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(54) Titre : METHODE DE FABRICATION D'UNE PROTHESE DENTAIRE EN CERAMIQUE  
(54) Title: METHOD OF MANUFACTURING A DENTAL CERAMIC STRUCTURE

(57) Abrégé/Abstract:

A method of producing a dental ceramic structure, in particular, for pressing against, over or around a supporting structure made of metal or ceramic, uses a muffle having two sections which define a cavity corresponding to the negative shape of the structure, flowable material being supplied into the cavity via at least one sprue. The method includes digitizing a model or partial model of the dental prosthesis to be produced and generating a CAD data set of the dental prosthesis to be produced; cutting each section of the muffle based on the CAD data set to form the cavity; pressing the ceramic, as the material to be supplied, into the cavity by way of the at least one sprue; after hardening the ceramic, removing the structure from the cavity with the sprue or flash thereof extending from the structure, and removing the sprue or flash on the basis of the CAD data set of the structure to be produced

ABSTRACT OF THE DISCLOSURE

A method of producing a dental ceramic structure, in particular, for pressing against, over or around a supporting structure made of metal or ceramic, uses a muffle having two sections which define a cavity corresponding to the negative shape of the structure, flowable material being supplied into the cavity via at least one sprue. The method includes digitizing a model or partial model of the dental prosthesis to be produced and generating a CAD data set of the dental prosthesis to be produced; cutting each section of the muffle based on the CAD data set to form the cavity; pressing the ceramic, as the material to be supplied, into the cavity by way of the at least one sprue; after hardening the ceramic, removing the structure from the cavity with the sprue or flash thereof extending from the structure, and removing the sprue or flash on the basis of the CAD data set of the structure to be produced

Method of Producing A Dental Ceramic Structure

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The invention relates to a method of producing a dental ceramic structure, in particular, for pressing against, over or around a supporting structure made of metal or ceramic using a muffle having two sections which define a cavity corresponding to the negative form of the structure, flowable material  
10 being supplied into the cavity via at least one sprue.

A corresponding method is known, for example, from DE-A 196 30 412 for producing a ceramic dental structure. With this method, the steps are as follows: an impression of the mouth situation is taken with inserted ceramic root pin, a mould is made from the impression whereby the pin  
15 protrudes from the mould, a reconstruction is made from an annealable material, a sprue attached, a pin and waxed parts are embedded in a muffle with a hardenable embedding substance, the wax is removed by heating and finally the ceramic pressed in.

The quality of the dental ceramic structure thereby depends, on the one hand, on the skill of the  
20 dental technician who undertakes the moulding of the reconstruction and, on the other hand, on the formation of the cavity with the embedded substance which surrounds the moulding,.

A corresponding method can also be found in DE-A 101 36 584 A1.

25 A method of producing dental prostheses is known from US-A 5,092,022. In this case, according to the embodiment of Fig. 27, a mould part is formed by cutting, from a block consisting, for example, of metal, on the basis of stored data which corresponds to the outer geometry of a dental ceramic structure to be produced. The cavity thus formed is defined by a mould part accommodating a metal structure. A sprue in which the liquid material, e.g. synthetic resin, is introduced extends  
30 between the mould parts.

It is an object of the present invention to further develop a method of the aforementioned type in such a manner that more precise dental ceramic structures are provided in which inadequacies due to manual intervention can be largely avoided.

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According to the present invention, there is provided a method of producing a dental ceramic

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structure, in particular, for pressing against, over or around a supporting structure made of metal or ceramic, using a muffle having two sections which define a cavity corresponding to the negative shape of the structure, flowable material being supplied into the cavity via at least one sprue, the method including the steps of:

- 5 a) digitizing a model or partial model of the dental prosthesis to be produced and generating a CAD data set of the dental prosthesis to be produced,
- b) cutting each section of the muffle based on the CAD data set to form the cavity,
- c) pressing the ceramic, as the material to be supplied, into the cavity by way of the at least one sprue,
- 10 d) after hardening the ceramic, removing the structure from the cavity with the sprue or flash thereof extending from the structure, and
- e) removing the sprue or flash on the basis of the CAD data set of the structure to be produced. In particular, the method in which the dental ceramic structure comprises a supporting structure is distinguished in that the structure is placed in the cavity after it has  
15 been formed (procedural step b), after which the ceramic is pressed into the cavity over the structure and procedural steps d) and e) are ultimately carried out.

