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[54] **AUTOMATIC BONDING MACHINE**

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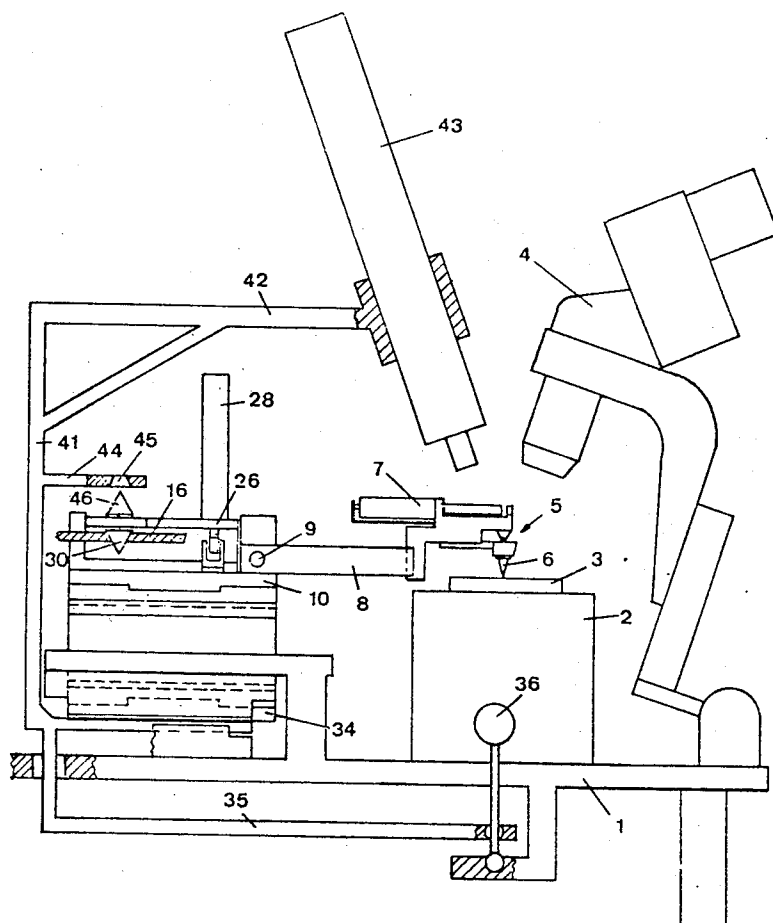
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[57] **ABSTRACT**

A machine for attaching connecting wires to connection points of a semiconductor component and to con-

nection points of a housing which is to accommodate the semiconductor component is comprised of a wire guide which is vertically adjustable with respect to the semiconductor component and to the housing and through which a wire is fed and a support which is adjustable in two dimensions parallel to the plane of a semiconductor component and which carries either the housing with the semiconductor component or the wire guide. The machine also includes a programme carrier which may be advanced step by step into successive detent positions and which have guide members which cooperate with a complementary guide member on a driver connected to an adjustable support and are so arranged that in each detent position a guide member of the programme carrier is disposed from a stationary reference point a distance which in magnitude and direction is in a predetermined relationship to the distance of a connection point from a reference point of the housing of the semiconductor component. The guide members of the programme carrier are conical bores, the driver is a rocker pivotally mounted on the adjustable support and the guide member of the driver is a guide cone. Because of the cooperation of the guide members on the programme carrier and the guide member on the driver, the adjustable support is automatically brought into the positions in which the guide lies exactly above a connection point of the housing or of the semiconductor component.

