United States Patent [19]

Zollinger

[11] **3,812,582**

[45] **May 28, 1974**

[54] **METHOD AND APPARATUS FOR THE PRODUCTION OF ELECTRICAL CONTACTS ON CONTACT CARRIERS**

[76] Inventor: **Hans-Rudolf Zollinger,** Bergstr. 23, 8954 Geroldswil, Switzerland

[22] Filed: **Nov. 13, 1972**

[21] Appl. No.: **305,781**

[30] **Foreign Application Priority Data**

Dec. 4, 1971 Switzerland 17608/71

[52] **U.S. Cl.** ..... **29/630 A,** 29/203 R, 29/203 D, 29/630 R, 228/5

[51] **Int. Cl.** **H01r 9/00**

[58] **Field of Search** ..... 228/3, 3.5, 4, 5; 83/277, 83/151, 578; 29/203 R, 203 B, 203 D, 628, 630 R; 226/149, 150, 151

[56] **References Cited**

UNITED STATES PATENTS

1,655,471	1/1928	Marcell	83/277
2,771,009	11/1956	Carroll et al	226/151
3,045,715	7/1962	Monahan et al	228/3.5
3,148,817	9/1964	Lord	226/151
3,194,098	7/1965	Kimball et al	29/203 R
3,473,716	10/1969	Butler	83/277
3,626,590	12/1971	Miller	228/5
3,680,761	8/1972	Rozmus et al.	228/3

Primary Examiner—Richard J. Herbst
Assistant Examiner—James R. Duzan
Attorney, Agent, or Firm—Brady, O'Boyle & Gates

[57] **ABSTRACT**

A cutting device for cutting a contact piece from a wire or ribbon-like contact material fed thereto by a first guide, after which an advancing and withdrawing device advances the remaining contact material to push the cut contact piece from the cutting device along a second guide in alignment with the first guide to a conductive connection means where the contact piece is conductively connected to a contact carrier. The remaining contact material is withdrawn, by the withdrawing device to bring the contact material into position for cutting the next contact piece, by a distance which is smaller by the length of the cut contact piece than the distance by which the cut contact piece is advanced to the position for conductive connection at the conductive connection means.

