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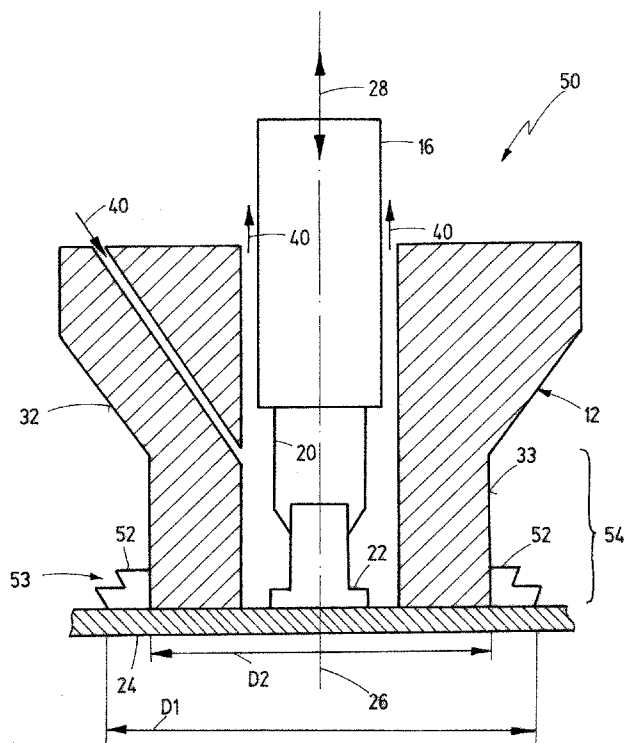


Fig.1

(57) Abstract: The present invention relates to a de-  
vice for joining, in particular arc welding, a first com-  
ponent to a second component, in which the weld-  
ing process takes place in a protective or inert gas at-  
mosphere, as for example when studs are welded to  
a workpiece such as a vehicle body panel, or vehicle  
body parts are connected to the chassis by means of  
studs which are provided with a thread. During stud  
welding it is necessary to coordinate electric switch-  
ing processes with mechanical movements of the stud  
and the movement of the protective gas in order to be  
able to handle the very rapid melting and solidifica-  
tion processes without introducing distortions caused  
by gas pressure. The present invention relates to pro-  
tective gas welding with a flow of protective gas to-  
wards the rear.

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### Flexible protective gas cover

The present invention relates to a device for joining, in particular arc welding, a first component to a second component, in which the welding process takes place in a protective or inert gas atmosphere. The invention is used in particular for stud welding. In stud welding, studs, which are provided, for example, with a thread, are joined or welded to a workpiece, such as for example a vehicle body panel. A significant field of application is in the car industry where various components are connected to one another, for example vehicle body parts are connected to the chassis, etc., by means of studs which are provided with a thread.

“Stud welding” is a form of arc welding which is defined, inter alia, by the fact that very short welding processes are carried out with strong currents. During stud welding it is necessary to coordinate electric switching processes with mechanical movements of the stud in order to be able to handle the very rapid melting and solidification processes.

During stud welding various resources are used to improve the welding process and the result. The use of a protective gas is one of the resources.

Depending on the direction in which the protective gas flows during a welding process, a distinction is made between protective gas welding with a flow of protective gas towards the front, protective gas welding with a flow of protective gas towards the rear or protective gas welding with a flow of protective gas towards the front and flow of protective gas towards the rear. The present invention relates to protective gas welding with a flow of protective gas towards the rear.

In the case of protective gas welding with a flow of protective gas towards the front the welding tool is closed at the rear and open at the front. The terms "rear" and "front" refer to the relative arrangement of the elements: workpiece, stud and welding tool (for example welding head, welding gun etc.). The stud is arranged at the front with respect to the welding device and is moved towards the front into the direction of the workpiece. Of course, the terms "towards the front" and "towards the rear" are not to be understood as restrictive, and in practice it is not significant how a welding axis is oriented in relative terms in space, with the workpiece, the stud or the welding tool being located on the welding axis.

Welding devices in which the flow of protective gas (discharge) occurs towards the rear, i.e. when the welding tool is closed towards the front and open towards the rear (during the welding), are described generally in German Patent Application DE 28 18 896 and German utility model DE 20 2004 001 667 U1.

Figures 7 and 8 show a conventional welding device 10 according to DE 20 2004 001 667 in a neutral position (Fig. 7) and in a welding position (Fig. 8).

Protective gas welding with a flow of protective gas which is directed towards the rear will be explained below with reference to the conventional welding device 10 which is illustrated in Fig. 7. The known volume device 10 comprises a cylindrical mouth-

piece 12 which tapers towards the front and defines an internal space or cavity 14 in its interior. In the internal space 14 of the mouthpiece 12 a movement device 16 (for example a welding head) is guided. The movement device 16 has, at its front end 18, a stud holder 20 which holds a stud 22 between its arms and is to be joined or welded to a workpiece 24. For this purpose, the welding device 10 is moved towards the front along a (welding) axis 26 in the direction of the workpiece 24. After the welding process has taken place, the welding device 10 is moved towards the rear. This to and fro movement is indicated by means of a double arrow 28. The mouthpiece 12 has (front) contact faces 30 which serve as a stop against the workpiece 24. A body 32 of the workpiece 12 also has a gas feed 34 in order to feed protective gas into an internal space (welding space) 14.

Of course, the location of the protective gas feed 34 in Fig. 7 is illustrated merely by way of example. The protective gas feed 34 could be composed of a plurality of ducts which open into the internal space 14 at a wide variety of locations. For example, the protective gas feed 34 is arranged in such a way that its opening is as far as possible towards the front (relative to the workpiece 24).

The internal space 14 also has a first (front) opening 36 and a second (rear) opening 38.

In Fig. 8, the known welding device 10 in Fig. 7 is shown in a welding position. For this purpose, the mouthpiece 12 was fitted onto the workpiece 24.

Protective gas is then introduced into the internal space 14 via the gas feed 34. The protective gas can leave the internal space 14 towards the "rear" via the second opening 38. The protective gas flow is indicated in Fig. 8 by a plurality of arrows 40. The protective gas ideally only escapes towards the rear. This is the case if the contact surfaces 32 (cf. Fig. 7) adjoin the workpiece 24 in a seal-forming fashion (cf. Fig. 8). This ideal state is indicated in Fig. 8 by arrows 42. During a welding process, the welding space 14 is continuously rinsed with protective gas.

