The invention relates to an apparatus according to the preamble of the Main Claim.

When producing electronic components in particular, and in this case especially integrated circuits, the connecting lugs are attached by means of an encapsulating or pressing operation through the casing. The individual connecting lugs are coupled to one another by way of connecting webs, which form a boundary for the plastics material flowing in between the connecting lugs. These connecting webs, since they generally consist of the same conductive material as the connecting lugs, must subsequently be removed.

For that purpose the integrated semiconductor circuits thus produced are placed on a die, are centred as far as possible, and then a punch is lowered. The punch has a series of crenellation-like projections, which pass between the connecting lugs and thereby punch out the connecting webs. This punching tool has up to now been guided by means of pillar jigs or sliding or roller guides, built into the tool and having round guide pillars and bushes. It is necessary for the die and punch to be guided precisely, that is to say that, for example, a total deviation of the punch to the die of a few µm only is permissible. This deviation is made up from the combined tolerances of the tool parts, the guidance play of the guides under load and bending occurring in the tool during the operation (cutting or punching operation). Such precise guidance is not possible with the conventional apparatuses mentioned above.

In these known apparatuses, relatively large masses must be moved and braked, thus reducing the speed at which the apparatus operates when using mechanical presses.

EP-A1-0 116 447 describes an apparatus for punching material in strip form. This apparatus has a guide channel for the two halves of the tool, which guide channel is machined in an integral block as a U-shaped channel.

For use for punching-out semi-conductor elements, a tool surface of approximately 100 x 100 mm is necessary, so that the guide channel must be made correspondingly large. Such a large guide channel cannot however be produced with the required degree of accuracy from an integral block, since unavoidable manufacturing tolerances and requirements regarding the closeness of the fit of the guide channel and the two halves of the tool for sliding guides must be taken into account which together unavoidably result in an increased guidance play which is not acceptable. The known apparatus is therefore suitable only for relatively rough punching operations.

The inventor has endeavoured to develop an apparatus of the type mentioned above which has a long life, in which the die and the punch are guided extremely precisely, and which operates at high speed.

This aim is fulfilled by means of the features described in Claim 1. The apparatus is generally suitable for cutting, punching, stamping and shaping. By means of this construction of the mounting means, the masses moved are reduced, so that the apparatus can be operated at a higher speed. The precise guidance is achieved in particular by way of the common guide block. This must therefore have an extremely precise external shape and/or an extremely precise cross-section. The manufacture of such a reference block is however, according to experience, considerably simpler to achieve than precise long term guidance with pillar jigs. The combined tolerances are reduced to a small fraction.

In order to improve the guidance of the die block and/or punch guide means on the reference block, according to the invention a roller bearing means is provided. The die block and the punch guide means are mounted in an accurate casing which is formed by the reference block and upper and side guide plates. This constrained guidance of die block and/or punch guide means on the one hand reduces

wear and on the other hand reduces the range of tolerance of the guide means.

The die block itself should have receiving channels for punches, these receiving channels preferably opening within the die block into a chamber to which a suction device can be connected. If connecting webs are punched out between the connecting lugs by the punches and pushed into the receiving channels, they can easily be removed in this manner.

In an individual case, there can be inserted beneath the upper guide plate of the casing an additional spacing plate which by means of a wedge-shaped configuration can reduce the space for the guidance of the die block and/or punch guide means, naturally only within a very limited range of tolerance, so that the same mounting of the die block and/or the punch guide means on the reference block is always maintained, and for roller bearings a bearing pre-tension can be set.

The punch guide means can be made of a one-piece block or a block with interchangeable inserts. Preferably, however, the punch guide means should have guide grooves in which punches are slidably mounted.

The combination or single punches should, according to the invention, be fixed in the pressure block. In this case the pressure block is also arranged on roller bearings in a casing, so that it can be moved together with the punch guide means in the direction y. Moreover, it is then possible to arrange force accumulators in the punch guide means and/or the pressure block which make it possible to return the punches to the protected position in the guide grooves, but against the pressure of which the punches can be extended in the closed position. They also serve to scrape the connecting lugs after the punching operation.