18 Claims, 4 Drawing Figures



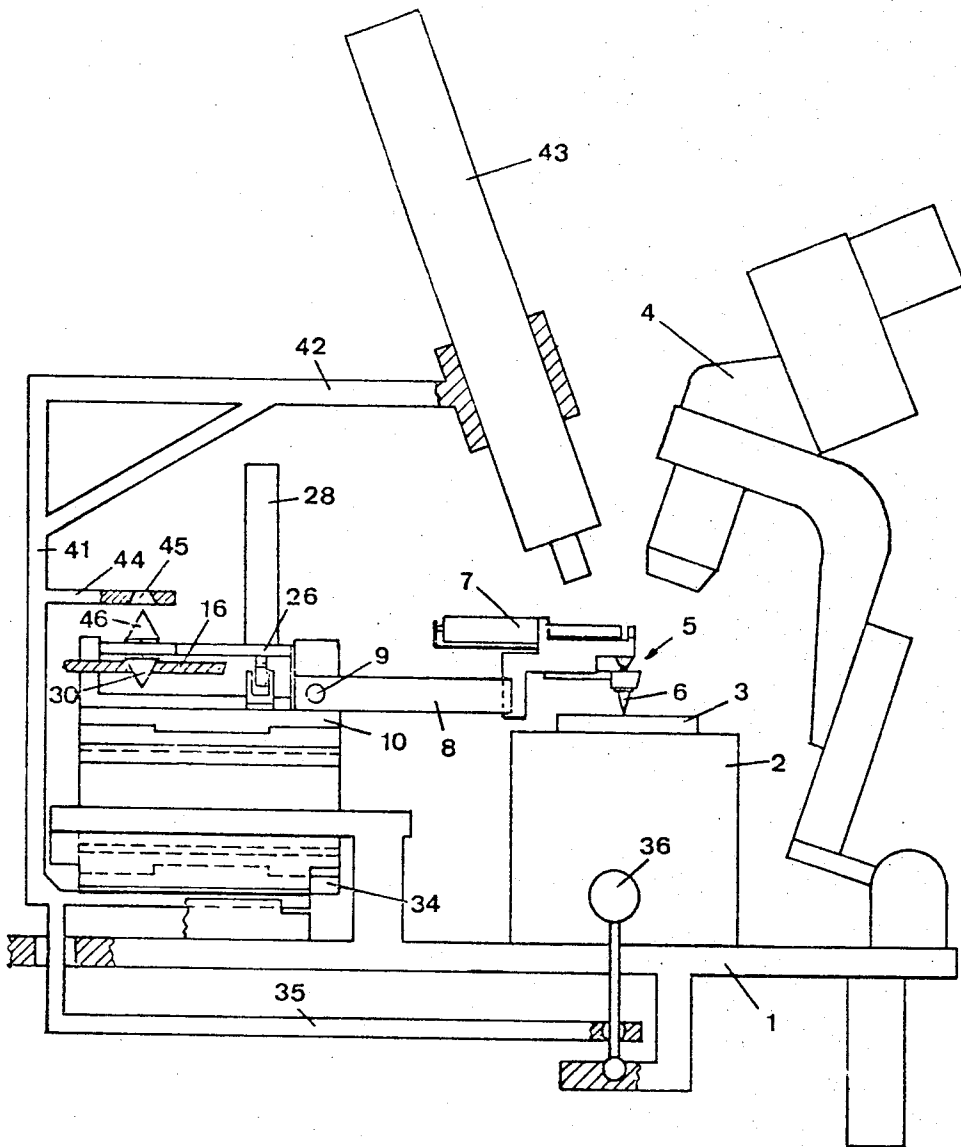
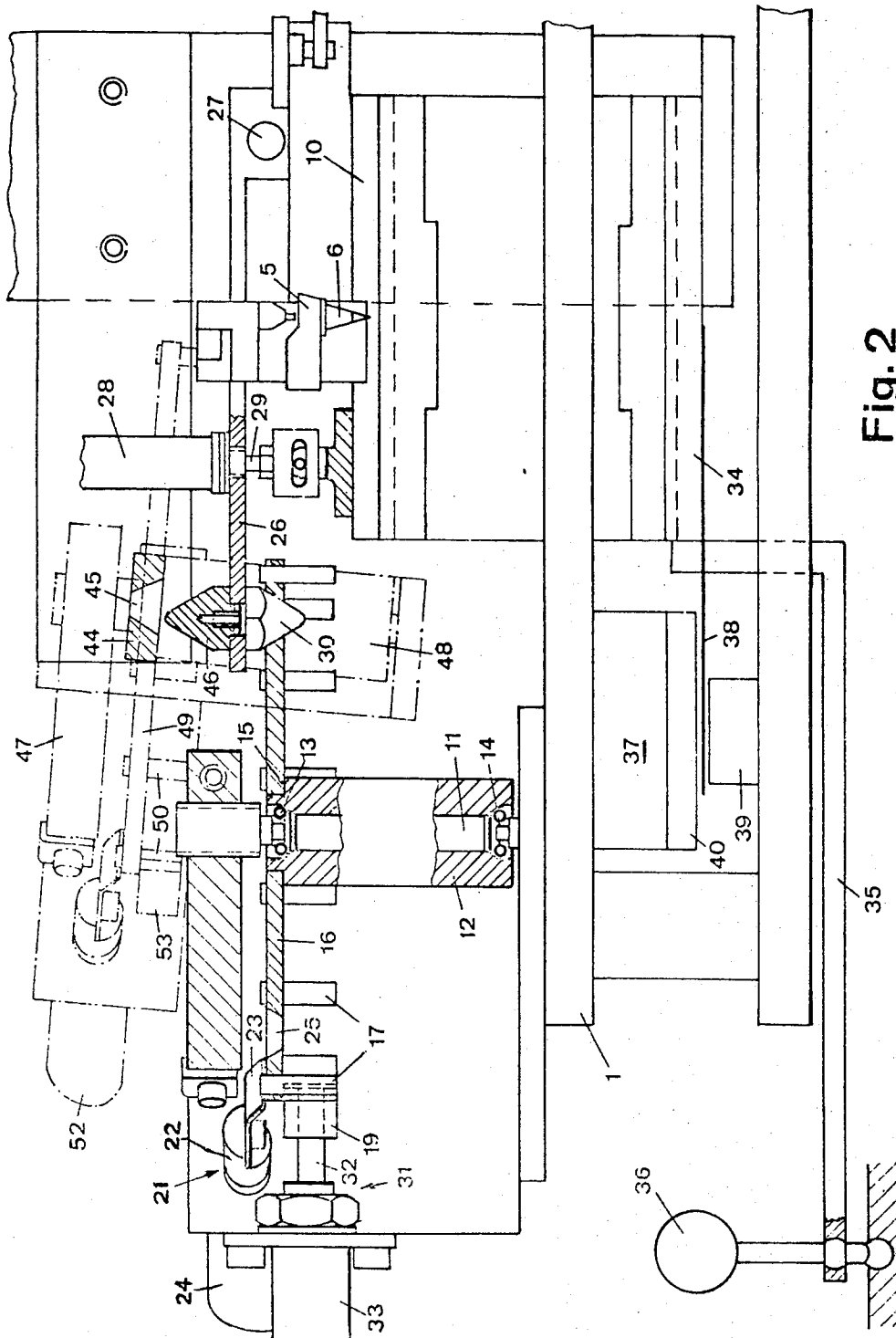