Preferably, the method by which the dental ceramic structure includes a supporting structure comprises placing the structure in the cavity after it has been formed in step b), after which the  
20 ceramic is pressed into the cavity over the structure and steps d) and e) are then effected.

The mould cavity is preferably formed from a hardened embedding substance.

The supporting structures may be moulded or pressed over for e.g. crowns or bridges in an  
25 automated production based on CAD data. For this purpose, the negative mould of the structure to be produced is, for example, worked out by milling in a suitable blank such as an embedding substance. The volume of the ceramic material to be pressed in is then produced from the geometry obtained on the basis of the CAD data and thus its volume less the volume of a prefabricated and used structure. The moulding ceramic is then pressed onto or around the structure. The dental  
30 structure, such as a crown or bridge, can then be removed from the mould in order to then be basically used immediately. If necessary, a minimal refinishing is required.

The invention will be more readily apparent from the the following description of a preferred embodiment thereof, given by way of example only, with reference to the accompanying drawings,  
35 in which:

Fig. 1 shows a basic representation of a muffle with a dental ceramic structure formed in it, and

Figs. 2 - 5 show basic representations to illustrate the method of producing the dental ceramic structure.

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In Fig. 1, a muffle 10 is shown which consists of sections 12, 14 that have been fitted together. The sections 12, 14 define a cavity 22 in which a dental ceramic structure is to be produced by pressing around a supporting structure 18.

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The internal geometry of the cavity 22 is produced on the basis of CAD data of the dental ceramic structure to be produced from blanks by machining, e.g. by cutting such as milling, which forms the sections 12, 14.

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The volume of the cavity 22 not filled by the structure 18 is calculated on the basis of the available CAD data in order to then injecting moulding ceramic (hatched area 22) via a sprue 20. After hardening, the sections 12, 14 are separated from one another, the dental ceramic structure removed and then the flash of the sprue 20 is removed. This takes place automatically since the data available for this are used.

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To generate the CAD data, an impression can be made of the tooth stump or stumps from a dental preparation, the impression forming a negative mould of the situation in the patient's mouth. The surface of the tooth stump or stumps, approximate surfaces of the adjacent teeth and counter bite are thereby determined. A positive mould, preferably consisting of plaster or plastic, is obtained from this mould. The dental ceramic structure can then be calculated taking into consideration the data obtained from the positive mould by scanning in order to machine, e.g. cut, the sections 12, 14 of the muffle 10 on the basis of the CAD data then available, in order to form the cavity 22 as a whole.

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The corresponding procedural steps follow from a synopsis of Figs. 2, 4 and 5. Thus, a positive mould of one or more tooth stumps is shown in principle in Fig. 2 which are to be provided with a dental ceramic structure. The positive mould 24, i.e. the area which is to be e.g. crowned, is scanned, for example, by means of a mechanical scanner 26 in contact with it or by means of a laser in a non-contact manner, in order to then supply the corresponding data to a computer 28. The corresponding data are then processed by means of a CAD program 30 to obtain data 32, on the basis of which the section 14 of the muffle is produced mechanically, e.g. by cutting. Furthermore, data 34 are produced which correspond to the entire dental ceramic structure with the result that the section 12,

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with respect to the area which defines the cavity 18, can be produced from the data 32, 34. Furthermore, data 36 can be generated which correspond to a structure to be produced. If the corresponding data are available, they must first be input into the computer 28 to obtain adapted data 34 for the dental ceramic structure without a supporting structure.

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Alternatively, a moulding for the dental ceramic structure can be prepared on the positive, a corresponding supporting structure for a crown or a bridge being situated on the tooth stump or stumps. The finished mould is then scanned in order to be able to work out the cavity 22 in the muffle 10 on the basis of this data. Of course, it is thereby necessary that the data of the supporting structure used be taken into consideration.

