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Fig. 3A

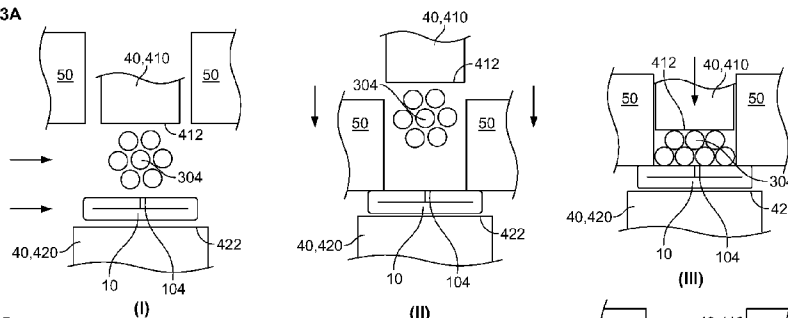
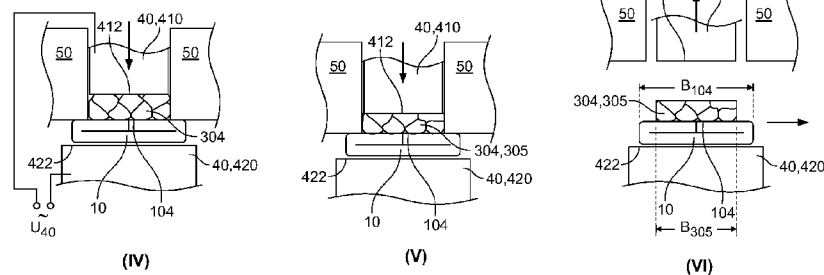


Fig. 3B



(57) Abstract: A process and a device (1) for compaction-welding of an electric line (304) to an electrical connection contact (10), such as for example an electric pin or socket contact, in particular for resistance-monitored circuits in a motor vehicle includes two welding tools (40; 410, 420) between which the electrical connection contact (10) and the electric line (304) can be provided for mutual welding and two welding members (50, 50) between which the electric line (304) can be clamped during the welding, wherein at least one of the welding members (50) can be attached on that side of the electrical connection contact (10) on which the electric line (304) can be provided.

PROCESS AND DEVICE FOR COMPACTION-WELDING

The invention relates to a process and a device for the compaction-welding of an electric line to an electrical connection contact, such as for example an electric pin or socket contact, in particular for resistance-monitored circuits in a motor vehicle.

In the automotive industry simple, rapid connection, which can be implemented on a large scale, of electric lines to electric terminals is desirable for the on-board wiring. A known process of this type is the 'compaction-welding' of an electric line to an electrical connection contact. Compaction-welding involves compacting the individual wires of the line and welding a pack of lines of this type to the electrical connection contact (terminal) at the same time. An insulation crimp is also produced in the process. This results in high efficiency, safety and low costs for each welding process.

However, known compaction-welding processes have the drawback that the width of an electrical connection zone on the electrical connection contact has to be adapted precisely to the size of a line to be electrically connected. This reduces the flexibility of the known compaction-welding processes, as without retrofitting a device for compaction-welding substantially just a single pairing of a line to a connection contact can be processed.

This disadvantageously restricts the capacity and increases the cost of a device of this type.

In a known device for electrical compaction-welding, a welding die is delimited by ceramic member, the ceramic members resting laterally against a lower electrode of the device during the welding process. A connection zone of the electrical connection contact is in this case adapted to the width of the electrodes (upper electrode and lower electrode) or the width of the electrodes is adapted to the width of the electrical connection zone.

The electric inner line, which consists of a large number of individual wires, of a cable is pressed by a movable upper electrode, which is slightly narrower than the lower electrode, onto the electrical connection zone of the electrical connection contact and is thus distributed over the entire width of the electrical connection zone. If a comparatively thin inner line is then to be connected to a comparatively large connection zone, a conventional process for compaction-welding can no longer properly be carried out.

In alternative compaction-welding processes, in a prior operation, the inner line, which consists of a large number of individual wires, of the cable is compacted to form a solid block and only then welded on. A drawback of a process of this type is the additional, cost-intensive operation required to obtain the desired result.

It is therefore an object of the invention to provide an improved process and an improved device for the compaction-welding of an electric line to an electrical connection contact. In particular, it is an object of the invention to provide a process and a device for compaction-welding that allow - without retrofitting the device for compaction-welding - differing connection contacts to be connected to differing cables in a mechanically secure and electrically conductive manner. This should preferably be achieved for a broad range of lines of differing sizes with a variable width of their zone for welding to the electrical connection contact at a specific width of its connection zone.

The object of the invention is achieved by a process according to claim 1 and by means of a device according to claim 7.

According to the invention, an electrical connection zone of a connection contact is welded to an electric inner line of a cable, the inner line being compacted. In this case, the electrical connection contact may, for example, be a plug/socket contact, a terminal or an electrical connection to a punched grid. For compacting and welding, the electrical connection zone of the electrical connection contact and the line of the cable are processed by means of four welding tools. The process according to the invention and the device according to the invention are distinguished by the fact that at least one welding tool rests, during

compacting and welding of the line to the electrical connection zone, on that side of the electrical connection contact on which the line for the compacting and welding is also arranged.

5 According to the invention, this allows the width of the compacted and welded portion of the electric line to be influenced by the electrical connection zone of the electrical connection contact. In other words, according to the invention, it is possible to weld a comparatively thin
10 line to a comparatively wide connection zone by means of a compaction-welding process.

 The device according to the invention and the process according to the invention allow an identical weld surface to be produced for electric lines of differing thickness or
15 a weld surface to be adapted in accordance with the size ratios of the line (cross section) and the electrical connection zone (surface area). This is particularly advantageous for electrical signal contacts, for example of an air bag or a sensor connection in a motor vehicle, as
20 such circuits are usually resistance-monitored and the invention allows precise setting of electrical resistance. This prevents failures or malfunctions of the respective electric or electronic system.

 In a preferred embodiment of the invention, two
25 opposing welding tools are attached on that side of the electrical connection contact on which the electric line for welding to the electrical connection contact is arranged.

As a result, the weld region on the electrical connection zone can be influenced from two sides, thus allowing, in particular, a weld region to be configured centrally in relation to the electrical connection zone.

5 In other embodiments of the invention, a welding tool can be attached laterally to the electrical connection zone and thus preferably also laterally to the portion of the electric line that is to be compacted. In addition, in an embodiment of this type, it is also possible for this
10 welding tool to rest against or at a certain distance from a welding tool which is directly responsible for welding (for example an electrode or anvil).