If the mouthpiece 12 does not tightly fit onto the workpiece 24, protective gas can escape in the lateral direction (towards the front) or air from the external surroundings can enter into the internal space 14. This in turn results in swirls occurring with the internal space 14, which have a disadvantageous effect on the quality of the welded connection to be produced. Ideally, a laminar flow of protective gas is generated in the internal space 14, in which case in a joint zone, i.e. the location at which the stud 22 is welded to the workpiece 24, the flow of protective gas should run parallel to the component and otherwise parallel to the stud.

Oblique positions of the welding tool 10 with respect to the workpiece 24 are problematic. Oblique positions may occur if the component is itself curved or the stud 22 is to be welded in the vicinity of edges. Oblique positions open the front protective gas cover and cause swirls in the joint region. A flow of gas which is directed radially onto the joint zone (air flow) constricts the arc and generates a Venturi effect even when the cover is only slightly opened.

In addition, a large quantity of protective gas is conventionally required for welding (8 - 15 l/min) in order to protect the joint region against undesired effects from draughts.

It is therefore an object of the present invention to provide a welding device which ensures a good welding quality under all circumstances. In particular, low protective gas capacities (for example 3 l/min) are desirable. Unevennesses in the component will preferably not have any effect on the welding quality.

This object is achieved by a device for joining, in particular arc welding, a component, preferably a stud, to a workpiece, wherein the device has a stud holder with which the held stud is moved along an axis in a first direction towards the workpiece in order to connect the stud to the workpiece, and has a protective gas feed in order to carry out the welding process in a protective gas atmosphere, wherein during the welding process the protective gas is discharged in a second direction which is

essentially opposed to the first direction, wherein in addition a sealing sleeve is provided which is embodied in the manner of a folding bellows and which is arranged in relation to the stud holder in such a way that a welding space, which is bounded by the workpiece, the stud holder, the stud and the sealing sleeve and through which the protective gas flows, is sealed from the external surroundings during the welding process so that the protective gas can escape only in the second direction.

Providing a flexible sealing sleeve around the joint zone ensures that protective gas does not leave the joint zone towards the front and ambient air does not enter the welding space from the front. The welding space is (air)tight. Unevennesses on the component or workpiece to which the stud is to be attached can be compensated without any problem. Since it is ensured at all times that the welding space is sealed, it is possible to operate with relatively low volume flows of protective gas. The risk of protective gas escaping is greatly reduced. Although a small amount of protective gas (for example only 3 l/min) is used, laboratory tests have shown that the quality of the welded connection between the component and the workpiece is considerably improved. As a result, fewer rejects are produced. Welding systems which use the welding device according to the present invention can be operated with an increased throughput rate.

According to one particular embodiment, the device also has a mouthpiece which can be used as a support foot and which has a body which defines an internal space which has a first opening, which faces the workpiece, and a second opening, wherein the stud holder is arranged in the internal space in such a way that the held stud is located in a front region of the mouthpiece, and at the same time the second opening is arranged in a rear region of the mouthpiece.

Using a mouthpiece reduces the wear on the sealing sleeve. Spatters, which can arise during the welding process, strike the mouthpiece which is manufactured from a material which is resistant to spatters. The sealing sleeve, which is more sensitive

than this material because it is of elastic design, serves then merely to ensure that the welding space is sealed. This increases life time.

According to one advantageous embodiment, the sealing sleeve is attached to the mouthpiece in such a way that in a neutral position of the device with respect to the mouthpiece the sealing sleeve protrudes in a relaxed state, and in a welding position of the device said sealing sleeve contacts the workpiece in a stressed state.

When the folding-bellows-like sealing sleeve is fitted onto the workpiece it is compressed or pressed together. If the workpiece moves away, for example, from the sealing sleeve, at the location at which the sealing sleeve is in contact with the workpiece (the welding tool slips for example), the stress on the sealing sleeve is automatically released, i.e. the sealing sleeve itself ensures that it remains in contact with the workpiece and continues to seal the welding space.

In addition, the elasticity of the sealing sleeve ensures that even studs which have a topography with pronounced differences in height can be welded onto workpieces.

In particular, the sealing sleeve is attached to a contact surface or an external bush of the mouthpiece in a front region of the mouthpiece. The further forward the sealing sleeve is seated, the smaller the amount of material which is necessary to manufacture it.

Furthermore, it is advantageous if a first surface, which is surrounded by the sealing sleeve when the sealing sleeve is in contact with the workpiece, is larger than a second surface which corresponds to a projection of the first opening onto the workpiece.

The sealing sleeve, therefore, always securely surrounds the mouthpiece or its opening, which is arranged opposite the workpiece. In this way it is possible, for example, even to weld studs with very small radii ( $r \approx 10$  mm), such as for example M8 alumin-

ium studs, to the component in a gas-tight fashion. The welding process can be reproduced even with very small radii.

According to a further preferred embodiment, the device also has a mask with at least one opening, wherein each opening is coupled to a sealing sleeve.

A mask which is embodied in this way can be used as a type of template in order to weld a plurality of studs onto one component. To do this, an operator simply has to introduce, for example, a welding gun into the opening of the mask and can then weld the stud in a gas-tight fashion. A mask also increases the working speed since the welding location is predefined for the operator by the openings in the mask.

Each opening is preferably lined with a bush to which the sealing sleeve is attached.

This makes it possible to replace a defective sealing sleeve easily and quickly since the sealing sleeve is not connected directly to the mask but rather to a ring or the like so that it can be replaced quickly.

In particular, the rubber sleeve is formed integrally and preferably rotationally symmetrically.

This facilitates the manufacture of said rubber sleeve.

Furthermore, it is advantageous if the sealing sleeve is formed of a plurality of parts which are mounted so as to be movable with respect to one another in order to permit the sealing sleeve to open laterally.

This embodiment of the sealing sleeve is provided in particular for welding devices stud holders of which consist of gripping means which are equipped with rigid gripping fingers which can be displaced laterally.

In this case it is advantageous if the parts of the multi-component sealing sleeve have male and/or female coupling elements at their ends.

These coupling elements ensure that in a closed state of the sealing sleeve the welding space is sealed.

Preferably, the sealing sleeve has a contact-forming edge which ensures contacting with the workpiece over an area.

It is advantageous to produce a flat seal over an area compared to a linear seal since it is then also possible to compensate better for unevennesses in the radial direction.