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As in the previous explanations, e.g. a cap 38 can be formed on the positive mould 24, the cap corresponding to the dental ceramic structure. The cap 38 is then scanned by non-contact or contact in order to supply the corresponding data to a computer 40 by means of which and by means of a suitable CAD program data 42 for forming the section 12 in its area defining the cavity and, in the event data of the structure is not already available, data for the structure 44 are then generated.

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Based on the data 32 or 34, 42, the lower section 14 or the upper section 12 is then formed in a CNC-controlled manner, for example, by means of a milling tool 46. The surfaces 48, 50 thus produced define the cavity 18. Furthermore, it can be seen that the sprue 20 should not be formed in section 12 (hatched illustration), namely also based on the existing digitalized data.

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The muffle is then inserted into a known muffle system in order to press flowable ceramic into the cavity 22 or the cavity not filled by the supporting structure 18 via the sprues 20. Press dies are used in the conventional manner for the moulding. However, in this respect, reference is made to sufficiently known techniques and constructions. For example, reference is made to DE-U 90 01 740 or DE-A 101 36 584.

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Since, as mentioned, the data of the cavity and thus the outer geometry of the finished dental ceramic structure are available, it is easy to automatically remove the flash of the sprue 20.

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**Patent Claims**

1. A method of producing a dental ceramic structure, in particular, for pressing against, over or around a supporting structure made of metal or ceramic, using a muffle having two sections which define a cavity corresponding to the negative shape of the structure, flowable material being supplied into the cavity via at least one sprue,  
5 the method including the steps of:
- a) digitizing a model or partial model of the dental prosthesis to be produced and generating a CAD data set of the dental prosthesis to be produced,
  - 10 b) cutting each section of the muffle based on the CAD data set to form the cavity,
  - c) pressing the ceramic, as the material to be supplied, into the cavity by way of the at least one sprue,
  - d) after hardening the ceramic, removing the structure from the cavity with the sprue or flash thereof extending from the structure, and
  - 15 e) removing the sprue or flash on the basis of the CAD data set of the structure to be produced.
2. The method according to claim 1, in which the dental ceramic structure comprises a supporting structure, the method including, after the cavity has been formed in method step  
20 b), placing the structure in the cavity, the ceramic then being pressed into the cavity over the structure and finally method steps d) and e) being effected.
3. The method according to claim 1, wherein the mould cavity is surrounded by a hardened embedding substance material.  
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4. The method according to claim 1, wherein the sections of the muffle defining the mould cavity are cut by milling or grinding.
5. The method according to claim 1, wherein a plurality of sprues opening into the mould cavity  
30 are formed for the ceramic to be injected.