 In one embodiment of the invention, the welding tools responsible for delimiting the electric line on the
15 electrical connection zone of the electrical connection contact are welding members which are made preferably at least partly of ceramic. In this case, the welding members are arranged opposing one another and determine the width of the compacted portion of the line.

20 The welding tools corresponding thereto, which are responsible for the actual welding of the electric line to the electrical connection zone, delimit during the welding of the electrical connection zone to the line substantially the two remaining, free sides of the composite structure
25 consisting of the electrical connection zone (connection contact) and line. In other words, one welding tool preferably rests on the electrical connection contact in a

planar manner and the other welding tool preferably rests on the line in a planar manner.

At least one of the welding members delimits one side of the portion of the electric line that is to be compacted and rests in this case at the same time on that side (connection zone) of the electrical connection contact on which the line is also arranged. The other welding member can in this case rest in a similar manner on the electrical connection zone, opposing the first welding member, or in addition delimits the electrical connection zone laterally, and can furthermore also rest laterally against a welding tool responsible for the welding or be set apart therefrom by a small distance.

In preferred embodiments of the invention, an electric resistance welding process or an ultrasonic welding process is carried out as the compaction-welding process according to the invention. For this purpose, two welding tools are configured accordingly as electrodes or sonotrodes or one as a sonotrode and the other as an anvil. Furthermore, a welding tool can be configured as a slide.

In the process according to the invention, the electrical connection contact and the electric line are provided between two welding tools for mutual welding. Furthermore, the line is clamped between two welding members for welding, at least one welding member being attached on that side of the electrical connection contact on which the line is also provided.

In the device according to the invention for compaction-welding, the electrical connection contact and the electric line for mutual welding can be provided between two welding tools and between two welding members, the two welding members being located laterally directly adjacent to the two welding tools. At least one welding member can be attached to the electrical connection contact on that side on which the line can also be provided. Subsequently, a welding process can be carried out, wherein the line can be compacted and welded to the electrical connection contact.

According to the invention, the same electrical connection zones can be used for a broad range of different electric lines by adapting the weld width, or a preceding process, which was previously required for this purpose, for compacting the line is dispensed with.

If the invention is applied to an electric resistance welding process, an electrode, in particular a lower electrode, can be configured so as to be more solid than in the prior art, thus lengthening the service life of the lower electrode. The various weld widths on the electrical connection zone are achieved by exchanging just a single electrode, in particular an upper electrode. There is no need to adapt the remaining components, in particular the lower electrode.

According to the invention, the costs of retrofitting the device for compaction-welding are reduced on conversion of production. Furthermore, more rapid adaptation results

from the fact that only the upper electrode must be exchangeable in its configuration, especially as the lower electrode also has a longer service life.

Additional embodiments of the invention emerge from the remaining dependent claims.

The invention will be described hereinafter in greater detail based on exemplary embodiments and with reference to the appended schematic drawings, in which:

Fig. 1 shows the basic construction of a device for the compaction-welding of an electric line to an electrical connection contact, and also the sequence of a corresponding process;

Fig. 2A to Fig. 2B show a device according to the prior art for compaction-welding and also a process sequence pertaining thereto (steps I to VI);

Fig. 3A to Fig. 3B show a device according to the invention for compaction-welding and also a process sequence according to the invention pertaining thereto (steps I to VI);

Fig. 4 shows an additional embodiment of a device according to the invention and of a process according to the invention for compaction-welding; and

Fig. 5 shows a further embodiment of a device according to the invention and of a process according to the invention for compaction-welding.

The invention will be described hereinafter in greater detail starting from the prior art illustrated in Fig. 2A to

Fig. 2B with reference to a device 1 and with reference to a process for the compaction-welding of an electric line 304 to an electrical connection contact 10 of a socket contact. The scope of the invention shall not however be limited to the electrical connection contact 10 of a socket contact but rather shall include connection contacts in general. This applies, for example, to an electrical connection contact to an electric pin contact, a terminal or a punched grid 15. In addition, the scope of the invention is not limited to applications in the automotive industry.

Furthermore, the invention will be described in greater detail with reference to a process and the device 1 for electric resistance compaction-welding. The scope of the invention shall not however be limited to the device 1 of this type or a process of this type but can rather also be applied to other welding devices or welding processes. Thus, it is for example possible to apply the invention to the device 1 or to a process for ultrasonic welding.

Fig. 1 is a three-dimensional view of the basic construction of the device 1 for compaction-welding. A plurality of the electrical connection contacts 10 (configured in the present case as socket contacts), emanating from the left-hand side (with reference to Fig. 1), are supplied to the device 1 via a supply source, in order each to be electrically connected to a cable 30. For forwarding of the electrical connection contacts 10, a carrier strip 110 of the electrical connection contacts 10

has conveyance openings 112 by which the carrier strip 110 can be advanced into a weld region of the device 1.

If the electrical connection contact 10 is located in the weld region of the device 1 for compaction-welding, an
5 end portion of the cable 30 is first placed on a rear portion of the electrical connection contact 10, wherein a stripped end portion of the electric line 304 of the cable 30 comes to rest on an electrical connection zone 104 of the electrical connection contact 10. In this case, an
10 electrically insulated region of the cable 30 is located in a region of two crimp lugs 102 of the electrical connection contact 10.

First, the crimp lugs 102 are closed by a crimping tool 20, which can be configured for example as a bending punch,
15 thus producing a mechanically secure connection of the cable 30 to the electrical connection contact 10 via electrical insulation 302 of the cable 30. Furthermore, in the same operation, the electrical connection contact 10 is separated from the carrier strip 110, i.e. the crimping tool 20
20 separates the carrier strip 110 from the electrical connection contact 10. Subsequently, two welding members 50 (welding tools) and two electrodes 40 (welding tools) are advanced to the region to be welded between the electric line 304 of the cable 30 and electrical connection zone 104
25 of the electrical connection contact 10.

If the welding members 50 and the electrodes 40 are in their respective working position, the free end portion of

the electric line 304 is compacted and welded to the electrical connection zone 104 of the electrical connection contact 10. Subsequently, the cable 30, which is electrically connected to the electrical connection contact 10 in a frictionally engaged manner by the crimp lugs 102 and in a materially integral manner by the compaction-welding, is removed from the device 1 and supplied for further processing. Subsequently, a further one of the electrical connection contacts 10 is introduced into the device 1.

Fig. 2A-I to Fig. 2B-VI show a device 1 and also a process pertaining thereto (steps I to VI) for compaction-welding according to the prior art.