Of course, the features which are mentioned above and will be explained below can be used not only in the respectively specified combination but also in other combinations or in isolation without departing from the scope of the present invention.

Exemplary embodiments of the invention are illustrated in the drawing and will be explained in more detail in the following description. In said drawing:

- Fig. 1 shows a sectional side view of a first embodiment of the present invention in a welding position;
- Fig. 2 shows the welding device from Fig. 1 in a neutral position;
- Fig. 3 shows a second embodiment of a welding device according to the present invention in a neutral position;
- Fig. 4 shows a third embodiment of a welding device according to the present invention in a neutral position;
- Fig. 5a-5c shows a further embodiment of the present invention;

Fig. 6 shows a cross section of a sealing sleeve according to the present invention;

Fig. 7 shows a conventional welding device in a neutral position; and

Fig. 8 shows the welding device from Fig. 7 in a welding position.

In the following description of the preferred embodiments of the present invention, identical components are provided with the same reference symbols.

Fig. 1 illustrates a first welding device 50 according to the present invention.

The welding device 50 is constructed like the welding device 10 in Figures 7 and 8, with an elastic sealing sleeve 52 being additionally provided in a front region 54 of the mouthpiece 12. The sealing sleeve 52 is attached to an external sleeve 33 of the mouthpiece body 32.

In the example in Fig. 1, the sealing sleeve 52 is formed rotationally symmetrical with respect to the welding axis 26 and thus has here an essentially circular cross section (in plan view). The cross section which is illustrated laterally in Fig. 1 shows a folding-bellows-like design. The sealing sleeve 52 in Fig. 1 merely has one fold 53 running in the circumferential direction of the mouthpiece 12. Of course, any desired number of folds 53 could be provided. The term "folding bellows" is to be understood as including any structure which tapers towards the rear and which permits the sealing sleeve 52 to be compressed in the direction of the axis 26.

The sealing sleeve 52 is of elastic design. It is preferably composed of rubber or silicone (for example UL listed). Since the sealing sleeve 52 may be subject to weld spatter, a material is selected which is very largely resistant to such spatter but which ensures elasticity.

The sealing sleeve 52 preferably has a wall thickness of  $< 1$  mm.

The sealing sleeve 52 is compressed in the direction 26 in the welding position of the mouthpiece 12 in Fig. 1. It completely surrounds the mouthpiece 12 which has a diameter D2. One edge of the sealing sleeve 52, which is connected to the workpiece 24, therefore has a relatively large radius D2.

Fig. 2 illustrates a neutral position of the welding device 50 in Fig. 1.

The sealing sleeve 52 is shown in a relaxed or non-stressed state. In the non-stressed state the sealing sleeve protrudes with respect to the mouthpiece 12, as is indicated by a height difference H1.

If the mouthpiece 12 is placed on the workpiece 24 (cf. Fig. 1) in order to carry out a welding process, the sleeve 52 is compressed and thus independently ensures that its edge remains stuck to the workpiece 24. Even if the mouthpiece 12 is fitted onto the workpiece 24 in a tilted fashion, the sealing sleeve 52 ensures that air from outside the mouthpiece 12 cannot enter the internal space or welding space 14 through a gap which is produced in the front region or at the front opening as a result of the misalignment.

As soon as the mouthpiece 12 has applied onto the workpiece 24, protective gas is fed in via the feed 34 and rinsed until it is ensured that the entirety of the internal space 14, and if tilting occurs, also the space which is bounded by the sealing sleeve 52 (space between the mouthpiece 12 and sealing sleeve 52), is filled with protective gas. The protective gas then flows through the mouthpiece 12 and leaves through the rear opening 38.

Fig. 3 shows a welding device 60 according to the present invention which differs from the welding device 50 in Fig. 1 and 2 in that the sealing sleeve 52 is arranged on

the contact-forming surface 30 instead of the external sleeve 33 of the mouthpiece 12.

As is illustrated in Fig. 4, the mouthpiece 12 is not absolutely necessary in order to be able to carry out a welding process in a protective gas atmosphere.

In comparison with the welding devices in Figures 1 to 3, the welding device 70 according to the present invention which is illustrated in Fig. 4 does not have a mouthpiece 12. Instead, the protective sleeve is made correspondingly larger. The protective sleeve in Fig. 4, two embodiments 72 and 74 of which are shown here, is so large that the welding head 16, the stud holder 20 and the stud 22 are surrounded completely by the sleeve.

The protective sleeve 72 is formed with one wall and is illustrated in the left-hand part of the figure. A double-walled alteration 74 is illustrated in the right-hand part with a dot-dashed line.

One end 76 of the sealing sleeve 72 is illustrated with a three-cornered cross section, while one end 78 of the sealing sleeve 74 is illustrated with a rectangular cross section. These cross-sectional shapes have been selected by way of example in order to illustrate a flat seal between the sealing sleeve and workpiece 24. Without ends being formed in such a way, a linear seal is obtained, which is, however, also possible. A flat seal (in the radial direction with respect to the axis 26) also ensures, however, that unevennesses on the workpiece 24 in the radial direction can be compensated for.

Fig. 5a shows a perspective view of a further embodiment of the present invention.

Fig. 5a shows a welding mask 82 with one or more openings 84. The opening 84 has here an internal bush 86 which is in turn connected to a sealing sleeve 88. However, the sealing sleeve 88 could, of course, also be connected directly to the opening 84.

The connection to the bush 86 permits an easier replacement of a defective sealing sleeve 88.

Welding masks 82 are used, for example, if the welding process is carried out manually, for example with a welding gun (not illustrated). The operator (not illustrated) must then simply introduce the welding gun into the opening 84 and weld. The rest of the welding process then takes place automatically, specifically in a gas-tight fashion in a protective gas atmosphere.

Fig. 5b shows a sectional side view of Fig. 5a.

Fig. 5b clearly shows that the height H2 of the sealing folding bellows 88 is significantly larger than its height H3 in Fig. 5c.

Fig. 5b illustrates a state in which a welding gun is introduced with a mouthpiece 12 in the direction of an arrow 90 into the opening 84. The welding mask 82 could for this purpose be folded down, for example, with a hinge from a (vertical) position of rest into a (horizontal) working position. A working position is shown by way of example in Fig. 5c.

In Fig. 5c the sealing sleeve 88 is compressed. This ensures that the welding process takes place in a gas-tight fashion. The height H3 corresponds virtually to the distance between the workpiece 24 and the mask 82. In Fig. 5c, the mouthpiece 12 is introduced into the opening 84. In this state in Fig. 5c, the welding process can be carried in a gas-tight fashion.