Fig.1



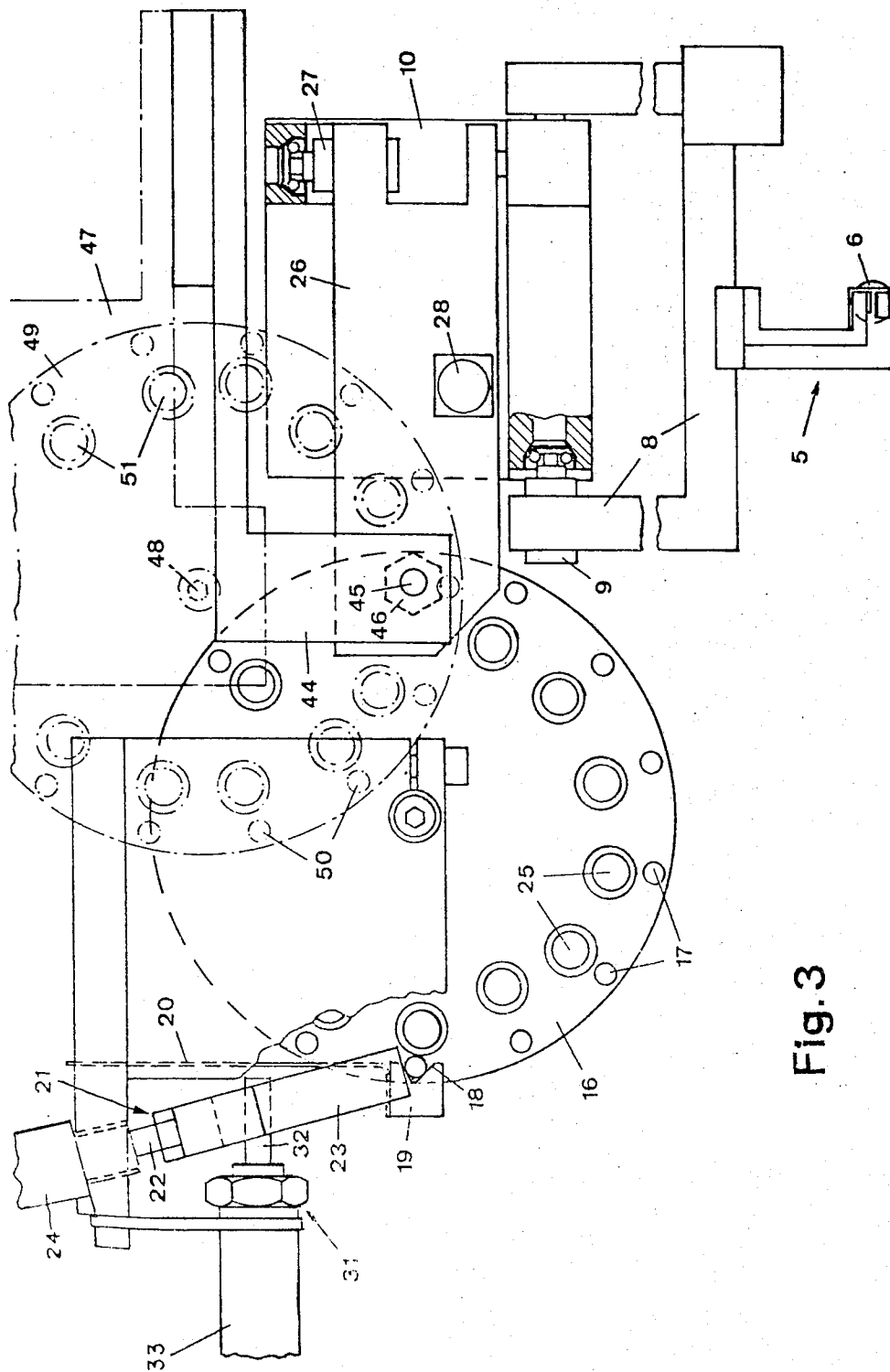


Fig. 3

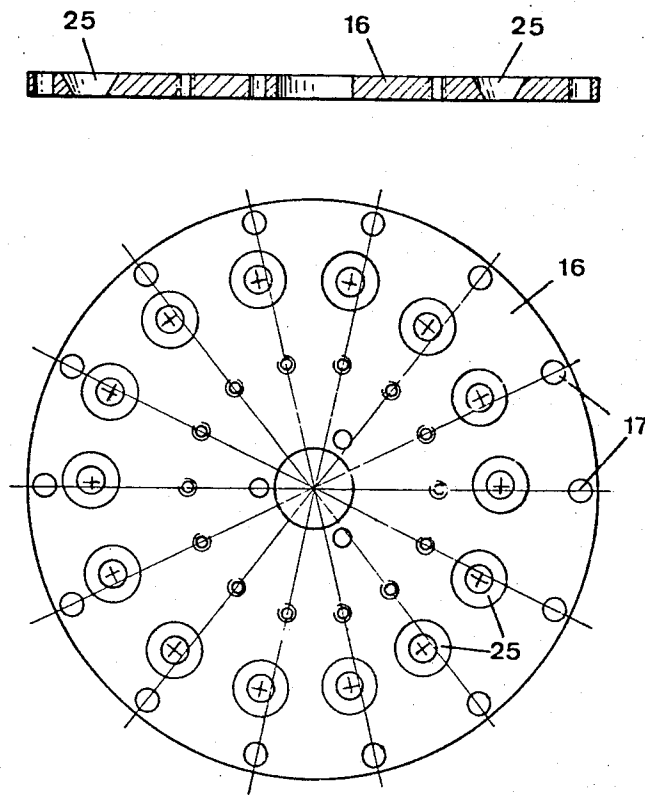


Fig.4

AUTOMATIC BONDING MACHINE

The invention relates to a machine for attaching the connecting wires to the connection points of a semiconductor component and of the housing accommodating the semiconductor component, comprising a wire guide which is vertically adjustable with respect to the semiconductor component and to the housing and through which a wire is fed and a support which is adjustable in two dimensions parallel to the plane of the semiconductor component and which carries either the housing with the semiconductor component or the wire guide.