12 Claims, 2 Drawing Figures

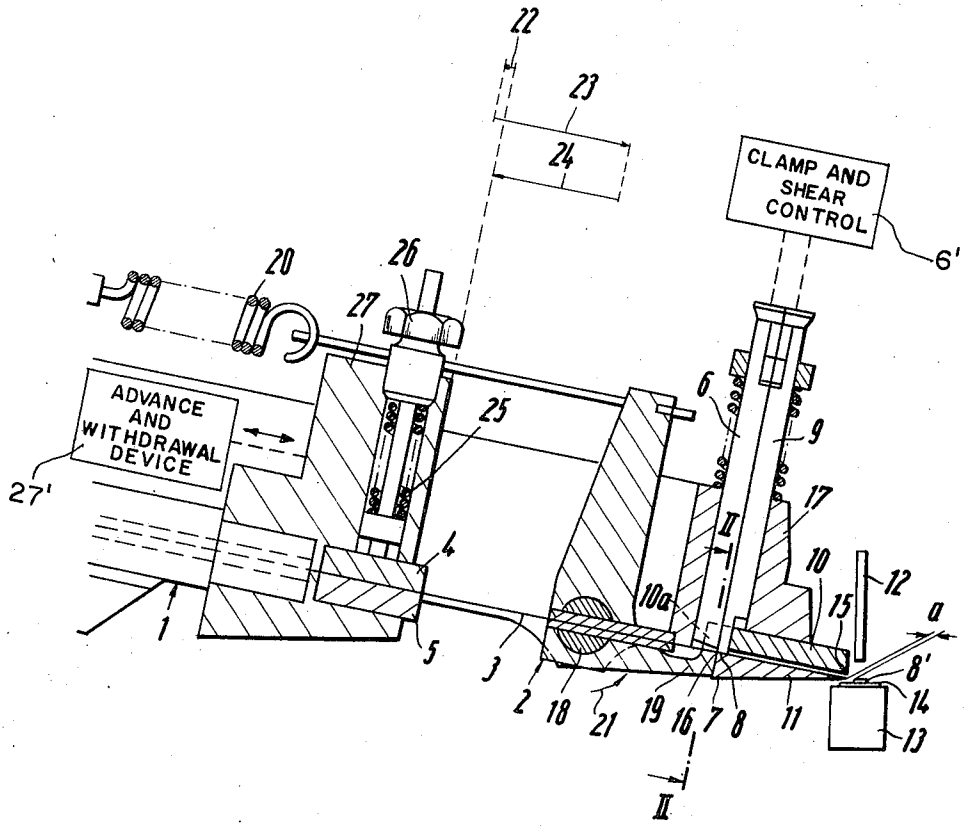


Fig. 1

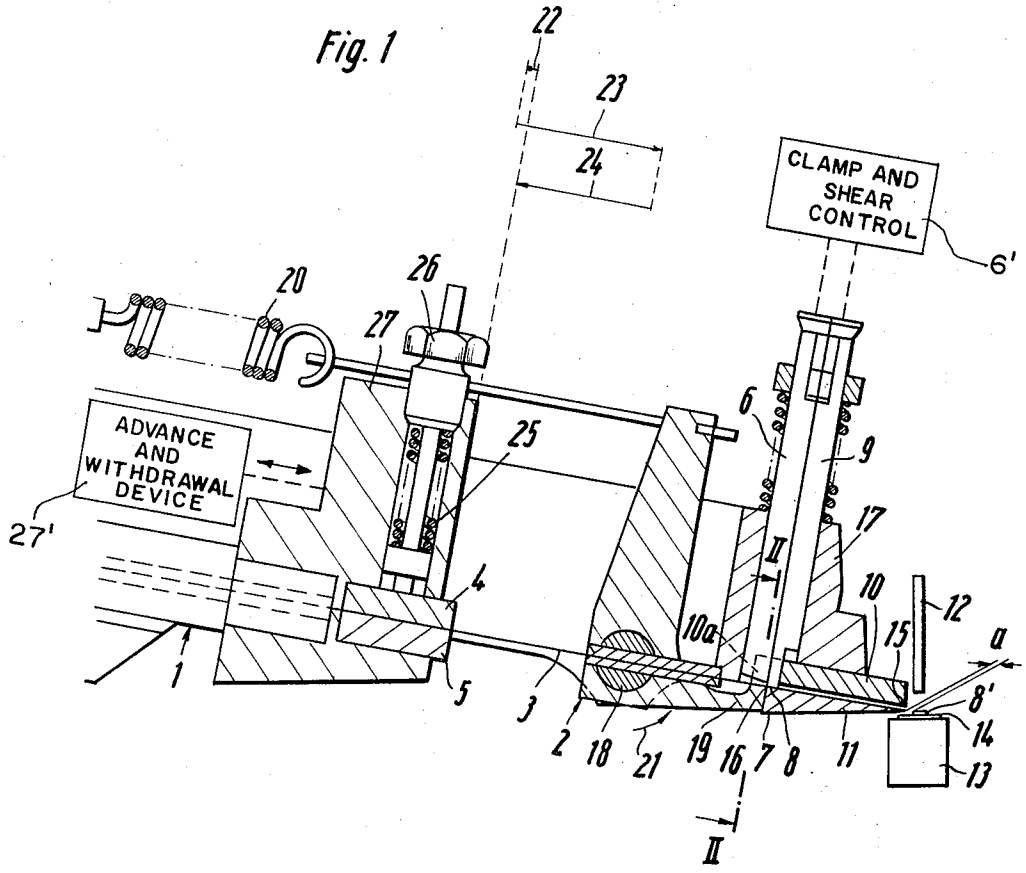
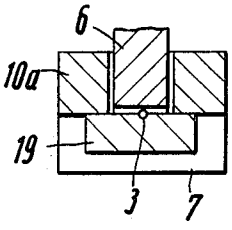