Fig. 6 shows a cross section through a further embodiment of a sealing sleeve 92 in a plan view.

The sealing sleeve 92 is formed of a plurality of parts, in this case of two parts 94 and 96. It has, by way of example, a rectangular cross section.

The sealing sleeve 92 surrounds a stud holder with partially illustrated grippers 20-1 and 20-2. The grippers 20-1 and 20-2 hold the stud 22 between them and have to be moved in the direction of the arrows 100 and 102 in order to load a new stud 22. This is the reason why the sealing sleeve 92 is in fact formed of two parts, in order to be able to follow the movement of the grippers 20-1 and 20-2.

The sealing sleeve parts 94 and 96 have coupling elements at their respective ends. Male coupling elements are designated by 98. Female coupling elements are designated by 99.

Of course, the sealing sleeve could also be constructed from more than two parts or else also be constructed integrally, depending on the field of application. The shape of the cross section can also be varied.

The welding device according to the present invention is defined by its high degree of resistance to oblique positioning of the welding tool in relation to the workpiece or unevennesses in the workpiece. Less protective gas is used. The quality of the gas cover is so good that spatters are reduced to an excellent degree and constantly reproducible welding results are thus obtained. Rubber sleeves have a long life time. It is, for example, also possible to weld M8 studs made of aluminium. The rubber sleeve preferably has a degree of hardness of < 80 Shore. The folding bellows according to the invention generates a pressing force on the component itself by virtue of the fact that it is of elastic design and protrudes, for example, with respect to the mouthpiece.

Patent claims

1. Device for joining, in particular arc welding, a component (22), preferably a stud (22), to a workpiece (24), wherein the device has a stud holder (20; 20-1, 20-2) by which the held stud (22) is moved along an axis (26) in a first direction (90) towards the workpiece (24) in order to connect the stud (22) to the workpiece (24), and has a protective gas feed (34) in order to carry out the welding process under a protective gas atmosphere, wherein during the welding process the protective gas is discharged essentially in a second direction which is opposed to the first direction, characterized by an elastic folding-bellows-like sealing sleeve (52; 72; 74; 88; 92) and which is arranged in relation to the stud holder (20) such that a welding space (14), which is bounded by the workpiece (24), the stud holder (20), the stud (22) and the sealing sleeve (52) and through which the protective gas flows, is sealed from the external surroundings during the welding process so that the protective gas can escape only in the second direction.

2. Device according to Claim 1, which also has a mouthpiece (12) which can be used as a support foot and which has a body (32) which defines an internal space (14) which has a first opening (36), which faces the workpiece (24), and a second opening (38), wherein the stud holder (20) is arranged in the internal space (14) such that the held stud (22) is located in a front region (54) of the mouthpiece (12), and wherein the second opening (38) is arranged in a rear region of the mouthpiece (12).

3. Device according to Claim 2, wherein the sealing sleeve (52) is attached to the mouthpiece (12) such that in a neutral position of the device (50) with respect to the mouthpiece (12) the sealing sleeve (52) in a relaxed state protrudes, and in a welding position of the device (50) said sealing sleeve (52) contacts the workpiece (24) in a stressed state.

4. Device according to Claim 3, wherein the sealing sleeve (52) is attached to a contact surface (30) or an external bush (33) of the mouthpiece (12) in a front region (54) of the mouthpiece (12).

5. Device according to one of Claims 2 to 4, wherein a first surface, which is surrounded by the sealing sleeve (52) when the sealing sleeve (52) is in contact with the workpiece (24), is larger than a second surface which corresponds to a projection of the first opening (36) onto the workpiece (24).

6. Device according to Claim 1, which also has a mask (82) with at least one opening (84), wherein each opening (84) is coupled to a sealing sleeve (88).

7. Device according to Claim 6, wherein each opening (84) is lined with a bush (86) to which the sealing sleeve (88) is attached.

8. Device according to one of the preceding claims, wherein the rubber sleeve (52) is embodied in one part and preferably rotationally symmetrically.

9. Device according to one of Claims 1 to 7, wherein the sealing sleeve (92) is formed from a plurality of parts (94, 96) which are mounted so as to be movable with respect to one another in order to permit the sealing sleeve (92) to open laterally.

10. Device according to Claim 9, wherein the parts (94, 96) have male and/or female coupling elements (98, 99) at their ends so that, in a closed state of the sealing sleeve (92), they tightly close with their respective adjacent parts (96, 94).

11. Device according to one of the preceding claims, wherein the sealing sleeve (72; 74) has a contact-forming edge (76; 78) which ensures that contact is formed with the workpiece (24) over an area.