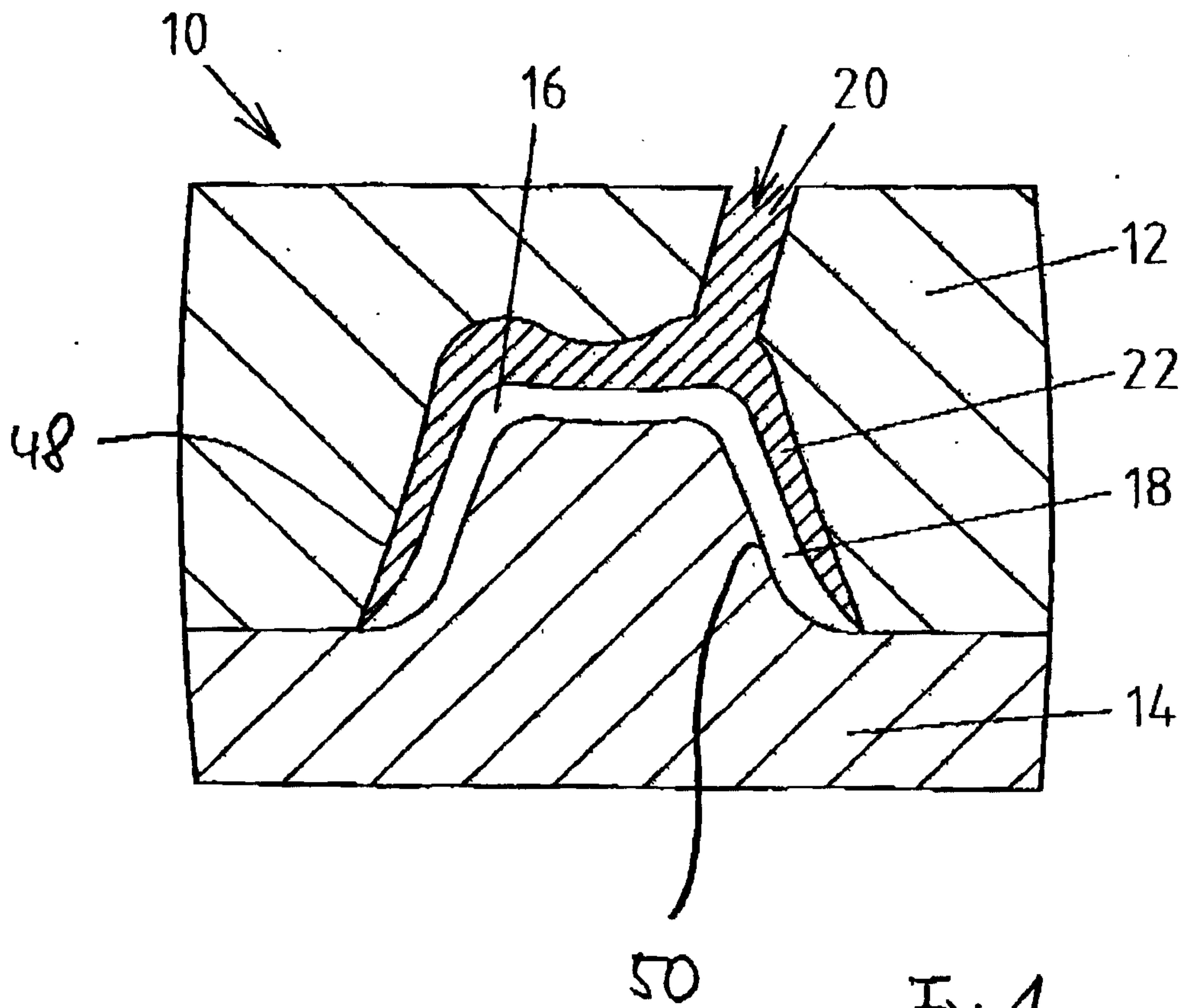


Fig. 1.