22
23
24
CLAMP AND SHEAR CONTROL
6'
20
26
27
ADVANCE AND WITHDRAWAL DEVICE
27'
25
6
9
17
II
10
12
15
a
10a
4
1
5
3
2
18
21
19
16
7
8
11
8'
14
13
II

Fig. 2


6
10a
19
3
7

METHOD AND APPARATUS FOR THE PRODUCTION OF ELECTRICAL CONTACTS ON CONTACT CARRIERS

This invention relates to a method and apparatus for the production of electrical contacts on contact carriers, the contacts being in the form of contact pieces which are cut from a wire or ribbon-like contact material and are conductively connected, e.g. by resistance welding, to a contact carrier consisting for example of sheet metal or wire.

A process has been proposed for producing electrical contacts wherein wire contact material is welded vertically to a contact carrier consisting of sheet metal, then cut off at a distance from the welding point and wherein the contact face of the contact piece removed thereby is subsequently stamped (Swiss Patent Specification No. 384,100). This method cannot be applied if the contact piece, which is of a wire or ribbon-like contact material, is to be welded flat on to a contact carrier and not vertically. Flat welded contact pieces are necessary for example for the production of pairs of contacts with ribbon or wire-shaped pieces of contact material intersecting one another. In particular, bi-metallic contact pieces which consist of a layer of a first material to be welded to the contact carrier and a layer of a second material forming the contact face, must be welded flat to contact carriers.

An object of the invention is to enable contact pieces to be cut from wire or ribbon-like contact material and to be welded in a predetermined position flat on contact carriers, e.g. of sheet metal or wire.

According to a first aspect of the invention, there is provided a method for the production of electrical contacts on contact carriers, comprising cutting a contact piece from a wire or ribbon-like contact material, advancing the remaining contact material to push the cut contact piece to a position for conductive connection to a contact carrier, and conductively connecting said contact piece to the contact carrier, the remaining contact material being withdrawn by a distance which is smaller by the length of the cut contact piece than the distance by which the cut contact piece is advanced to said position for conductive connection, in order to bring the contact material into position for cutting the next contact piece. Desirably, conductive connection is made by resistance welding.

According to a second aspect of the invention, there is provided apparatus for the production of electrical contacts on contact carriers, comprising a cutting device for cutting a contact piece from wire or ribbon-like contact material, means for conductively connecting a cut contact piece to a contact carrier, and advancing and withdrawing means for advancing the remaining contact material to push a cut contact piece from the cutting device to the conductive connection means and subsequently withdrawing the remaining contact material by a distance which is smaller by the length of the cut contact piece than the distance by which the cut contact piece is advanced to the conductive connection means, there being a first guide for guiding contact material to the cutting device, and a second guide for guiding contact material from the cutting device to the conductive connection means, said first and second guides being in alignment. Desirably, the means for conductively connecting a cut contact piece to a contact carrier is an electrical resistance welding apparatus.

In order to enable the invention to be more readily understood, reference will now be made to the accompanying drawings, which illustrate diagrammatically and by way of example an embodiment thereof, and in which:

FIG. 1 is a partially sectioned elevation of an apparatus for the production of electrical contacts; and

FIG. 2 a section view on an enlarged scale along the line II-II of FIG. 1.