At the end of the fabrication process semiconductor components, more especially integrated semiconductor circuits, are usually enclosed in standardised housings which are provided with terminal pins or terminal wires. After securing the semiconductor component in the housing and before final sealing of the latter, the electrical connection between the connection points of the semiconductor component and the terminals of the housing must be established. For this purpose thin connecting wires are attached at one end to a connection point of the semiconductor component and at the other to a connection point of the housing. Because of the very small size of the semiconductor components the attaching of the connecting wires, also known as "bonding" is a very difficult operation which it has hitherto not been possible to automate and which hitherto had to be carried out by skilled workers manually.

For the connecting wires a thin gold or aluminum filament is generally used which is fed from a coil through a capillary of the wire guide. This filament is usually attached to the connection points by welding using thermocompression or ultrasonic methods.

By suitable vertical movement of the capillary the filament is pressed against a connection point of the semiconductor component and welded. The filament is then led in an arc to the corresponding connection point of the housing by simultaneously raising the capillary and displacing the semiconductor component and is also welded at this connection point. By raising the capillary the filament is then torn off or burnt off and prepared for the attachment of the next connecting wire.

In the known machines of the type referred to at the beginning the adjustable support is connected to a manipulator by means of which an operator observing the operation through a stereo microscope displaces the housing with the semiconductor component relatively to the wire guide until the latter is positioned exactly above the desired connection point of the housing or of the semiconductor component. The operator then initiates a welding operation. Thereafter the wire guide is again raised and the operator displaces the adjustable support by means of the manipulator until the wire guide is disposed above the corresponding connection point of the housing. If double welding at one connection point is necessary the same operation is repeated with a slight displacement of the adjustable support. Thereafter the wire is torn or burnt off and with the aid of the manipulator the operator can then locate the next connection point on the semiconductor component, whereupon the operation is repeated.

In these known machines, apart from the usual secondary operations such as threading, attaching component parts, etc., the operator has above all to carry out the difficult and tedious location and approach of the

various connection points. These operations take up a considerable amount of time of skilled personnel and result in poor utilisation of the machine capacity.

The invention is based on the problem of providing a machine of the type indicated at the beginning which largely automates the attachment of the connecting wires and substantially reduces the necessary production time.

The machine according to the invention comprises a programme carrier which may be advanced step-by-step into successive detent positions and which comprises guide members which cooperate with a complementary guide member on a driver connected to the adjustable support and are so arranged that in each detent position a guide member of the programme carrier is disposed from a stationary reference point a distance which in magnitude and direction is in a predetermined relationship to the distance of a connection point from a reference point of the housing of the semiconductor component.

In the machine according to the invention due to the cooperation of the guide members on the programme carrier and of the guide member on the driver the adjustable support is automatically brought into the positions in which the wire guide lies exactly above a connection point of the housing or of the semiconductor component. Thus, for each type of semiconductor component a programme carrier need only be made once; the connection points are indicated on said carrier by the position of the guide members. For a given type of semiconductor component to be fabricated the associated programme carrier is inserted into the machine. It is then merely necessary to bring the housings with the semiconductor components disposed therein successively into a fixed reference position. The guide member on the driver is then brought in succession into engagement with the guide members of the programme carrier and as soon as the guide members have aligned themselves with each other the corresponding welding operation may be initiated. The connecting wire is thus automatically welded to the correct point.

The guide members of the programme carriers may for example be conical bores, the guide member of the driver then being a conical projection. When the conical projection extends into a conical bore the driver displaces the adjustable support until the conical projection is exactly concentric with the conical bore.

According to a preferred embodiment of the invention the programme carrier is a rotatably mounted rigid disc which can be brought successively into the different detent positions by simple rotation.

A detent mechanism is preferably provided for fixing the programme carrier in each detent position. To obviate the necessity of providing two separate guide members on the programme carrier for double weldings means are preferably provided with which a predetermined slight displacement may be imparted to the programme carrier in each detent position, said displacement corresponding exactly to the desired distance between the two weld points of the double welding.

According to a preferred embodiment of the invention this may be achieved in that the detent mechanism comprises a leaf spring which is fixedly clamped at one end and at the other end carries a stop member engaging in notches in the programme carrier, and in that

means are provided for producing a predetermined bending of the leaf spring.

If in a machine of the type described above the guide members were arranged on the programme carrier in such a manner that they corresponded alternately to the position of a connection point on the semiconductor component and to the position of a connection point on the housing, it would be possible with the aid of a single programme carrier to apply all the necessary weld points completely automatically. However, this would require that all the semiconductor components are disposed in their housing in an exactly defined position relatively to said housing. At the present stage of the art this cannot be achieved in practice.

A further development of the machine according to the invention therefore resides in that a second support is provided which is adjustable parallel to the plane of the semiconductor component, connected to a manipulator and carries at least one guide member which cooperates with a further complementary guide member of the driver.

This further development makes it possible to compensate for the different positions of the semiconductor components relatively to their housings by means of the manipulator.

A brake is preferably provided for locking the second adjustable support. This brake enables the second adjustable support to be locked when the desired setting is reached. If the second guide member of the driver then engages in the guide member of the second adjustable support the cooperation of the guide members brings the first adjustable support into the position fixed by the setting of the second adjustable support.

A first embodiment of this further development resides in that a light-spot projector is connected to the second adjustable support and directs a light spot onto the semiconductor component, and that on the second adjustable support a single guide member is arranged in such a manner that by cooperation with the further complementary guide member of the driver it brings the wire guide into coincidence with the light spot.