In order to produce the movement of the die block and the punch guide means or pressure block in the direction x or y, a series of movement mechanisms are conceivable. The

movement mechanism referred to in the exemplary embodiment described hereinafter represents only one exemplary embodiment. In this case the movement is effected by way of two cams which actuate two levers, which are tiltable about their rotation axes. The die block and punch guide means or pressure block execute a smooth movement which is controlled by means of the cams and consists of a limited travel.

In total, by means of this apparatus an accuracy is achieved which can be represented by a tolerance of a few µm. The speed at which the apparatus operates is around five closures per second.

Further modules for additional operations, such as shaping, stamping, and deep-drawing, can be additionally built up in the apparatus in the same way.

Further advantages, features and details of the invention are revealed by the following description of preferred exemplary embodiments and also with reference to the drawing, in which

Fig. 1 shows a portion of an integrated semiconductor circuit as an example of an electronic component;

Fig. 2 is a perspective view of basic elements of the apparatus according to the invention for processing electronic components;

Fig. 3 is a longitudinal section through the apparatus according to the invention for processing electronic components;

Fig. 4 is a perspective view of the apparatus according to Fig. 3 with a diagrammatically illustrated movement mechanism;

Fig. 5 is a perspective view of a portion of a part of the apparatus according to Fig. 3;

Fig. 6 is a perspective view of a further exemplary embodiment.

According to Fig. 1, a semiconductor component 1

consists essentially of a plastic casing 2 with connecting lugs 3 which are moulded into the edges and are generally metallic. Between these connecting lugs 3 there is a connecting web 4, which during the process of encapsulation of connecting lugs 3 forms with the plastic casing 2 a boundary for the plastics material flowing in between the connecting lugs 3. For reasons of manufacturing technology, these connecting webs 4 generally consist of the same conductive material as the connecting lugs 3. They would therefore produce a short-circuit between the individual connecting lugs 3, and so must be removed before further processing of the integrated semiconductor circuits.

An apparatus for processing integrated semiconductor circuits shown in Figure 1 has, according to Figure 2, a guide or reference block 5. This extends for three casings 6, 7 and 8, the casing 6 serving to receive a die block, the casing 7 to receive a punch, and the casing 8 to receive an additional pressure block. The casings 6,7 and 8 have clamp-like side walls, each engaging beneath the reference block 5 and engaging over a cover plate 10. Beneath the cover plate 10 a further spacing plate 11 can be arranged in the form of a wedge.

In all three casings 6, 7 and 8, by means of the reference block 5 the side walls 9 and the spacing plates 11, receiving spaces 12,13 and 14 are formed for the movable elements of the apparatus according to the invention. The space 12 serves to receive a die block 15, the space 13 to receive a punch guide means 16, and the space 14 to receive a pressure block 17. The die block 15, the punch guide means 16 and also, optionally, the pressure block 17, are guided on all sides by rollers 18, but for the sake of clarity in Figure 3 only the lower and upper rollers are indicated, and the lateral rollers are omitted.

The die block 15 or optionally the interchangeable insert has receiving channels 19 into which punches 20 can

penetrate from the punch guide means 16 during the punching operation. In the present exemplary embodiment, the receiving channels 19 open on the other hand into a chamber 21 which is joined to a suction channel 22 for drawing off punched-out connecting webs 4.

The punches 20 are guided in guide grooves 23 in the punch guide means 16. Preferably, in order to increase the accuracy, the guide grooves 23 and the receiving channels 19 are produced together in one operation. Between the end face of the die block 15 with the receiving channels 19 and the end face of the punch guide means 16 with the guide grooves 23, a guide channel 24 of the width a is formed to receive the work-piece guide means (semiconductor guide means) and to lead through, for example, integrated semiconductor circuits 1.

The punches 20 are guided out of the punch guide means 16 into the pressure block 17 and there secured by means of a punch plate 25. In the rest position, a force accumulator 26 maintains a distance b between the punch guide means 16 and the pressure block 17.

During the punching operation, the die block 15 is guided in the direction x and the punch guide means 16 or the pressure punch 17 in the direction y. First the die block and then the punch guide means 16 meet a semiconductor component 1 guided in the guide channel 24. This semiconductor component is thereby precisely centred. The pressure block 17 moves further in the direction y and then reduces the distance b against the pressure of the force accumulator 26. By this means the punches 20 are extended out of the guide grooves 23, separate the connecting webs from the connecting lugs 3 and slide, if occasion arises, with the connecting webs 4, into the receiving channels 19. The punch guide means 16, the pressure block 17 and then the die block 15 are then moved apart from one another in the opposite direction to the directions y and x, respectively, so that the guide channel

24 is produced again and a further semiconductor circuit 1 to be processed can be introduced.