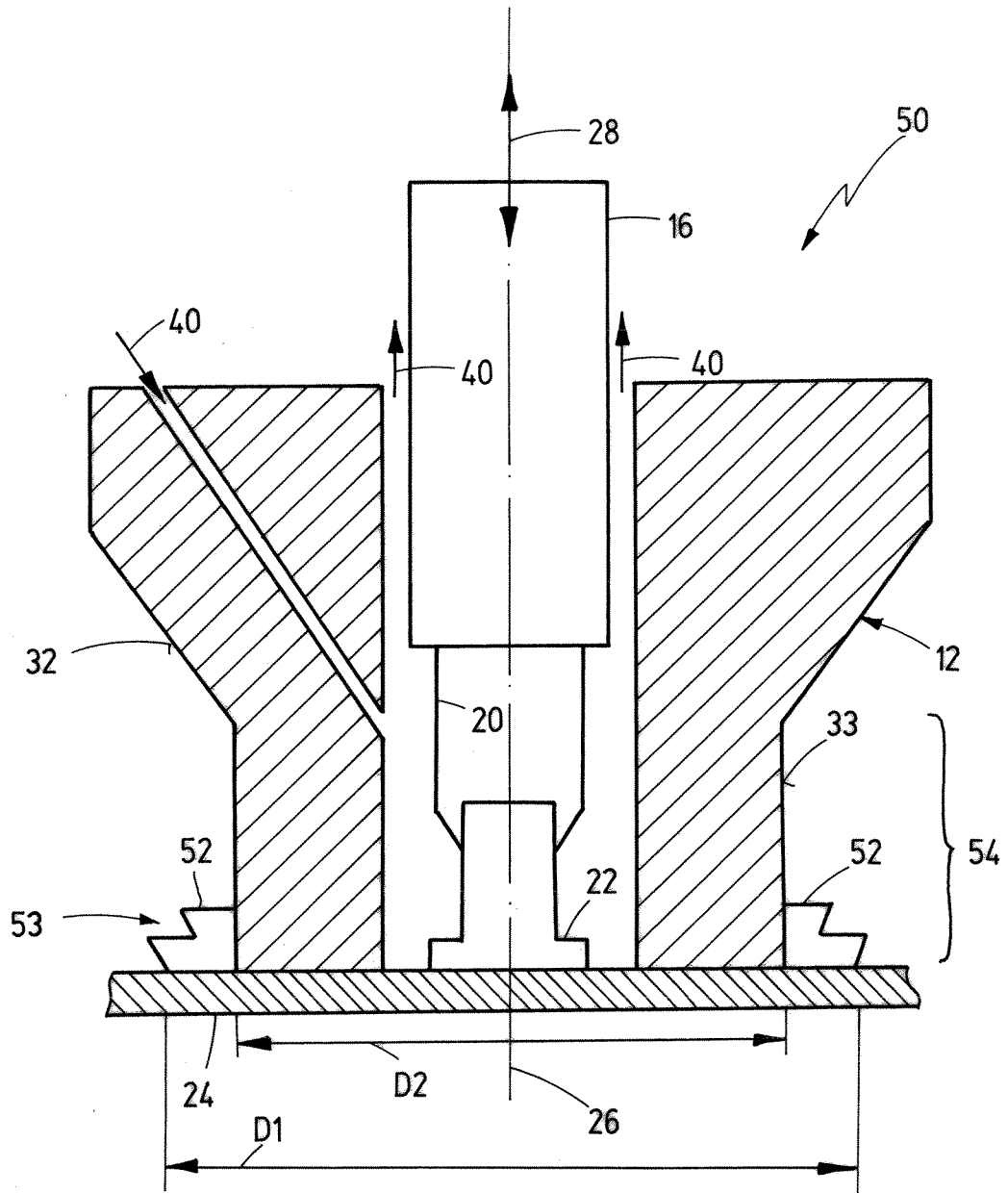


Fig.1

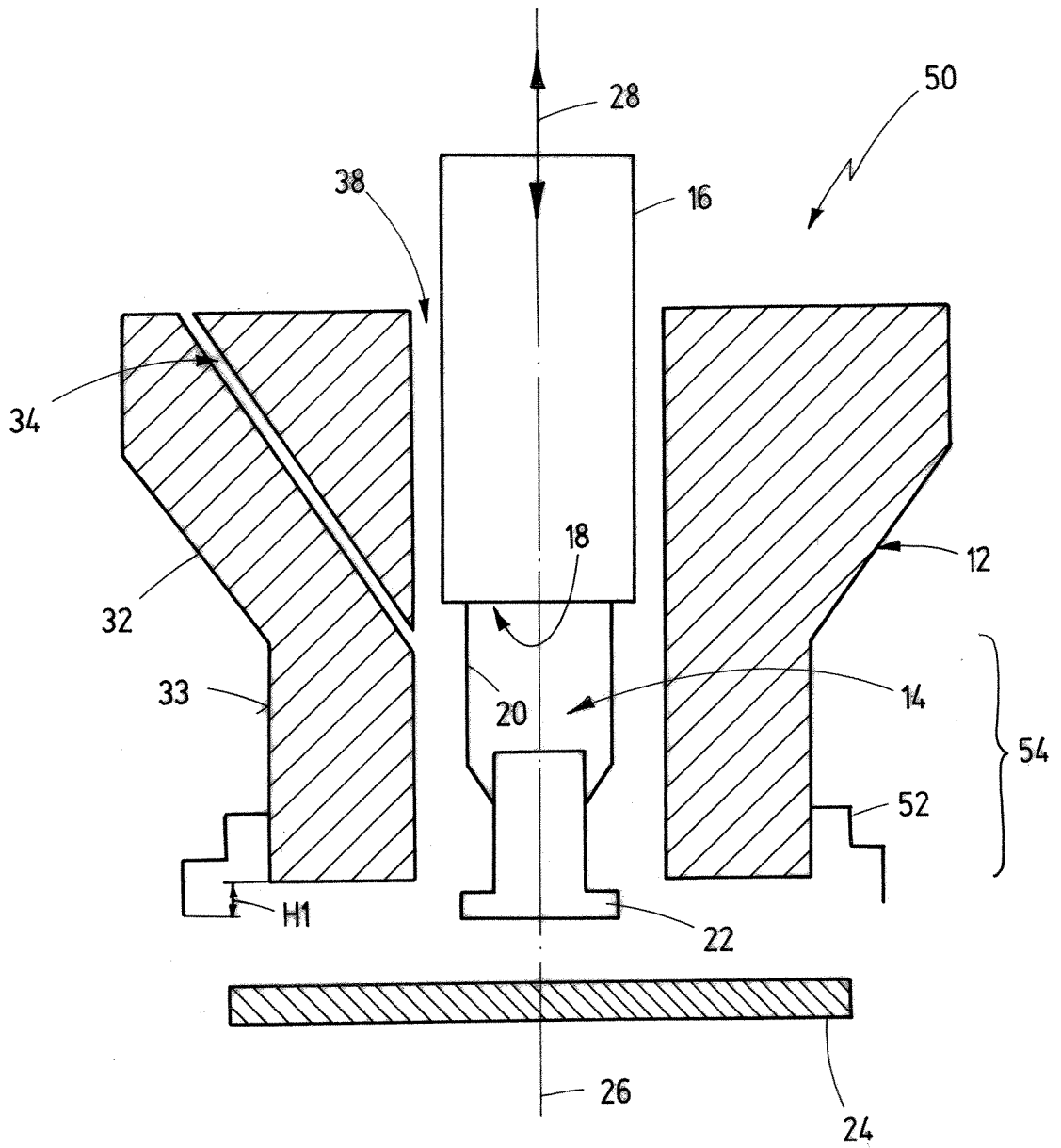


Fig.2

