characterised in that the lead bending punch (24) is arranged to move in an oblique path converging in a downward direction toward the path of the holding punch (20) so as to apply a downward bending force to said lead.
2. A forming press according to Claim 1, in which the lead bending punch (24) is located on one side of the holding punch (20) and an additional lead bending punch (24) is located on the opposite side of the holding punch (20) for contacting and, in cooperation with the die (14), bending a lead extending from the opposite side of said component, the additional lead bending punch (24) being movable relative to the holding punch (20) in an oblique path converging in the downward direction toward the path of the holding punch (20).
3. A forming press according to Claim 1 or 2, wherein the holding punch (20) includes guide means (30) for constraining the movement of the lead bending punch (24) relative to the holding punch (20).
4. A forming press according to Claim 3, wherein the guide means (30) comprises a through passage (30) in which the lead bending punch (24) is slidably received.
5. A forming press according to any preceding claim, which has means (42) for permitting a limited amount of relative movement between the punch holder (22) and the holding punch (20) and spring means (40) urging the holding punch (20) apart from the punch holder (22) toward the limit of relative movement between the punch holder (22) and the holding punch (20).
6. A forming press according to any preceding claim, wherein spring means (34) are provided for urging the lead bending punch (24) away from the

die (14) toward a retracted position.

7. A forming press according to claim 6, wherein the lead bending punch (24) has one end adapted for contact with the lead of an electronic component and the punch holder (22) includes roller means (50) for contacting the other end of the lead bending punch (24), the spring means (34) urging the lead bending punch (24) into contact with the roller means (50).
8. A forming press according to Claim 7, wherein the other end of the lead bending punch (24) comprises a smooth face which is contactable with the roller means (50).
9. A forming press according to any preceding claim, wherein the electronic component is a semi-conductor package.

Patentansprüche

1. Umformpresse (10) zum Biegen der Leitungen von elektronischen Bauteilen, umfassend: ein Gesenk (14) zum Tragen eines elektronischen Bauteils mit einer sich davon erstreckenden Leitung; einen Stempelhalter (22), der so angeordnet ist, daß er in Richtung auf das Gesenk (14) gedrückt werden kann; einen haltenden Stempel (20), der von dem Stempelhalter (22) getragen wird und so angeordnet ist, daß er von dem Stempelhalter (22) gegen den Bauteilkörper auf dem Gesenk (14) vorsteht; und einen Leitungsbiegestempel (24), der von dem Stempelhalter (22) getragen ist und so angeordnet ist, daß er von dem haltenden Stempel (20) vorsteht, wenn sich der Stempelhalter (22) abwärtsbewegt, nachdem der haltende Stempel (20) so positioniert ist, um das Bauteil in fester Beziehung zum Gesenk (14) zu halten, dadurch gekennzeichnet, daß der Leitungsbiegestempel (24) so angeordnet ist, daß er sich auf einem schrägen Weg bewegt, der in Abwärtsrichtung zum Weg des haltenden Stempels (20) hin konvergiert, so daß eine abwärtsgerichtete Biegekräft auf die besagte Leitung ausgeübt wird.
2. Umformpresse nach Anspruch 1, dadurch gekennzeichnet, daß der Leitungsbiegestempel (24) auf einer Seite des haltenden Stempels (20) angeordnet ist und ein weiterer Leitungsbiegestempel (24) auf der gegenüberliegenden Seite des haltenden Stempels (20) angeordnet ist, um mit einer von der gegenüberliegenden Seite des besagten Bauteils vorstehenden Leitung in Berührung zu kommen und diese gemeinsam mit dem Gesenk (14) zu biegen, wobei der weitere