For the movement of the die block 15, the punch guide means 16 and the pressure block, an example is given in Figure 4. In this case levers 27 and 28 are each connected to the die block 15 or the pressure block 17, this connection being made by way of an adapter 29. On the other side of the adapter 29, the levers 27 and 28 engage with two cams or cam discs 30,31 which rotate about an axis A. As the cams 30,31 turn, the levers 27 and 28 rotate about their rotation axes B and C arranged in the region of the elbows. The die block and pressure block 15, 17 are thereby pushed in the directions x and y, respectively, the respective adapters 29 having sufficient play not to limit the movement clearance of the levers 27 and 28. The return of the levers 27 and 28 on the cam 30 can be assisted by means of force accumulators 35. It is likewise possible to assist the return movement of the die block 15 and pressure block 17 in the directions x and y, respectively, by means of additional pressure devices. The return can however also be controlled by means of cams or cams discs.

Figure 5 shows, on an enlarged scale, guide grooves 23 and individual punches 20 guided therein.

In the exemplary embodiment illustrated in Figure 6, the drive of the levers 27, 28 is effected by means of a cam rod 32, which has cams or cam discs 33,34. The different directions of movement are indicated by means of arrows.

Patent Claims

1. Apparatus with at least one module for cutting, punching, stamping or shaping electronic, electromechanical or mechanical components, particularly for punching out the connecting webs (4) present between the connecting lugs (3) during the manufacture of semiconductor components (1), and with a tolerance in the micrometre range,

each module having a punch guide block (16) with tool punches (20) and a die block (15) with receiving channels (19) for the tool punches,

the punch guide block and the die block being arranged facing one another and being movable in opposite directions on a reference plane which is formed by the surface of a common guide block (5), and leaving a guide channel (24) free between their end faces to receive work-pieces, and

the common guide block, with a cover plate (10) and clamp-like side plates, each of which engages beneath the guide block and over the cover plate, forming a casing (6,7,8) in which the die block (15) and the punch guide block (16) are received and bear on all sides on roller bearings (18).

2. Apparatus according to Claim 1, characterised in that a wedge-shaped spacing plate (11) is inserted below the cover plate (10) and by means of a longitudinal adjustment precisely sets the space (12) for the die block (15) or the space (13) for the punch guide block (16) and produces the bearing pre-tension for the roller bearings.

3. Apparatus according to one of Claims 1 or 2, characterised in that the punch guide block (16) has frontal guide grooves (23) in which the tool punches (20) are slidably mounted.

4. Apparatus according to Claim 3, characterised in

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that the tool punches (20) on the side opposite to the front project out of the punch guide block (16) and are secured by means of a punch plate (25).

5. Apparatus according to Claim 4, characterised in that the punch plate (25) lies in a pressure block (17) which, bearing on roller bearings (18), is mounted in a casing (8) and, like the punch guide block (16), is longitudinally displaceable.

6. Apparatus according to Claim 5, characterised in that at least one force accumulator (26) is arranged between the punch guide block (16) and the pressure block (17).

7. Apparatus according to one of Claims 1 to 6, characterised in that with the die block (15) and the punch guide block (16) or the pressure block (17) there is associated a movement mechanism with a closed force circuit, which functions in a tong-like manner and causes the tools to reciprocate longitudinally.

8. Apparatus according to Claim 7, characterised in that levers (27,28) with their own rotation axes (B,C) are provided, which are driven by way of cams or disc cams (30,31,33,34) and supply the working force in a tong-like manner to the die block (15) and also to the punch guide block (16).

9. Apparatus according to Claim 8, characterised in that the drive for the levers (27,28) has one or more cam discs (30,31) which are arranged on a common shaft with the rotation axis (A).

10. Apparatus according to Claim 9, characterised in that a common cam or cam disc rod (32) with cams or disc cams (33,34) arranged on either side actuates the levers (27,28).

11. Apparatus according to one of Claims 8 to 10, characterised in that to assist the movement of the die block (15) and of the punch guide block (16) or the pressure block (17) into the closed or starting position,

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force accumulators (35) are provided in the movement mechanism.

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