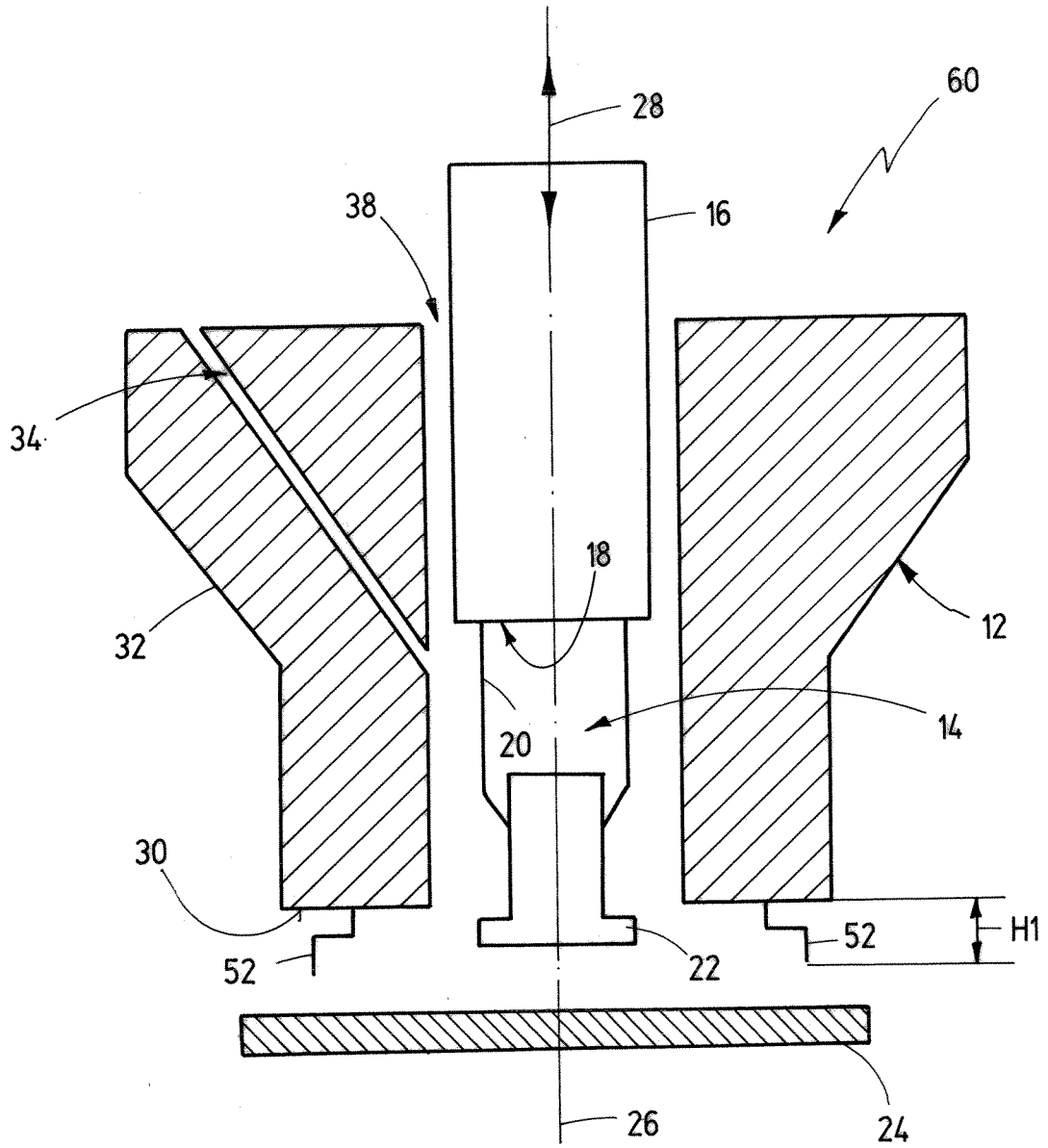


Fig.3

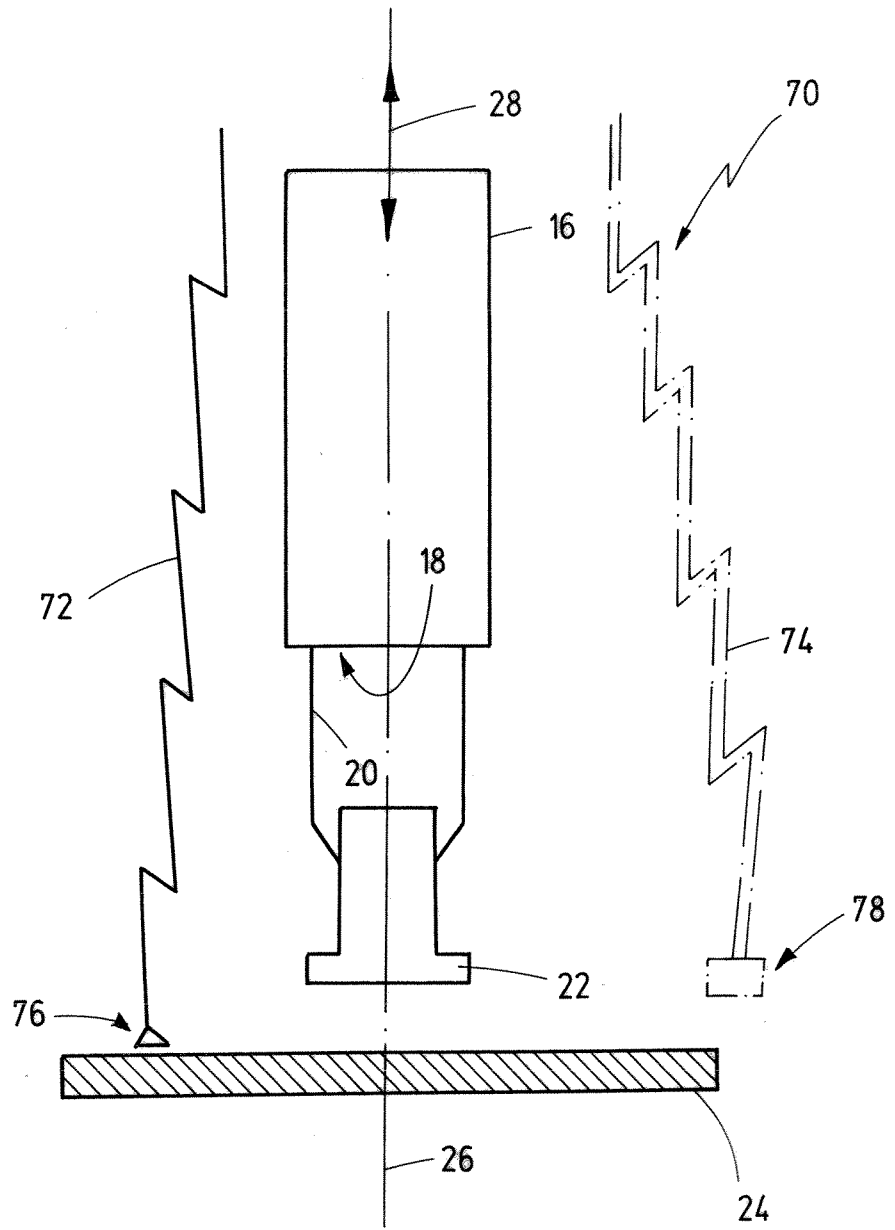