In this embodiment an operator is necessary in order to bring the light spot into coincidence with the connection points on the semiconductor component; on the other hand, the connection points on the housing are automatically located by the programme carrier. This results in a substantial reduction in the operating time compared with hitherto known machines because the location of the next connection point with the aid of the light spot may be carried out during the time in which the connecting wire is being welded to the connection point of the housing. The operating time is thus determined in practice solely by the machining time because the location times, which have in any case been cut by half, coincide with the machining times.

According to another embodiment it is however alternatively possible to fully automate the operation in this case. This is achieved in that on the second adjustable support a second programme carrier is arranged which may be advanced step-by-step into consecutive detent positions and on which a plurality of guide members are so arranged that in each detent position of the second programme carrier one of its guide members is disposed from a reference point linked to the second adjustable support a distance which in magnitude and direction is in a predetermined relationship to the distance of a connection point of the semiconductor com-

ponent from a reference point of the semiconductor component.

In this preferred embodiment of the machine two programme carriers are provided for each production type of semiconductor component, one of which carriers designates the position of the connection points of the housing and the other of which designates the position of the connection points of the semiconductor component. For fabrication of a given type of semiconductor component the two associated programme carriers are inserted into the machine. The manipulator only serves the purpose of adjusting the two programme carriers after placing a housing with the semiconductor component contained therein in the machine in such a manner that the mutual position of the semiconductor component and the housing is taken into account. For this purpose the guide member of the driver is first brought into engagement with a guide member of the second programme carrier and using the manipulator the operator then sets the two adjustable carriers coupled by the guide members in such a manner that the wire guide is positioned exactly over the corresponding connection point of the semiconductor component. The second adjustable support is then locked by means of the brake and the attachment of the connecting wires may then be carried out completely automatically, the driver being brought in each case alternately into engagement with a guide member of the one programme carrier and a guide member of the other and the programme carriers being further turned in the meantime in each case by one detent position. On completion of a semiconductor component and after introduction of the next semiconductor component into the machine the brake is released, the position of the second adjustable support corrected using the manipulator and the second adjustable support then again locked with the brake.

Examples of embodiments of the invention are illustrated in the drawings wherein:

FIG. 1 shows a schematic side view of a machine according to the invention;

FIG. 2 is a partially sectioned front view to a somewhat larger scale of the essential components of the machine of FIG. 1;

FIG. 3 is a plan view of the machine of FIGS. 1 and 2; and

FIG. 4 shows a plan view and a sectional view of a perforated disc used in the machine of FIGS. 1-3.

The machine shown in the drawings comprises a frame 1 carrying the various parts of the machine. Disposed on the frame 1 is a table 2 on which a housing with the semiconductor component disposed therein may be fixed in a mounting 3 in an exactly defined working position. For example, for series production the housings may be attached to an index strip which is advanced step-by-step so that each time one housing is brought into the working position on the table 2. This operation can be observed in the usual manner by the operator with the aid of a stereo microscope 4.

Above the table 2 is a wire guide 5 comprising a capillary 6 through which is led a thin gold or aluminum filament which comes from a coil 7 and from which the connecting wires between the connection points of the housing and the connection points of the semiconductor component are formed. The wire guide 5 is mounted on the end of a support 8 which is mounted for pivotal movement about a horizontal pivot axis 9.

By drive means (not illustrated) the support arm 8 may be pivoted and the wire guide 5 thus vertically adjusted so that the capillary 6 may be raised from or lowered onto the housing with the semiconductor component therein disposed on the table 2.

The pivot axis 9 is mounted on a compound table 10 which is adjustable in a horizontal plane in two mutually perpendicular coordinate directions. By moving the compound table 10 it is therefore possible to position the capillary 6 on any desired point of the housing or of the semiconductor component mounted in the housing. The compound table 10 thus performs the function of an adjustable support for the wire guide 5.

As shown in FIG. 2 there is mounted on the frame 1 of the machine a vertical bearing column 11 on which a hollow shaft 12 is rotatably mounted by means of ball bearings 13, 14. At the upper end the hollow shaft 12 comprises a shoulder 15 on which is detachably mounted a circular perforated disc 16. Detent pins 17 are mounted spaced uniformly along the edge of the perforated disc 16 in such a manner that a small portion of said pins projects from the upper side of the disc 16 and a substantially larger portion projects downwardly from the lower side of said disc 16. The downwardly projecting portion of each detent pin is adapted to engage in a notch 18 provided in a stop member 19 mounted on the free end of a leaf spring 20 whose other end is clamped to a member of the frame 1. The perforated disc 16 can thus assume a number of defined stop positions in each of which a detent pin 17 is in the notch 18. The perforated disc 16 may be rotated by an indexing mechanism 21 step-by-step from one position to the next. The indexing mechanism comprises an indexing push member 21 which carries at the front end a resilient sheet metal strip 23 whose front edge engages the portions of the pins 17 which project above the upper side of the disc 16. By means of a drive mechanism 24, for example a pneumatic or hydraulic cylinder or an electromagnet, the indexing push member may be set in linear reciprocating movement. During the forward movement thereof the front edge of the resilient sheet metal strip engages the pin disposed in the notch 18, the disc 16 thereby being rotated until the next pin 17 is engaged in the notch 18. The indexing push member is then pulled back and the disc 16 has then been advanced to the next stop position.

The perforated disc is provided with a plurality of guide members in the form of conical bores 25 which are each associated with one of the detent pins so that in each stop position one conical bore is disposed in a predetermined working position. A rocker 26 is mounted on the compound table 10 for pivotal movement about a horizontal axis 27. Secured to the rocker 26 is a pneumatic or hydraulic drive cylinder 28 whose piston rod 29 is pivotally connected to the frame 1. The rocker 26 can thus be pivoted about the axis 27 by actuating the drive cylinder 28.