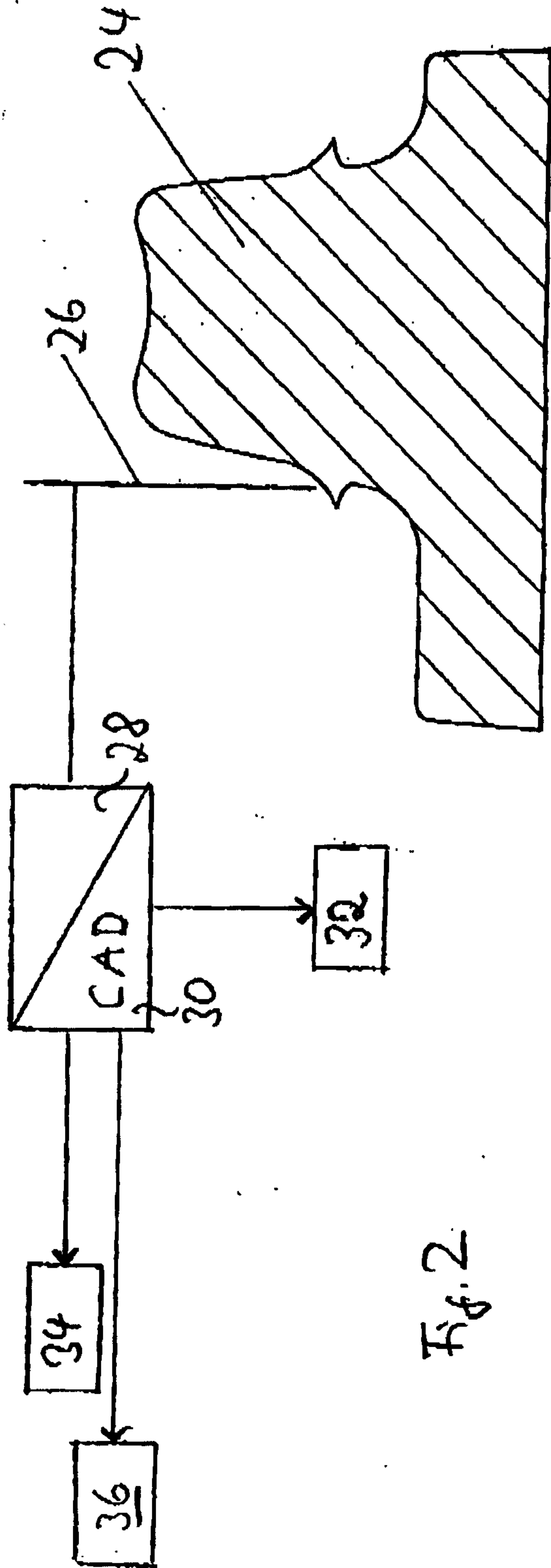


Fig. 2

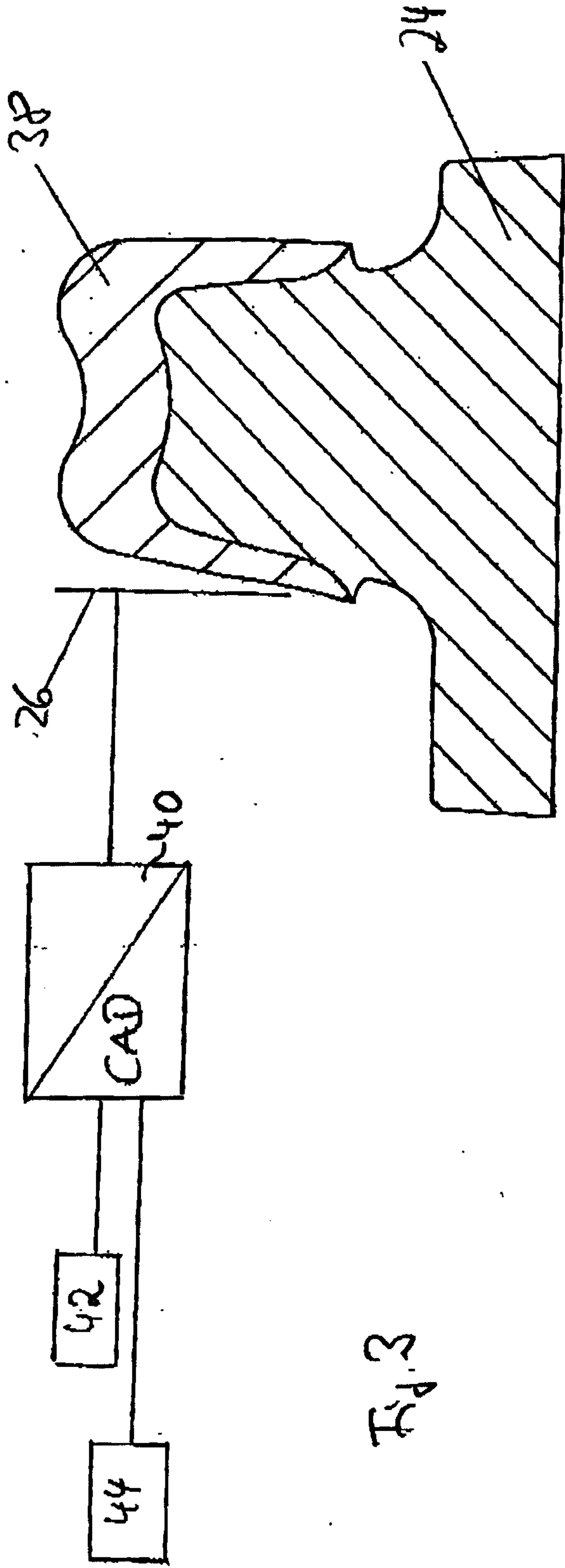


Fig. 3