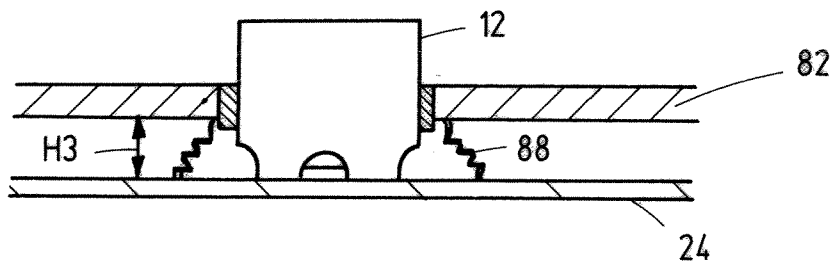
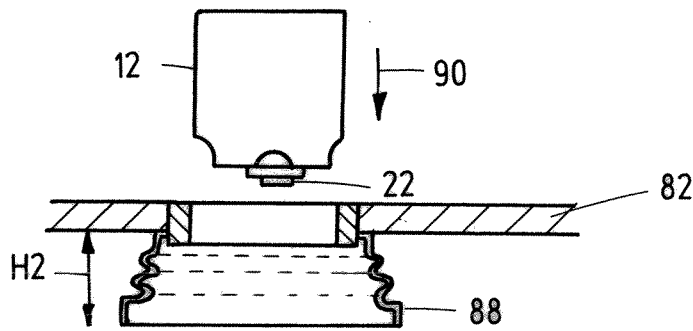
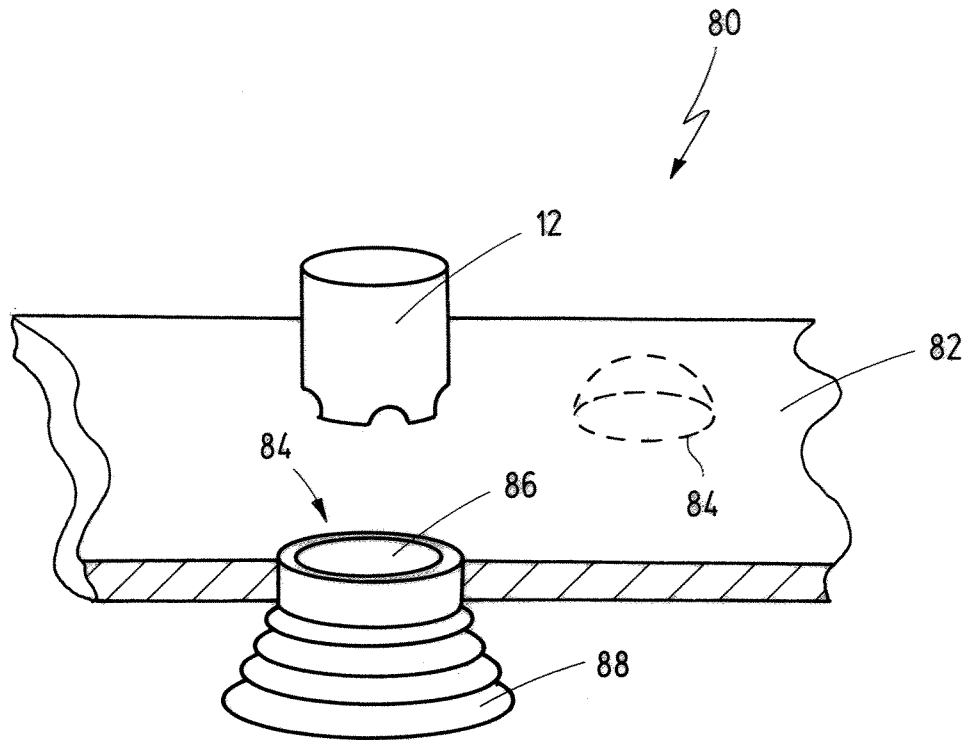