Mounted at the front end of the rocker 26 is a downwardly projecting guide cone 30. The arrangement is such that the guide cone is positioned exactly above the location which is assumed by the conical bore 25 of the disc 16 disposed in the working position. When the rocker 26 is swung downwardly by the drive cylinder 28 the guide cone 30 enters said conical bore; the inclined surfaces of the conical bore 25 and of the guide cone 30 cooperate to provide an automatic centering effect until the guide cone 30 is finally disposed exactly

centrally of the conical bore 25. This automatic alignment is made possible because the compound table 10 is freely movable in all directions in the horizontal plane and is therefore able together with the rocker 26 as a rigid structure to follow the movements of the guide cone 30 and finally assumes a position which is determined by the location of the corresponding conical bore 25 in the perforated disc 16. Since the compound table 10 entrains in turn the wire guide 5 the capillary 6 finally also assumes above the housing or the semiconductor component disposed therein a position which is fixed by the location of the conical bore 25 in the perforated disc 16.

As can be seen from FIG. 4 the conical bores 25 are at different distances both from the center of the perforated disc 16 and from the radii passing through the center of the detent pins 17. These distances are dimensioned for a given semiconductor component to be fabricated in such a manner that they correspond exactly to the location of the connection points for the connecting wires. Supposing for example that a predetermined reference point is present on the housing of the semiconductor component and is brought on the table 2 into an exactly defined position. There is then also on the frame 1 a reference point through which the axis of the guide cone 30 passes when the capillary 6 is set exactly to the reference point of the housing. Each conical bore 25 is provided in the disc 16 in such a manner that in the working position it is spaced from said reference point of the frame a distance which in magnitude and direction corresponds exactly to the distance of a connection point for the connecting wire from the reference point of the housing. When the guide cone 30 is aligned by entering said conical bore the capillary 6 is displaced above the housing by the corresponding distance and in a direction which brings it to rest above the corresponding connection point.

The perforated disc 16 thus represents a programme carrier on which the location of the connection points of the connecting wires of a given semiconductor component is represented by the different locations of the conical bores 25.

The connecting wires may be attached using the machine described above in the following manner:

Before production is started the perforated disc 16 corresponding to the semiconductor component to be provided with connections is mounted on the hollow shaft 12. The first housing with the semiconductor component mounted therein is placed on the table 2 in such a manner that the reference point of the housing is disposed at the prescribed location. By means of the drive cylinder 28 the guide cone 30 is then introduced into the first conical bore 25 of the disc 16. The compound table 10 and thus also the capillary 6 are thereby displaced corresponding to the location of said conical bore. As soon as the guide cone has reached the central position in the conical bore the wire guide 5 is moved downwardly so that the capillary 6 is placed on the corresponding connection point. The wire end is then welded, for example by thermocompressive or ultrasonic methods, and if necessary, the wire is severed by tearing or burning off.

The drive cylinder 28 is then actuated in the opposite direction so that it pivots the rocker 26 upwardly and the guide cone 30 leaves the conical bore 25. By means of the indexing mechanism 21 the perforated disc 16 is rotated one step until the next detent pin 17 engages in

the notch 18. The rocker 26 is thereafter again moved downwardly so that the guide cones 30 enters the next conical bore 25. Corresponding to the different location of this conical bore the capillary 6 is moved over the next connection point and the next bonding may be carried out.

In many cases the connecting wire has to be connected to a connection point of the housing by a double weld comprising two closely adjacent weld points. For this purpose the capillary 6 must be displaced a slight distance after the first welding. This is done in very simple manner by utilizing the resiliency of the leaf spring 20. For this purpose there is provided on the machine frame a mechanism 31 comprising a push member 32 directed towards the center of the leaf spring 19. Said push member is displaced linearly by a drive member 33 (pneumatically, hydraulically or magnetically). The drive member 33 is actuated after completion of the first weld of a double weld, the guide cone 30 being held in the same conical bore. The drive member 33 presses the push member 32 against the center of the leaf spring 20 so that the latter is bent a predetermined amount. This bending slightly displaces the stop member 19 which via the corresponding detent pin 17 entrains the perforated disc 16 so that the latter is turned a slight amount. During this turning the guide cone 30 in the conical bore is entrained and displaces the compound table 10 and thus also the capillary 6 a corresponding small distance. This distance is dimensioned to correspond exactly to the spacing between the two weld points of a double weld.

With the machine described above it would be theoretically possible to attach the connecting wires to all the connection points of the housing and of the semiconductor component completely automatically. For this purpose it would merely be necessary to associate the conical bores 25 of the disc 16 alternately with a connection point of the housing and a connection point of the semiconductor component. The capillary 6 would then be constantly reciprocated alternately between these connection points.

However, at the present state of the art this is not possible in practice because a requirement is that all the semiconductor components are in the same exactly defined position in their housings. Such precision cannot be obtained without excessive costs. The machine illustrated in the drawings is therefore provided with additional means for taking account of the different locations of the semiconductor components with respect to their housings.

For this purpose there is mounted on the frame 1 of the machine a second compound table 34 which is adjustable independently of the first compound table 10 likewise in two mutually perpendicular coordinate directions in a horizontal plane. In the example of embodiment illustrated the compound table 34 is disposed exactly beneath the upper compound table 10, although this is of course not absolutely essential. The compound table 34 is connected via a linkage 35 to a manipulator 36 so that by actuation of the latter said table may be brought into any desired position. Furthermore, a brake 37 is provided with which the table 34 may be locked in any desired position. For this purpose a brake plate 38 is mounted on the table 34 and extends between a fixed brake shoe 38 and a movable (for example pneumatically, hydraulically or magnetically actuated) brake shoe 40. When the movable

brake shoe 40 is pressed against the fixed brake shoe 39 the brake plate 38 is clamped and the lower compound table 34 thus locked.