In a first step I, the electrical connection contact 10 and the free, stripped end portion of the electric line 304 of the cable 30 are introduced in a region of the two opposing electrodes 40 (upper electrode 410 and lower electrode 420); this is illustrated by the two arrows in Fig. 2A-I. In this case, the electrical connection contact 10 is placed on the lower electrode 420, the electrical connection zone 104 of the electrical connection contact 10 being remote from the lower electrode 420. The free end portion of the electric line 304 is placed onto the electrical connection zone 104, the upper electrode 410 being located on the side of the electric line 304 that is remote from the electrical connection zone 104. In other words, a region of mechanical contact between the electrical

connection zone 104 and the electric line 304 is located between the electrodes 40.

In a subsequent step II, the two welding members 50 are then advanced into their respective working position. For this purpose, the welding members 50 are moved downward (with reference to Fig. 2A-II) and a portion of the welding members 50 is subsequently placed against the lower electrode 420 and the electrical connection contact 10 (sideways movement). In the prior art, the electrical connection contact 10 is configured in the region which is welded to the electric line 304 so as to be roughly as wide as the lower electrode 420. In other words, the lower electrode 420 must be adapted to the width of the electrical connection contact 10 in the region of the electrical connection zone 104 thereof. This also means that if the electrical connection zones 104 of differing width are to be used, the lower electrode 420 must be adapted, i.e. has to be exchanged. The movement of the welding member 50 is, again, illustrated by arrows.

In a subsequent step, step III, the electric line 304 is mechanically precompacted by movement of the upper electrode 410. In other words, the upper electrode 410 moves toward the lower electrode 420 and clamps the electric line 304 between itself and the electrical connection zone 104 of the electrical connection contact 10. This eliminates any air present between the electrical connection contact 10 and the lower electrode 420, so the lower

electrode 420, the electrical connection contact 10, the electric line 304 and the upper electrode 410 are pressed against one another, the electrodes 40 clamping the electric line 304 and the electrical connection contact 10 between themselves.

In this case, the electric line 304 is clamped in a substantially 90° direction thereto, thus preventing the welding members 50 from causing the electric line 304 to move laterally out of the weld region. During the mechanical precompaction, an electric stranded conductor, which is initially substantially circular and consists of a large number of individual wires, is compressed and becomes increasingly rectangular in shape. The mechanical precompaction of the electric line 304 is monitored by way of an attachment height h_A . In other words, once the attachment height h_A has been reached, the mechanical precompaction is stopped (see Fig. 2A-III) and the actual compaction-welding process can take place.

This is shown in Fig. 2B-IV. Between the upper electrode 410 and the lower electrode 420, a welding voltage U_{40} is applied for a period of time Δt_{40} . In this case, the upper electrode 410 again presses with a force toward the lower electrode 420, thus allowing a reduction in size of the cross section of the electric line 304 resulting from melting of the electric line 304 in the weld region to be compensated for. During the welding process, the upper electrode 410 moves toward the lower electrode 420 by an

amount Δh_{40} . If the amount Δh_{40} exceeds a certain value, the welding process is interrupted (setting-distance deactivation). Monitoring is performed by way of the weld time Δt_{40} .

5 During the welding, electric current flows from the upper electrode 410, via a weld surface 412 thereof, to the free end portion of the electric line 304 and from there to the electrical connection zone 104 of the electrical connection contact 10, the electric current being conducted
10 from the electrical connection zone 104 via the material of the electrical connection contact 10 to a weld surface 422 of the lower electrode 420 which it subsequently enters.

 The welding process is then immediately followed by a certain waiting period in which the upper electrode 410 is
15 still acted on by a force in the direction of the lower electrode 420. This is shown in Fig. 2B-V. Within this dwell time, monitoring is performed over a setting distance Δh_s . In other words, after the welding, the upper electrode 410 continues for a certain distance. Once the
20 predetermined setting distance Δh_s has been reached, the desired weld quality has been achieved and the cable 30, which is welded to the electrical connection contact 10, can subsequently be removed from the device 1.

 This is shown in Fig. 2B-VI, wherein the welding member
25 50 and the upper electrode 410 move into a starting position shown in Fig. 2A-I and subsequently the electrical connection contact 10 and the cable 30 can be removed from

the device 1. Afterwards the process continues in step I, a subsequent one of the electrical connection contacts 10 being connected to the cable 30.

The process according to the invention shown in Fig.

5 3A-I to Fig. 3B-VI and the device 1 according to the invention for compaction-welding differ from the prior art substantially in that the welding members 50 are attached at a different position (Fig. 3A-II); use can be made of the lower electrode 420, the width of which no longer has to be adapted to the electrical connection zone 104 of the electrical connection contact 10; and the width of the upper electrode 410, which is preferably provided so as to be exchangeable, has merely to be adapted to a width B_{305} (see in this regard Figs. 4 and 5) of a compacted portion 305 to be compacted of the electric line 304. In other words, in the latter regard as well, if the compacted portion 305 has any desired width B_{305} , the upper electrode 410 must not specifically be provided. As a result, the device 1 according to the invention is simpler to handle and the process according to the invention is simpler and quicker to carry out. Furthermore, according to the invention, fewer defects occur in the production of the welded connection than in the prior art; there is therefore less wastage.

The device 1 according to the invention and the process according to the invention for compaction-welding are therefore configured in such a way that the welding members 50 are no longer brought laterally up to the lower electrode

420 or laterally up to the electrical connection zone 104 of the electrical connection contact 10 (see Fig. 2A-II); instead, the two welding members 50 rest above or at or on the electrical connection zone 104 (see Fig. 3A-II).

5 The term "'electrical connection zone 104'" refers in this case only to that surface region of the electrical connection contact 10 on which the free stripped portion of the electric line 304 can come to rest. In other words, in the exemplary embodiment shown according to Fig. 1, the
10 electrical connection zone 104 is a substantially rectangular surface above the electrical connection contact 10, the electrical connection zone 104 being a portion of two large longitudinal sides 11, 12 (see Figs. 1, 4 and 5) of the electrical connection contact 10, and that the
15 longitudinal side 11 being selected on which the electrical contact region (electric contact socket of a socket contact or electric contact pin of a pin contact) is also located. In other words, according to the invention, the welding members 50 no longer rest laterally (transverse ends or
20 short edges) against the electrical connection contact 10.