- Leitungsbiegestempel (24) relativ zum haltenden Stempel (20) entlang eines schrägen Wegs bewegbar ist, der nach unten in Richtung auf den Weg des haltenden Stempels (20) konvergiert. 5
3. Umformpresse nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der haltende Stempel (20) ein Führungsmittel (30) zum Erzwingen der Bewegung des Leitungsbiegestempels (24) relativ zum haltenden Stempel (20) einschließt. 10
4. Umformpresse nach Anspruch 3, dadurch gekennzeichnet, daß das Führungsmittel (30) einen Durchgang (30) aufweist, in dem der Leitungsbiegestempel (24) verschieblich aufgenommen ist. 15
5. Umformpresse nach einem der vorangehenden Ansprüche, gekennzeichnet durch eine Vorrichtung (42), um eine begrenzte Relativbewegung zwischen dem Stempelhalter (22) und dem haltenden Stempel (20) zuzulassen, und Federmittel (40), die den haltenden Stempel (20) vom Stempelhalter (22) in Richtung auf die Grenze der Relativbewegung zwischen dem Stempelhalter (22) und dem haltenden Stempel (20) drücken. 20
6. Umformpresse nach einem der vorangehenden Ansprüche, gekennzeichnet durch Federmittel (34), um den Leitungsbiegestempel (24) vom Gesenk (14) in Richtung auf eine zurückgezogene Stellung wegzudrücken. 25
7. Umformpresse nach Anspruch 6, dadurch gekennzeichnet, daß der Leitungsbiegestempel (24) einen Endabschnitt zur Berührung mit der Leitung eines elektronischen Bauteils hat und der Stempelhalter (22) ein Rollenmittel (50) aufweist, um mit dem anderen Ende des Leitungsbiegestempels (24) in Berührung zu kommen, wobei das Federmittel (34) den Leitungsbiegestempel (24) in Berührung mit dem Rollenmittel (50) drückt. 35
8. Umformpresse nach Anspruch 7, dadurch gekennzeichnet, daß der andere Endabschnitt des Leitungsbiegestempels (24) eine glatte Stirnseite aufweist, die mit dem Rollenmittel (50) in Berührung gebracht werden kann. 40
9. Umformpresse nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß das elektronische Bauteil ein Halbleitergehäuse ist. 45

Revendications

1. Une presse de formage (10) pour plier les pattes de composants électroniques comprenant : une

matrice (14) propre à porter un composant électronique ayant une patte s'étendant depuis celui-ci ; un porte-poinçon (22) disposé pour être forcé vers ladite matrice (14) ; un poinçon de maintien (20) porté par ledit porte-poinçon (22) et disposé pour saillir depuis ledit porte-poinçon (22) contre le corps d'un composant sur ladite matrice (14) ; et un poinçon de pliage de patte (24) porté par le porte-poinçon (22) et disposé pour saillir depuis ledit poinçon de maintien (20) alors que ledit porte-poinçon (22) descend après que ledit poinçon de maintien (20) soit positionné pour maintenir le composant en liaison fixe avec la matrice (14), caractérisé en ce que le poinçon de pliage de patte (24) est disposé pour se déplacer selon un trajet oblique convergeant dans une direction descendante vers le trajet du poinçon de maintien (20) de manière à appliquer une force de pliage vers le bas à ladite patte.

2. Une presse de formage conforme à la revendication 1, dans laquelle le poinçon de pliage de patte (24) est situé sur un côté du poinçon de maintien (20) et un poinçon de pliage de patte additionnel (24) est situé sur le côté opposé du poinçon de maintien (20) pour entrer en contact avec et, en coopération avec la matrice (14), plier une patte s'étendant depuis le côté opposé dudit composant, le poinçon de pliage de patte additionnel (24) étant déplaçable par rapport au poinçon de maintien (20) selon un trajet oblique convergent dans la direction descendante vers le trajet du poinçon de maintien (20).
3. Une presse de formage conforme à la revendication 1 ou 2, dans laquelle le poinçon de maintien (20) inclut un moyen de guide (30) pour contenir le déplacement du poinçon de pliage de patte (24) par rapport au poinçon de maintien (20).
4. Une presse de formage conforme à la revendication 3, dans laquelle le moyen de guide (30) comprend un passage traversier (30) dans lequel le poinçon de pliage de patte (24) est reçu à coulissement.
5. Une presse de formage conforme à une quelconque revendication précédente, qui a un moyen (42) pour permettre une quantité limitée de déplacement relatif entre le porte-poinçon (22) et le poinçon de maintien (20) et un moyen de ressort (40) écartant le poinçon de maintien (20) du porte-poinçon (22) vers la limite de déplacement relatif entre le porte-poinçon (22) et le poinçon de maintien (20).

6. Une presse de formage conforme à une quelconque revendication précédente, dans laquelle un



moyen de ressort (34) est prévu pour écarter le poinçon de pliage de patte (24) de la matrice (14) vers une position de retrait.

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7. Une presse de formage conforme à la revendication 6, dans laquelle le poinçon de pliage de patte (24) a une extrémité propre à entrer en contact avec la patte d'un composant électronique et le porte-poinçon (22) inclut un moyen de roulette (50) pour entrer en contact avec l'autre extrémité du poinçon de pliage de patte (24), le moyen de ressort (34) pressant le poinçon de pliage de patte (24) en contact avec le moyen de roulette (50).
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8. Une presse de formage conforme à la revendication 7, dans laquelle l'autre extrémité du poinçon de pliage de patte (24) comprend une face lisse avec laquelle le moyen de roulette (50) peut entrer en contact.
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9. Une presse de formage conforme à une quelconque revendication précédente, dans laquelle le composant électronique est un boîtier semi-conducteur.

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