Fig.4



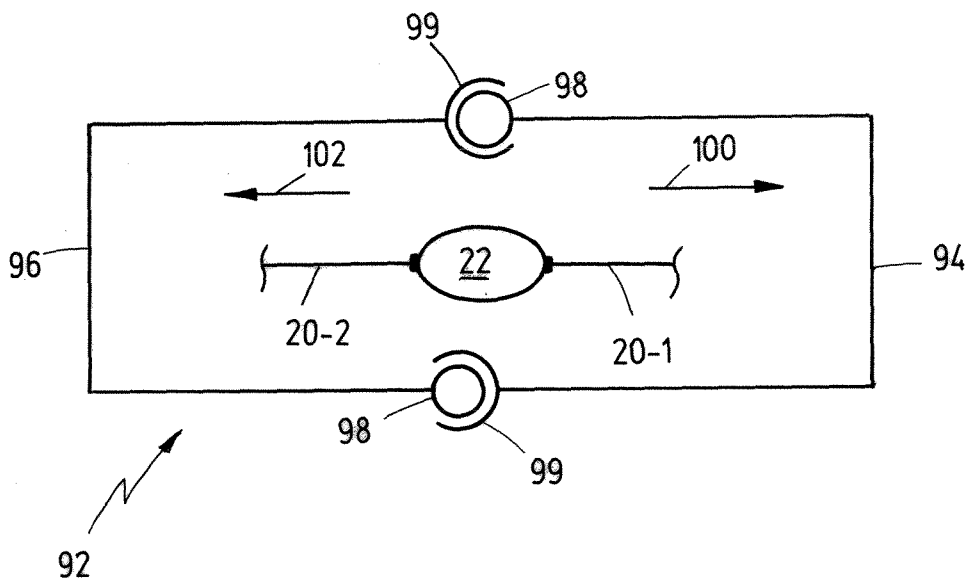


Fig.6



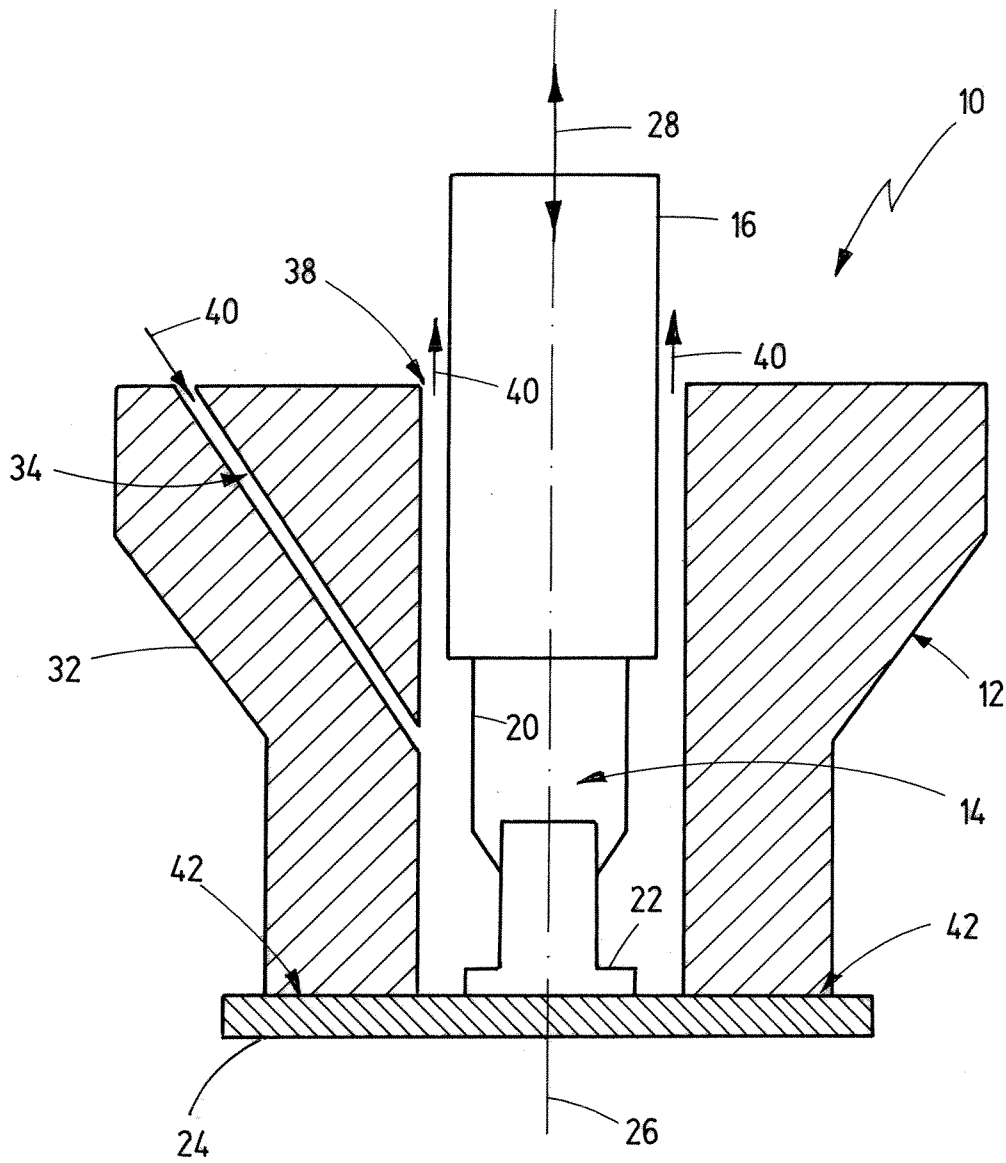


Fig.8

**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US 08/63594

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC(8) - B23K 26/12 (2008.04)  
 USPC - 219/121.64  
 According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**  
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
 219/72,74,98,121.63,121.64,121.84,121.86,137R,146.52,148 (Text limited search, see terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
 PubWEST(USPT,PGPB,EPAB,JPAB); Google Patents TERMS shield\$3 protect\$3 inert gas direction weld\$3 back\$4 direction hood apron bellows sleeve seal\$3 gas bellows escape exit exhaust back\$4 rear stud holder escape welding space

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,277,353 A (Budig et al.) 11 January 1994 (11.01.1994) col. 1, ln. 4-7	1-7
Y	US 3,096,429 A (Mowry et al.) 02 July 1963 (02.07.1963) Fig. 4, col. 3, ln. 72-col. 4, ln. 13	1-7
Y	US 4,371,773 A (Kondo) 01 February 1983 (01.02.1983) Fig. 1, col. 1, ln. 61-66, col. 3, ln. 26-col. 4, ln. 2	3-5
Y	US 7,109,434 B2 (Willershausen) 19 September 2006 (19.09.2006) col. 4, ln. 13-17	4, 5
Y	US 2,753,426 A (Aversten) 03 July 1956 (03.07.1956) Fig. 3, col. 1, ln. 17-22	6, 7
Y	US 6,525,288 B2 (Rehrig) 25 February 2003 (25.02.2003) col. 2, ln. 17-19	7

Further documents are listed in the continuation of Box C.

\* Special categories of cited documents:  
 "A" document defining the general state of the art which is not considered to be of particular relevance  
 "E" earlier application or patent but published on or after the international filing date  
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)  
 "O" document referring to an oral disclosure, use, exhibition or other means  
 "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  
 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone  
 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art  
 "&" document member of the same patent family

Date of the actual completion of the international search 14 August 2008 (14.08.2008)	Date of mailing of the international search report <b>20 AUG 2008</b>
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 08/63594

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.: 8 - 11  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 08/63594

**Box No. IV** Text of the abstract (Continuation of item 5 of the first sheet)

The present invention relates to a device for joining, in particular arc welding, a first component to a second component, in which the welding process takes place in a protective or inert gas atmosphere, as for example when studs are welded to a workpiece such as a vehicle body panel, or vehicle body parts are connected to the chassis by means of studs which are provided with a thread. During stud welding it is necessary to coordinate electric switching processes with mechanical movements of the stud and the movement of the protective gas in order to be able to handle the very rapid melting and solidification processes without introducing distortions caused by gas pressure. The present invention relates to protective gas welding with a flow of protective gas towards the rear.