 As a result of the fact that the welding members 50 rest on the electrical connection contact 10, it is possible to select almost any desired width B_{305} of the compacted portion 305 of the electric line 304 between almost zero and
25 a width B_{104} of the electrical connection zone 104 of the electrical connection contact 10. If a certain width B_{305} of the compacted portion 305 of the electric line 304 is

necessary, this can be achieved by movement of the upper electrode 410, the welding members 50 advancing into the corresponding position on the electrical connection zone 104. The lower electrode 420 remains unaffected by this.

5 Preferably, the lower electrode 420 is wider in its configuration than the electrical connection zone 104 or wider than the electrical connection contact 10; this lengthens its service life.

The process according to the invention for compaction-welding (see Fig. 3A-I to Fig. 3B-VI) is carried out, apart from the foregoing embodiments, as in the prior art, although it is not absolutely necessary to configure the welding members 50 so as to be movable laterally to the upper electrode 410. In other words, for an embodiment of this type of the invention, the respective welding members 50 can now be moved up and down in a translatable manner during operation of the device 1 only in one direction (with reference to Fig. 3A-I to Fig. 3B-IV). In other embodiments of the invention, like the one illustrated in Fig. 3A-I to Fig. 3B-IV, the welding members 50 can however be moved both up and down, and also laterally to the upper electrode 410.

The invention allows, in particular, the electric lines 304 comprising a small number of individual wires to be welded to the electrical connection zone 104 of the electrical connection contact 10, which is comparatively large or wide. For this purpose, the distance between the welding members 50 on the electrical connection zone 104 has

merely to be selected in such a way that at least a single layer of the individual wires can be produced on the electrical connection zone 104 between the welding members 50. Preferably, however, at least two layers, located one
5 above the other, of individual wires can be produced (see in this regard also Fig. 3A-III).

The invention provides a means and a process for the connection by welding of the electric line 304 consisting of a plurality of individual wires to the electrical connection
10 contact 10 at a variable weld width.

The invention eliminates the need to have both of the welding members 50 rest on the same side at the electrical connection zone 104 of the electrical connection contact 10. Such embodiments of the invention are illustrated in Fig. 4
15 and Fig. 5.

Although in embodiments of this type it is usually not possible to achieve the compacted portion 305, located symmetrically with respect to a center line M of the electrical connection contact 10, of the electric line 304,
20 this is not strictly necessary and relates merely to aesthetic aspects.

Fig. 4 thus shows a welding member 50 (on the left-hand side with reference to Fig. 4) resting laterally against the electrical connection contact 10 or laterally against the
25 electrical connection zone 104. The welding member 50 opposing it then rests, as taught hereinbefore, at the top (with reference to Fig. 4) on the electrical connection zone

104 of the electrical connection contact 10. This produces,
subsequently to the welding process according to the
invention, the compacted portion 305 which is welded to the
electrical connection zone 104 and is located no longer
5 symmetrically to the center line M of the electrical
connection contact 10.

In one embodiment of the device 1 according to the
invention for compaction-welding according to Fig. 4, it is
also possible for one side of the welding member 50 to rest
10 on the lower electrode 420, preferably on the weld surface
422 thereof. This is illustrated in Fig. 4 by the dotted
line. It is however also possible, as shown in Fig. 4, to
provide a free space between the weld surface 422 of the
lower electrode 420 and the welding member 50.

15 An advantage of an embodiment according to Fig. 4 is
the fact that the lower electrode 420 and the welding member
50, namely the welding member 50 resting laterally against
the electrical connection contact 10, can be stationary in
their configuration. In other words, with reference to Fig.
20 4, the electrical connection contact 10 and the cable 30 are
placed with its free, stripped end portion, emanating from
the right-hand side, on the lower electrode 420, the
electrical connection contact 10 being advanced until it
abuts the welding member 50. Subsequently, the other one of
25 the welding members 50 moves into the working position,
after which the mechanical precompaction of the electric
line 304 and subsequently the welding process itself can be

continued. The electrical connection contact 10 is removed toward the right-hand side or upward accordingly.

An embodiment similar to Fig. 4 is shown in Fig. 5 in which a welding member 50 rests not only laterally against the electrical connection contact 10 and the electric line 304 but rather also laterally against the lower electrode 420. In other words, following the welding process according to the invention, the compacted portion 305 of the electric line 304, the electrical connection contact 10 in a region of the electrical connection zone 104 and the lower electrode 420 rests flush on the welding member 50. In this case, the welding member 50 can also be connected integrally to or configured in one piece with the lower electrode 420.

Furthermore, Figs. 4 and 5 show the electrical connection contact 10 of the punched grid 15, a remainder of the punched grid 15 being illustrated schematically by broken lines.

According to the invention, it is possible to carry out, instead of the electric resistance welding process, an ultrasonic welding process using the device 1 according to the invention for ultrasonic welding. In this case, the welding tools are no longer the electrodes 40 but rather sonotrodes (welding horns) or an anvil interacting with a sonotrode.

The device 1 according to the invention and the process according to the invention for compaction-welding are particularly suitable for resistance-monitored circuits in a

motor vehicle, for example for an air bag, a sensor connection, a high-pressure sensor contact, etc.

CLAIMS

1. Process for the compaction-welding of an electrical connection contact (10), in particular for resistance-monitored circuits in a motor vehicle, wherein

5 the electrical connection contact (10) and an electric line (304) are arranged (I, II/II, I) for mutual welding between two welding tools (40; 410, 420) and between two welding members (50) which are located laterally to the two welding tools (40; 410, 420), wherein

10 at least one welding member (50) is attached to the electrical connection contact (10) on a side on which the electric line (304) is also arranged, and subsequently a welding process is carried out (IV), the electrical connection contact (10) being compacted and welded to the
15 electric line (304).

2. Process according to claim 1, wherein a welding tool (40; 410, 420), preferably a lower welding tool (40; 420), is wider in its configuration than the electrical connection contact (10).

20 3. Process according to either claim 1 or claim 2, wherein both welding members (50, 50) are attached (II) on a side of the electrical connection contact (10) on which the electric line (304) is arranged for welding to the electrical connection contact (10).

25 4. Process according to any one of claims 1 to 3, wherein both welding members (50, 50) are attached (II) to the electrical connection contact (10) in such a way that

their respective distance from a center line (M) of the electrical connection contact (10) is substantially identical.

5 5. Process according to any one of claims 1 to 4, wherein during the carrying-out of the process at least one welding member (50) has just a single degree of translatory freedom.

10 6. Process according to any one of claims 1 to 5, wherein the welding process is a resistance or ultrasonic welding process.