Referring now to the drawings, the apparatus comprises guide parts **1,2** for drawing off wire-like contact material **3** from a supply coil (not shown). A pair of spring-loaded grips **4,5,** is provided for advancing the wire contact material, and a pair of shearing blades **6,7** is provided for cutting contact pieces **8** from the material **3.** A raisable and lowerable clamp **9** is provided for the contact piece to be cut. Contact piece guides **10,11** guide the contact pieces to a pair of welding electrodes **12,13** for resistance welding a contact piece **8'** to a contact carrier **14.**

The contact piece guides **10,11** define an outlet **15** which leads to the welding point on the contact carrier **14** through an acute angle. An inlet **16** leading to the contact piece guides is defined by the clamp **9** and the lower shearing blade **7** which is stationary, and integral with the lower guide **11.** The upper shearing blade **6** is movable and disposed adjacent the clamp **9** directly in front of the inlet **16** leading to the contact piece guides **10,11.** The upper blade **6** has an obtuse cutting angle. The upper blade **6** and the clamp **9** are arranged to be led towards one another by sliding in a guide **17** (not shown in FIG. **2**) and are connected with an advance and withdrawal device schematically shown at **6'**, the cycle of movement of which is explained in greater detail hereafter in conjunction with the operation of the apparatus. The upper guide section **10** has two bifurcations **10***a* running in its longitudinal direction (FIGS. **1** and **2**), between which the lower extremity of the upper blade **6** and the lower extremity of the clamp **9** are arranged one behind the other.

The guide part **2** located in front of the inlet **16** leads the material **3** to the contact piece guide **10,11.** The part **2** can be swung about a pivot **18** which intersects the contact material guide path of the part **2** at right angles and is disposed at right angles to the direction of movement of the upper blade **6** at a distance from the latter, so that an extremity **19** of one arm of the guide section **2,** can follow the movement of the cutting edge of the upper blade **6.** The extremity **19** exhibits a guide face for the contact material **3** and is arranged with the upper blade **6** as a counter-abutment. The guide section **2** is subject to the action of a tension spring **20** which exerts a torque on it in the direction of the arrow **21,** so that the extremity **19** adjoins the bifurcations **10***a* in the rest position illustrated, whereby its guide face lies in a common plane with the guide face of the contact piece guides **11** and the upper blade **6** is at a small distance (e.g. 0.1 mm) from the contact material **3.** When the upper blade **6** descends and cuts through the material **3,** the blade lowers the extremity **19** from the bifurcations **10***a*. Then the end of the material **3** is firmly clamped between the upper blade **6** and the guide face of the arm extremity **19,** under the action of the spring **20.** The upper grip **4** of the pair of grips **4,5** is subject to the action of a pressure-exerting spring **25,** the pre-tensioning of which can be adjusted by means of a nut **26.** A part **27** of the guide part **1** which sur-

rounds the pair of grips **4,5** and the spring **25** is connected with a device for the sequential production of three strokes, which are represented by the arrows **22, 23** and **24.** The device schematically shown at **27'** may comprise for example an off-drive member of a cam gear. The stroke **23** is longer than the length of the contact piece guides **10,11** between the cutting edges of the blades **6** and **7** and the outlet **15** by a distance *a* which represents the desired distance of the contact piece **8'** to be welded from the outlet **15.** The stroke **24** is shorter than the stroke **23** by the longitudinal dimension of an individual contact piece **8, 8'**, and the stroke **22** matches this contact piece dimension.

The guide parts **1,2** together with the contact piece guides **10,11** and the parts connected with it metallically are electrically insulated from the welding circuit (of which only the electrodes **12** and **13** are shown). The pre-tensioning of the spring **25** is chosen such that in the illustrated rest position of the guide section **2,** the wire **3** clamped between the grips **4** and **5** is drawn along by these grips without slipping, pulled off the supply coil (not shown) by them, drawn through the guide part **1,** pushed through the guide part **2,** across the guide face of the extremity **19** and the lower blade **7** and through the guide pieces **10, 11,** when the part **27** with the grips **4** and **5** executes the stroke **23,** and is accordingly pushed back and pulled when the part **27** effects the stroke **24.**