Mounted on the lower compound table 34 is a support 41 which comprises an arm 42 extending over the upper compound table 10 and the members carried thereby.

Mounted at the free end of the arm 42 is a light-spot projector 43 which is arranged in such a manner that the light spot thereof may be directed onto the semiconductor component disposed on the table 2. Also attached to the support 41 is a rigid arm 44 which projects over the end of the rocker 26 and is provided with a conical bore 45 which widens downwardly and cooperates with an upwardly directed second guide cone 46 of the rocker 26. The conical bore 45, the second guide cone 46 and the light-spot projector 43 are arranged in such a manner that the capillary 6 is disposed exactly above the light spot projected by the projector 43 when the guide cone 46 is centered in the conical bore 45.

In this embodiment of the machine the disc 16 comprises only the conical bores corresponding to the connection points of the housing and the setting of the capillary 6 to the connection points of the semiconductor component is carried out by the operator using the light-spot projector 43 and the stereo microscope 4 in the following manner:

When the rocker 26 is moved downwardly and the guide cone 30 engages in the first conical bore 25 of the disc 16 the capillary 6 is located on the first connection point of the housing. The end of the connecting wire may then be welded in the usual manner to this point. During this operation the operator can use the manipulator 36 to adjust the second compound table 34 as desired and thereby direct the light spot projected by the projector 43 onto the desired next connection point of the semiconductor component, observing this operation with the stereo microscope. As soon as the light spot is directed to the desired connection point the operator actuates the brake 37, thus locking the lower compound table 34. Upon completion of the welding operation the drive cylinder 28 is actuated in such a manner that the rocker 26 is pivoted upwardly and the upper guide cone 46 enters the conical bore 45. The inclined surfaces of the conical bore and of the guide cone provide automatic centering and this correspondingly displaces the upper compound table 10 and thus the capillary 6. When the guide cone 46 is central in the conical bore 45 the capillary 6 is exactly above the light spot, i.e., above the desired next connection point. The next welding operation can thus be immediately initiated. During this operation the disc 16 is advanced one step and as soon as the welding operation is completed the rocker 26 is again pivoted downwardly the capillary 6 thus automatically being set to the next connection point of the housing. The operator can now release the brake again and set the light spot to the next connection point of the semiconductor component. The advantage of this solution is that firstly the operator need only carry out half the settings because the setting to the connection points of the housing is effected automatically by the disc 16 and secondly the settings which do have to be made by the operator may be carried out while other machine operations are in progress so that no machining time is lost on these setting operations. The operating time is thus substantially limited to the machining time necessary in any case.

In FIGS. 2 and 3 a modification of this second embodiment is illustrated in dot-dash line which enables the necessary manual operations to be still further reduced and to locate the connection points on the semiconductor component completely automatically as well, even if the locations of the semiconductor components in their housings differ.

In this embodiment there is no light-spot projector 43 and instead of the arm 44 with the single conical bore 45 a holder 47 is mounted on the support 41 and carries a bearing 48 for a second perforated disc 49. The disc 49 is constructed in the same manner as the disc 16; it carries at the periphery detent pins 50 which each engage in an associated conical bore 51. Furthermore, for the second perforated disc an indexing mechanism 52 is provided which is constructed in the same manner as the indexing mechanism 21 of the first disc 16. A stop member 53 cooperating with the pins 50 holds the second disc 49 in its stop positions.

In this case the first perforated disc 16 again comprises the conical bores associated with the connection points of the housing whereas the conical bores 51 provided in the second disc 49 represent the location of the connection points on the semiconductor component. The second guide cone 46 is retained on the rocker 26 and the upper disc 49 is arranged in such a manner that in each stop position one of its conical bores 51 is disposed in the operating position above said second guide cone 46.

Imagining again a reference point fixedly connected to the lower compound table 34, the various conical bores 51 are disposed in the disc 49 in such a manner that they are spaced from said imaginary reference point in the operating position a distance which in magnitude and direction corresponds to the distance of the corresponding connection point on the semiconductor component from a fixed reference point of said component.

In this embodiment the connecting wires are attached in the following manner: When the housing with the semiconductor component disposed therein has been mounted in the correct location on the table 2 the rocker 26 is pivoted upwardly by means of the drive cylinder 28 so that the upper guide cone 46 is centered in the first bore 51 of the disc 49, said bore being disposed in the operating position. The operator then uses the manipulator 36 with the brake 37 released to bring the capillary 6 above the first connection point of the semiconductor component corresponding to said conical bore, observing this operation with the aid of the stereo microscope 4. As soon as the capillary 6 is correctly set to the first connection point the brake 37 is actuated to lock the lower compound table 34. This setting of the table 34 is then maintained for as long as the corresponding semiconductor component is disposed in the machining position on the table 2 and the brake 35 is not released until the next semiconductor component in its housing is brought into the machining position.

The first welding operation is then initiated, the end of the connecting wire being bonded to the connection point of the semiconductor component which has been set by the operator. Thereafter the rocker 26 is pivoted downwardly by means of the drive cylinder 28 so that the lower guide cone 30 engages in the first conical bore 25 of the lower disc 16. The capillary 6 is thus automatically set to the first connection point of the hous-

ing. While the connecting wire is welded to said connecting point the upper disc 49 is advanced one step. The rocker 26 is then again pivoted upwardly so that the upper guide cone 46 engages in the next conical bore 51 of the disc 49. The capillary 6 is thus automatically set without the assistance of the operator to the next connection point of the semiconductor component. These operations repeat themselves completely automatically as necessary until all the required connections have been made. Following this the next semiconductor component is moved in its housing into the machining position on the table 2 and the operator uses the manipulator 36 with the brake 37 to adjust the position of the upper disc 49 in accordance with the location of the new semiconductor component in its housing.