15 7. Device (1) for the compaction-welding of an electrical connection contact (10), in particular for resistance-monitored circuits of a motor vehicle, comprising two welding tools (40; 410, 420) between which the electrical connection contact (10) and an electric line (304) can be provided (I) for mutual welding and comprising two welding members (50, 50) between which the electric line (304) can be clamped (III, IV) during the welding, wherein at least one welding member (50) can be attached (II) on a side of the electrical connection contact (10) on which the electric line (304) can be provided.

20 8. Device (1) according to claim 7, wherein a welding tool (40; 410, 420), preferably a lower welding tool (40; 420), is wider in its configuration than the electrical connection contact (10).

25 9. Device (1) according to either claim 7 or claim 8, wherein both welding members (50, 50) can be attached (II)

on a side of the electrical connection contact (10) on which the electric line (304) can be provided for welding to the electrical connection contact (10).

10. Device (1) according to any one of claims 7 to 9,
5 wherein both welding members (50, 50) can be attached (II) to the electrical connection contact (10) in such a way that their respective distance from a center line (M) of the electrical connection contact (10) is substantially identical.

10 11. Device (1) according to any one of claims 7 to 10, wherein during operation of the device (1) at least one welding member (50) has just a single degree of translatory freedom.

12. Device (1) according to any one of claims 7 to 11,
15 wherein the device (1) is a resistance or ultrasonic welding device.