The tension of the spring **20** is determined such that when the upper blade **6** has cut the contact piece **8** from the wire **3** and thereby lowered the extension **19** from the bifurcations **10***a*, the free end of the wire **3** is so firmly clamped between the upper blade **6** and the extension **19** that the grips **4,5** slide on the contact material **3** and cannot draw the same along when the part **27** with the grips **4,5** executes the stroke **22.** Thereby the cutting edge movement of the upper blade **6** runs downwards further than is required for cutting through the thin wire **3.**

In the illustrated starting position of the contact material **3** and the moving parts of the apparatus, the material **3** protrudes beyond the cutting edges of the blades **6** and **7** into the guides **10,11** by the length to be cut off for the contact piece, the clamp **9** holds this length firmly on the lower blade **7,** the part **27,** with the grips **4,5,** is at the start of the stroke **22,** and the grips **4,5** hold the contact material **3** firmly. The upper blade **6** descends and cuts the contact piece **8** off, whereupon the blade **6** presses downwards across the remaining contact material onto the extremity **19,** and thus lowers the extremity **19** from the bifurcations **10***a* and swings the guide section **2** in the direction counter to that shown by the arrow **21.** Thereby, under the action of the spring **20,** the wire end arising from the cutting is clamped between the upper blade **6** and the extremity **19.** The pair of grips **4,5** now carry out the stroke **22,** whereby the grips **4** and **5** slide on the contact material **3** because its extremity, as was just described, is held firm. Thereby the part of the contact material **3** situated between the clamped end and the grips **4,5** is tensioned and thus straightened. This is advantageous for untroubled functioning of the subsequent wire advance (stroke **23**) in that this part of the wire **3** was previously pushed through the guide part **2** and the guides **10, 11** (stroke **23**) and withdrawn while only lying loosely therein (stroke **24**) when contact pieces are continuously cut off and welded to contact carriers. After stroke **22** of the pair of grips **4,5** the upper blade **6** returns upwards until its cutting edge and the cutting edge of the lower blade **7** form a gap which is only greater than the thickness of the contact material **3** by the required tolerance. Thereby the guide section **2** under the action of the tension spring **20** swings in the direction of the arrow **21** back to the illustrated position in which the extremity **19** comes against the bifurcations **10***a*. Then the end of the wire is no longer held firm. The clamp **9** is released until its lower face comes flush with the guide face of the upper contact guide **10** and with the cutting edge of the upper blade **6.** Then the grips **4,5** execute the stroke **23.** Thereby they draw the contact material **3** along, pushing the material across the guide face on the extremity **19,** across the lower blade **7** and through the guides **10,11,** whereby the material pushes the previously cut contact piece **8** before it until the same lies on the contact carrier **14** in the position of the contact piece **8'**. The contact piece is then welded to the contact carrier. During the welding the part **27,** with the grips **4,5,** carries out the stoke **24,** as a result of which the free end of the contact material **3** again assumes the position shown in FIG. **1,** in which a length of contact material **3** corresponding to the next contact piece to be cut protrudes beyond the cutting edges of the blades **6,7.** Thereafter the clamp **9** is lowered. Thereupon all moving parts and the wire **3** are again in the illustrated starting position, and the described procedures for cutting, advancing and welding of the next contact piece to the next contact carrier and withdrawal of the contact material are repeated.

The apparatus as has just been described works satisfactorily, but if desired an additional mechanism may be provided through which the part **2,** when swung counter to the arrow direction **21** out of the illustrated position (i.e. during the stroke **22**), wholly or partly unloads the spring **25** or lifts the grip **4** off. Moreover, alternative conveying means may be provided for pushing the contact material **3** forwards as per stroke **23** and pulling it backwards as per stroke **24** e.g. conveyor rollers driven forwards and backwards in cycles.

What we claim is:

1. A method for the production of electrical contacts on contact carriers, comprising cutting a contact piece from a strip of wire or ribbon-like contact material, advancing the remaining strip of contact material to push the cut contact piece to a position for conductive connection to a contact carrier, conductively connecting said contact piece to the contact carrier, and withdrawing the remaining strip of contact material by a distance which is smaller by the length of the cut contact piece than the distance by which the cut contact piece is advanced to said position for conductive connection, to bring the contact material into position for cutting the next contact piece.