Since in this embodiment of the machine the operator's attention is required only for short periods a substantial saving of personnel is possible because one operator can for example attend several machines. Apart from the initial setting for each semiconductor component the operations are completely automatic. The individual operations are controlled via a programme switching mechanism which controls the correct time cycle of the advancing of the perforated discs, the rocker actuation, the upward and downward movement of the capillary, the welding operations, the severing mechanism, etc.

The invention is not of course limited to the examples of embodiment described and illustrated. For example, linearly displaceable programme carriers may be provided instead of rotatable perforated discs. Nor is it absolutely essential for the cooperating guide members to consist of conical bores and guide cones. In the examples of embodiment described and illustrated there is a rigid connection between the guide members and the capillary and consequently the movement of the latter is exactly identical to the movement of the guide cones. It will of course also be possible to provide a reduction gearing in the connection between the guide members and the capillary to make the movement of the guide members greater by a predetermined factor than the movement of the capillary. The conical bores on the perforated discs would then have to be at corresponding greater distances from the reference points. This measure would in particular provide greater accuracy for very small adjustments.

The diameter of the conical bores 25, 45 and 51 must of course be sufficiently great to ensure that the tip of the guide cone 30 or 46 engages in the conical bore even for the greatest displacements occurring. The necessary dimensions may be easily calculated from the known distances between the connection points.

Furthermore, it is not absolutely essential for the guide members whose cooperation effects the adjustment of the capillary to comprise conical bores and guide cones. It is basically possible to use any guide members with which such an adjustment can be effected.

What is claimed is:

1. A machine for attaching connection wires to connection points of a semiconductor component and to connection points of a housing accommodating the semiconductor component comprising:

a. a wire guide member through which connection wire is fed, said wire guide member being vertically

- adjustable with respect to said semiconductor component and said housing;
- b. an adjustable support member having a driver member including a guide member fixed thereto, said adjustable support member being adjustable in two dimensions parallel to the plane of said semiconductor component for selectively carrying said housing with said semiconductor component or said wire guide member; and
 - c. a programme carrier having a plurality of guide members complementary to and engageable with the guide member on said driver member, said programme carrier being advanceable step-by-step into successive detent positions and the plurality of guide members of said programme carrier being positioned such that in each detent position at least one of said plurality of guide members is disposed from a stationary reference point a distance which in magnitude and direction is in a predetermined relationship to the distance of a connection point from a reference point of the housing of said semiconductor component.
2. The machine according to claim 1 wherein the guide members of said programme carrier are conical bores and said guide member of the driver member is a cone shaped guide member.
3. The machine according to claim 1 wherein said driver member is a rocker member pivotally mounted on said adjustable support member.
4. The machine according to claim 1 wherein said adjustable support member is a compound table.
5. The machine according to claim 1 wherein said programme carrier is a rotatably mounted rigid disc.
6. The machine according to claim 1 including a detent mechanism for fixing the programme carrier in each detent position.
7. The machine according to claim 6 including means for imparting a predetermined slight displacement to said programme carrier in each detent position.
8. The machine according to claim 6 wherein said detent mechanism comprises:
- a. a leaf spring fixedly clamped at one end and having a stop member provided with a notch at its other end;
 - b. a plurality of detent elements fixed to said programme carrier, said detent elements being successively engageable in said notch to define respective detent positions; and
 - c. means for selectively bending said leaf spring a predetermined amount wherein said stop member is selectively displaced to change the position of said notch and the detent element engaged therein.
9. The machine according to claim 1 wherein said adjustable support member carries said wire guide member and wherein said housing with said semiconductor component is held immovable during the attachment of said connection wires.

10. The machine according to claim 9 including an index strip advanceable step-by-step, said index strip providing means for carrying a plurality of housings with semiconductor components.

11. The machine according to claim 9 wherein said driver member includes a further complementary guide member and said machine includes a second adjustable support member adjustable parallel to the plane of said semiconductor component, said second adjustable support member being connected to a manipulator and including at least one guide member which cooperates with said further complementary guide member of said driver member.

12. The machine according to claim 11 including a brake for locking said second adjustable support member.

13. The machine according to claim 11 wherein said second adjustable support member is a compound table.

14. The machine according to claim 11 including a light spot projector connected to said second adjustable support member for directing a light spot onto said semiconductor component wherein said guide member on said second adjustable support member is positioned in a manner that by cooperation of the guide member on said second adjustable support member with said further complementary guide member of said driver member the said guide member brings said wire guide member into coincidence with said light spot.

15. The machine according to claim 11 including a second programme carrier having a plurality of guide members, said second programme carrier being advanceable step-by-step into successive detent positions and the plurality of guide members of said second programme carrier being positioned such that in each detent position at least one of said plurality of guide members is disposed from a reference point linked to the second adjustable support member a distance which in magnitude and direction is in a predetermined relationship to the distance of a connection point of the semiconductor component from a reference point of said component.

16. The machine according to claim 15 wherein said second programme carrier is a rigid disc rotatably mounted on said second adjustable support member.

17. The machine according to claim 11 wherein said driver member is a rocker member pivotally mounted on said adjustable support member.

18. The machine according to claim 17 wherein said rocker member includes two oppositely directed guide members arranged such that on the pivoting of said rocker member said oppositely directed guide members come into engagement alternately with a guide member of the programme carrier and with a guide member of said second adjustable support member.

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