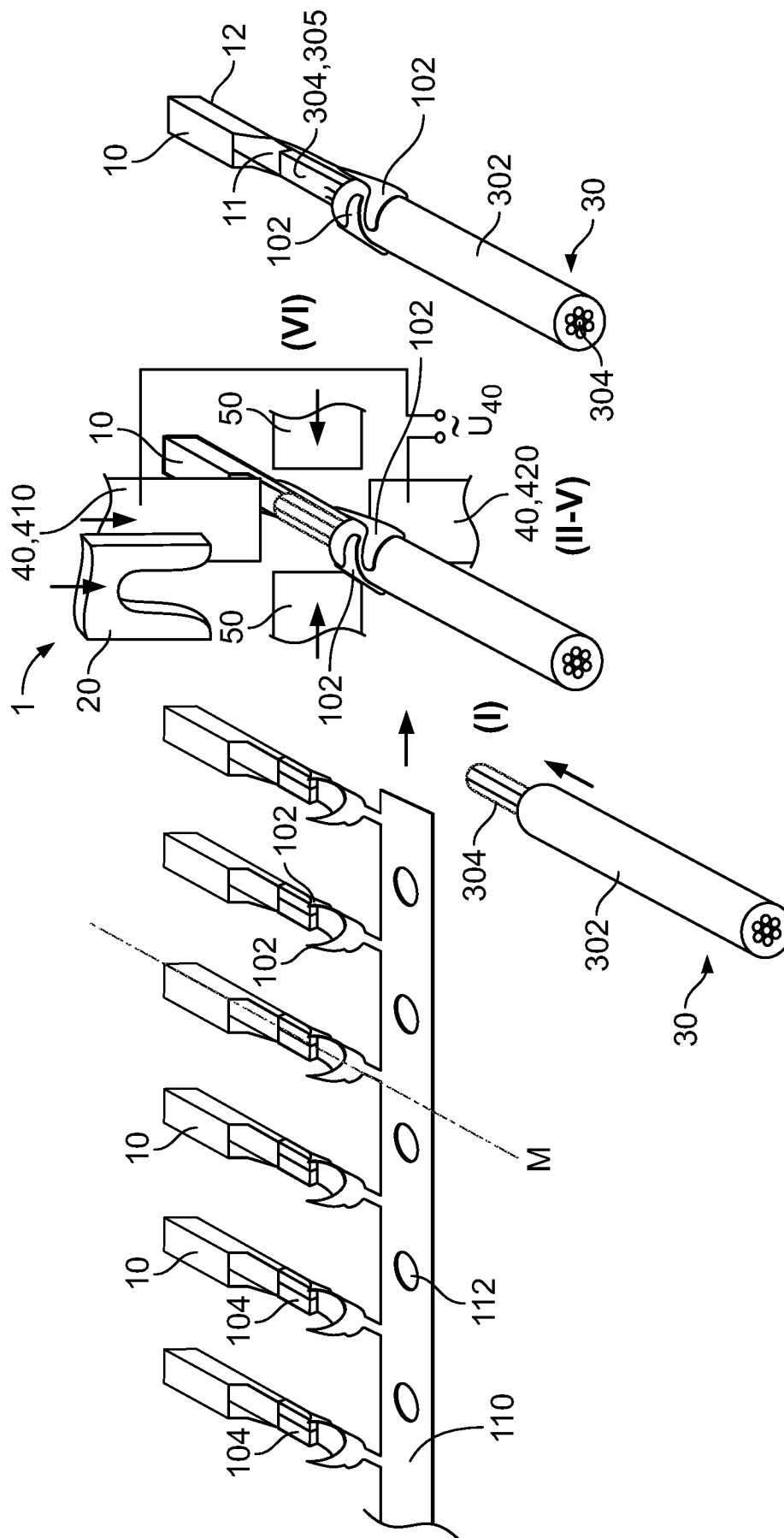


Fig. 1

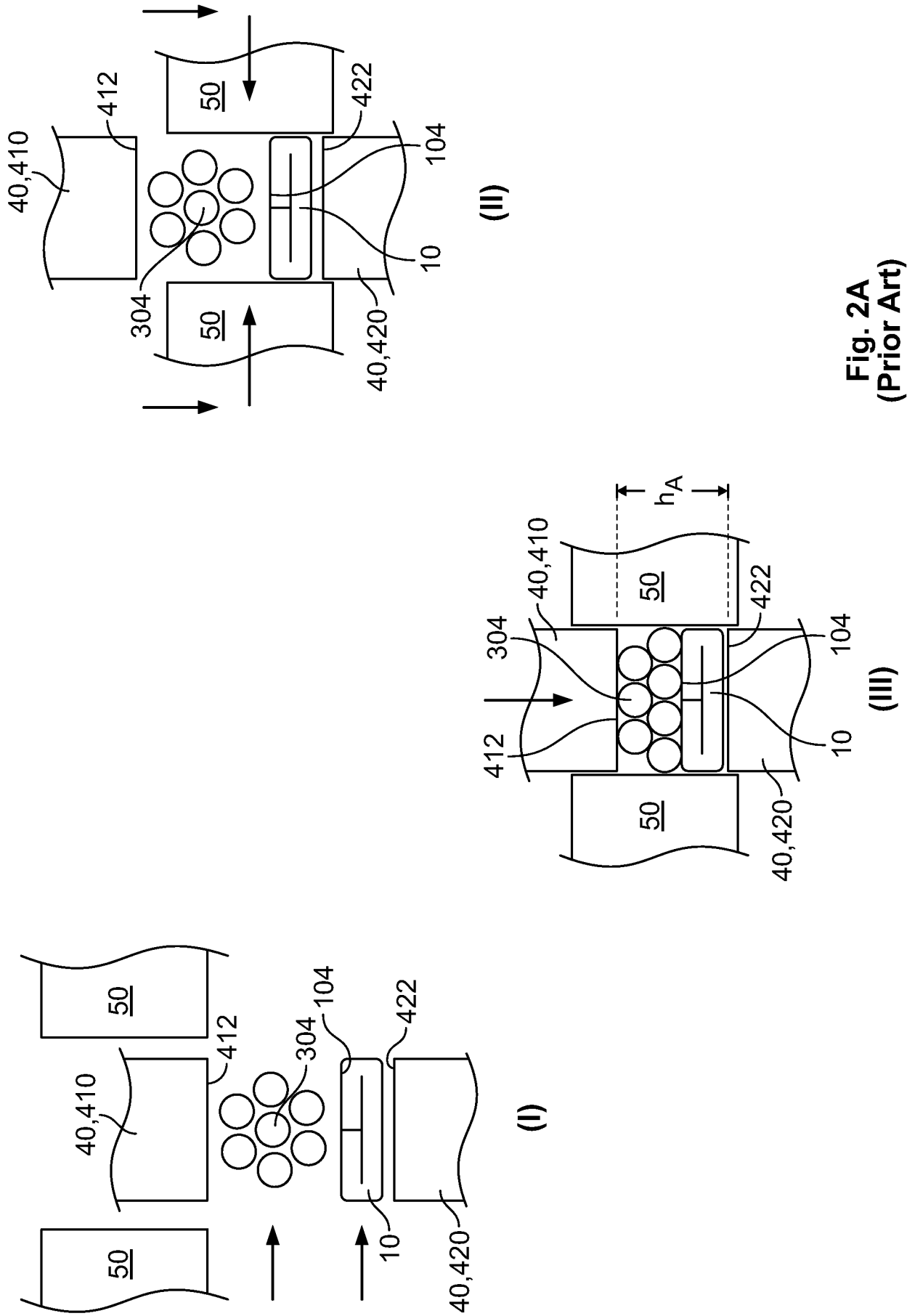
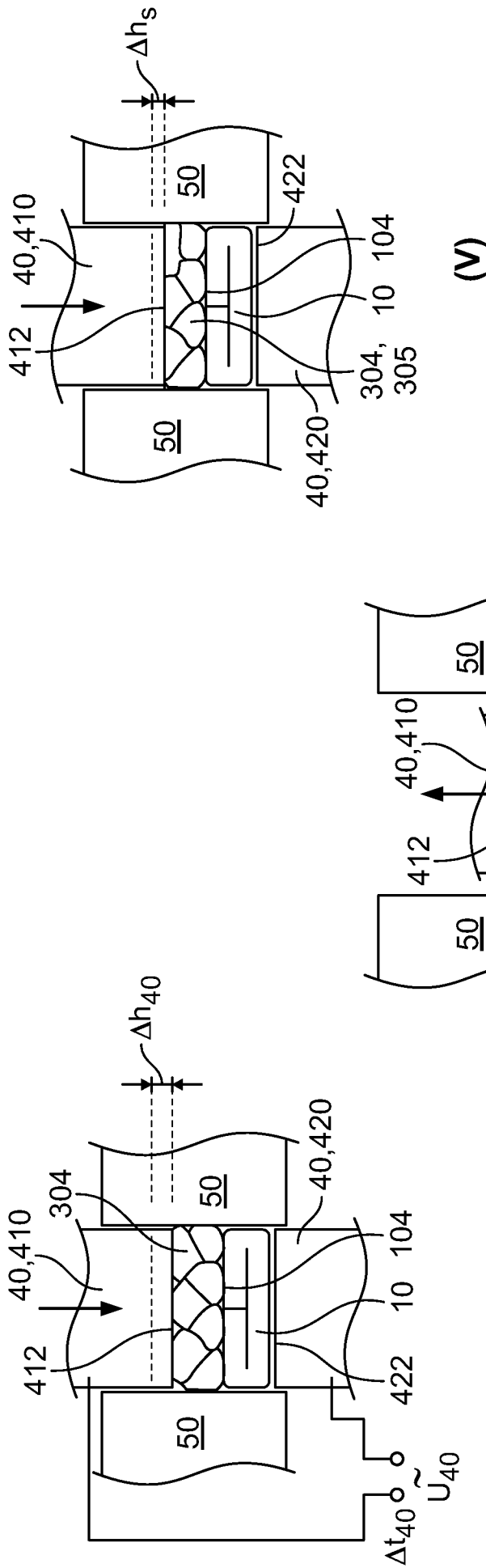
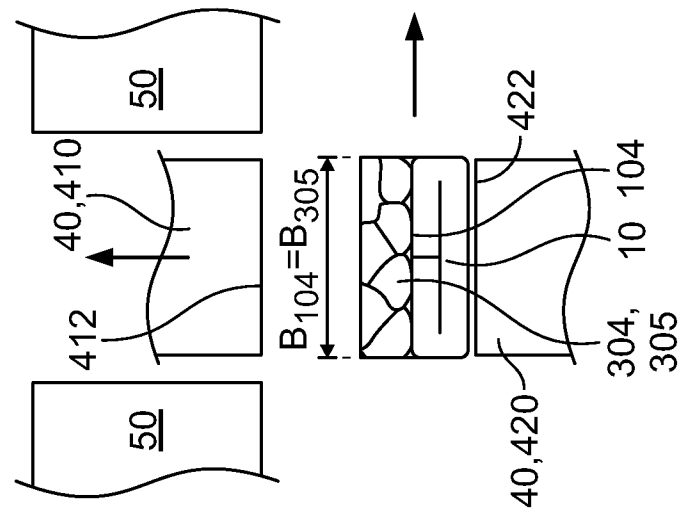


Fig. 2A
(Prior Art)