2. A method as claimed in claim **1,** wherein conductive connection of the cut contact piece to the contact carrier includes the step of resistance welding.

3. Apparatus for the production of electrical contacts on contact carriers, comprising a cutting device adapted to cut a contact piece from a strip of wire or ribbon-like contact material, a first guide means positioned for guiding the strip of contact material to said cutting device, means spaced from said cutting device for conductively connecting a cut contact piece to a contact carrier, a second guide means connected be-

tween said cutting device and said conductive connection means for guiding contact material from said cutting device to said conductive connection means, said first and second guide means connected in alignment, and movable advancing and withdrawing means adapted to grip and advance the remaining strip of contact material into said second guide means to push a cut contact piece from said cutting device through said second guide means to the conductive connection means and movable to subsequently withdraw the remaining strip of contact material from said second guide means by a distance which is smaller by the length of the cut contact piece than the distance by which the cut contact piece is advanced to the conductive connection means by the strip of contact material.

4. Apparatus as claimed in claim **3,** wherein the means for conductively connecting a cut contact piece to a contact carrier is an electrical resistance welding apparatus.

5. Apparatus as claimed in claim **3** wherein the cutting device comprises a displaceable blade connected adjacent the end of said first guide means, a spring-loaded first counter-abutment connected to co-operate with said displaceable blade, and a stationary blade connected at one end of said second guide means, a second counter-abutment connected to co-operate with said stationary blade, and said spring-loaded first counter-abutment having a guide face leading to said second guide.

6. Apparatus as claimed in claim **5,** wherein the displaceable blade and the first counter-abutment are slidable towards one another.

7. Apparatus as claimed in claim **5,** wherein the displaceable blade and the first counter-abutment define in their rest position a third guide for strip of contact material, said third guide being in alignment with said first and second guides.

8. Apparatus as claimed in claim **5,** wherein the movable advancing and withdrawing means includes spring-loaded grip members, and wherein said first counter-abutment is spring-loaded in such a manner that it presses the strip of contact material against the cutting edge of the displaceable blade with a force increasing with the extent of cutting displacement of the displaceable blade.

9. Apparatus as claimed in claim **8** wherein the displaceable blade in the cutting operation is positioned beyond the cutting path required for cutting through the contact material.

10. Apparatus as claimed in claim **8,** wherein, in sequence, said spring loaded grip members are withdrawable for a first backward stroke for sliding the spring loaded grip members back on the strip of the stationary contact material by a distance which corresponds to the length of a cut contact piece, are advanceable for a forward stroke to advance the strip of contact material to push a cut contact piece adjoining the remaining strip of contact material through said second guide means to the conductive connection means, and are withdrawable with the strip of contact material for a second backward stroke, the total displacement of the two backward strokes being equal to that of the forward stroke.

11. Apparatus as claimed in claim **10** wherein said spring loaded grip members execute the first backward stroke at the end of the cutting movement of the displaceable blade and execute both the forward stroke and the second backward stroke with the displaceable blade retracted in the rest position.

12. Apparatus as claimed in claim **11** including stop means against which said first counter-abutment is spring-loaded in its rest position, and said first counter-abutment connected to be lifted from the stop means at the end of the cutting movement of the displaceable blade by said displaceable blade for holding the end of the strip of contact material firmly between the displaceable blade and the first counter-abutment such that said spring loaded grip members slide with respect to the strip of contact material during the first backward stroke.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,812,582 Dated May 28,1974

Inventor(s) HANS-RUDOLF ZOLLINGER

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading of the patent, after the name and address of the inventor, add:

Assignee: H.A.SCHLATTER, AG,
Geroldswil, Switzerland

Signed and sealed this 17th day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334