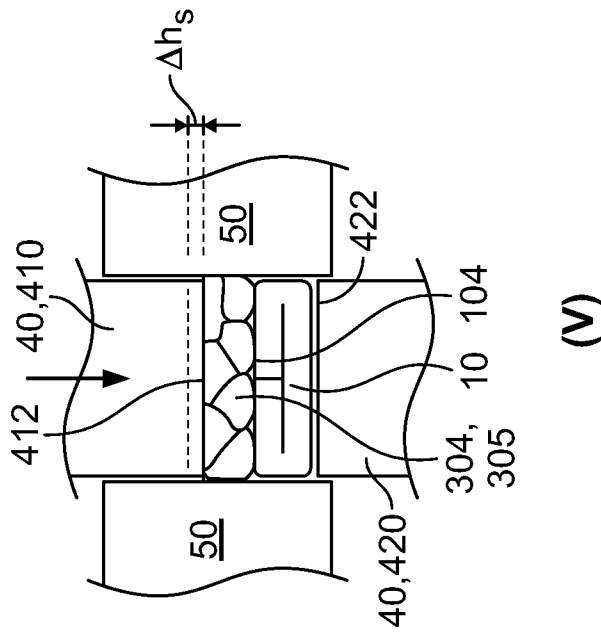


(IV)



(VI)

Fig. 2B
(Prior Art)



(V)

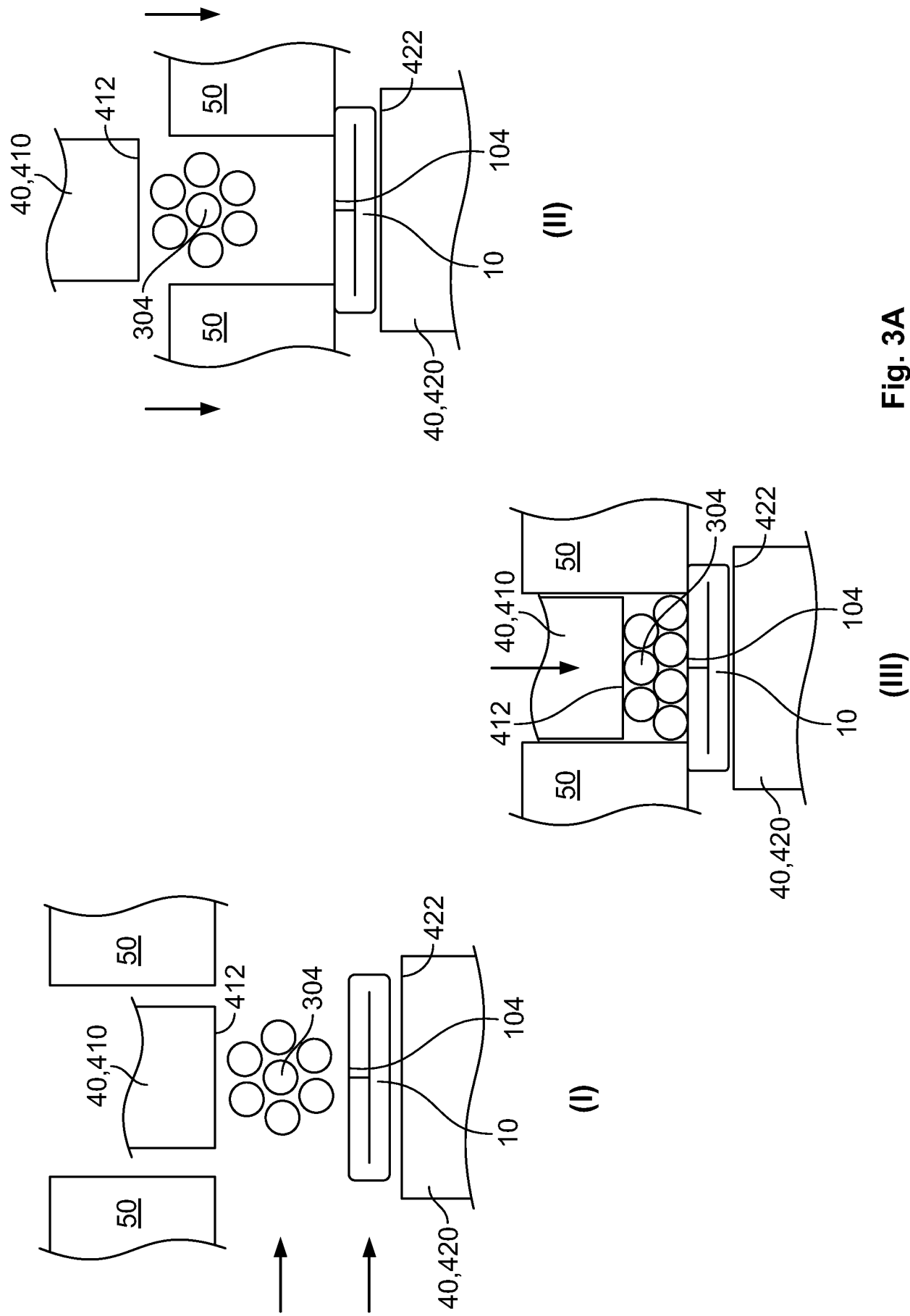


Fig. 3A

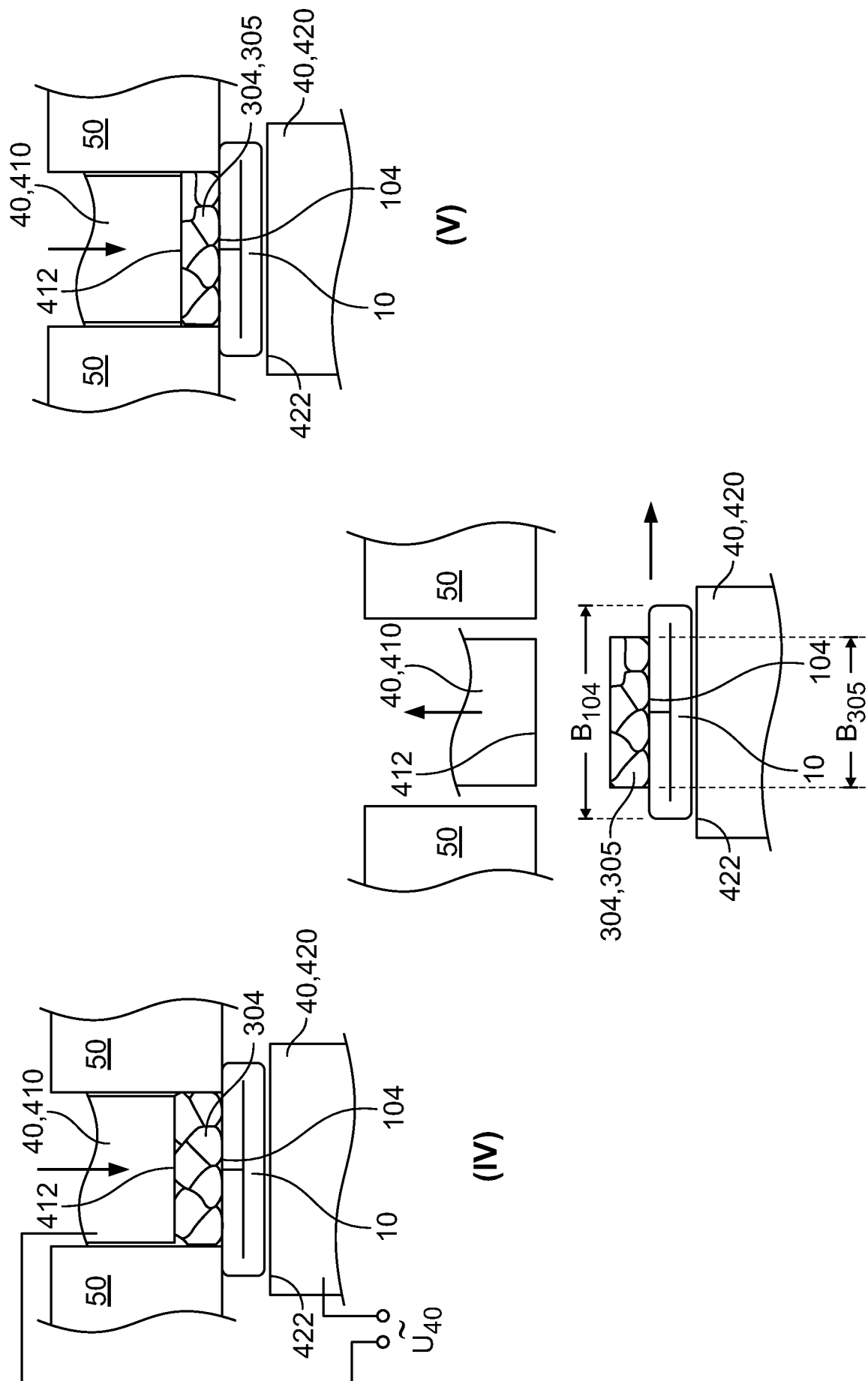


Fig. 3B

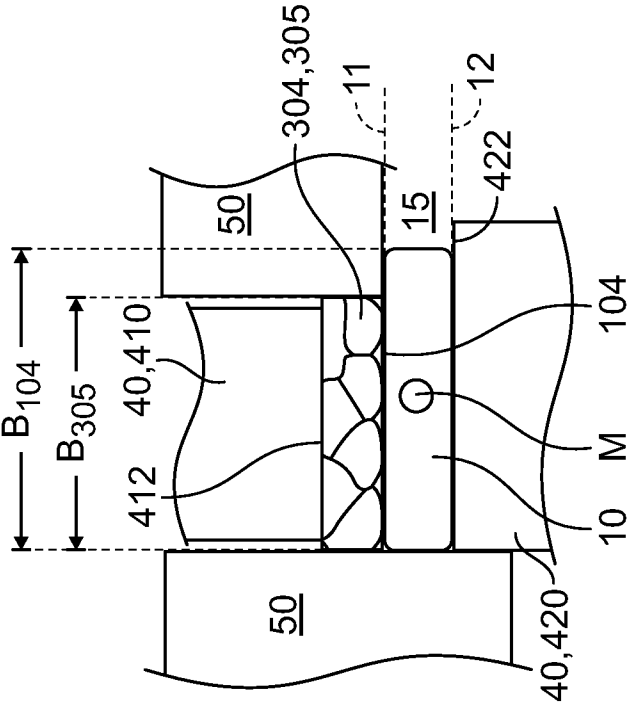


Fig. 5

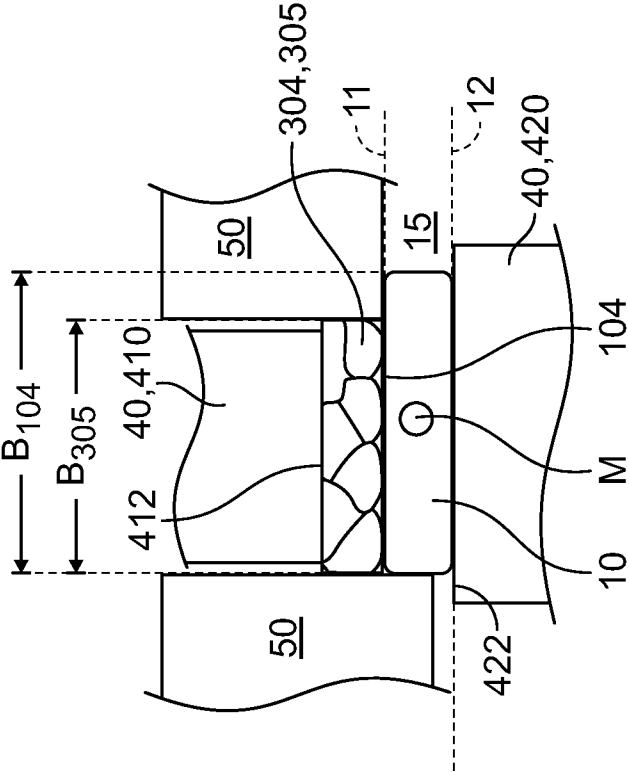


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/057108

A. CLASSIFICATION OF SUBJECT MATTER

INV. B23K20/10 B23K11/00 H01R43/02
ADD. B23K101/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B23K H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GOLDE, HANS-DIETER: "Ultraschall-Metallschweissen" 1995; VERLAG MODERNE INDUSTRIE, 86895 LANDSBERG/LECH, GERMANY, XP002498186 figures 1,29	1-12
X	DE 34 37 749 A1 (SCHUNK ULTRASCHALLTECHNIK GMBH [DE]) 17 April 1986 (1986-04-17) page 7, line 24 - page 8, line 13	1,3-12
X	DE 10 2004 044480 A1 (SCHUNK ULTRASCHALLTECHNIK GMBH [DE]) 16 February 2006 (2006-02-16) figure 2	7,8,11, 12
A	US 2007/000890 A1 (STEINER CHRISTIAN [DE] ET AL) 4 January 2007 (2007-01-04) paragraph [0016]	6,12

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

2 October 2008

Date of mailing of the international search report

13/10/2008

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Jaeger, Hein

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2008/057108

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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DE 102004044480	A1	16-02-2006	NONE	
US 2007000890	A1	04-01-2007	WO 2005021203 A1 JP 2007503313 T	10-03-2005 22-02-2007