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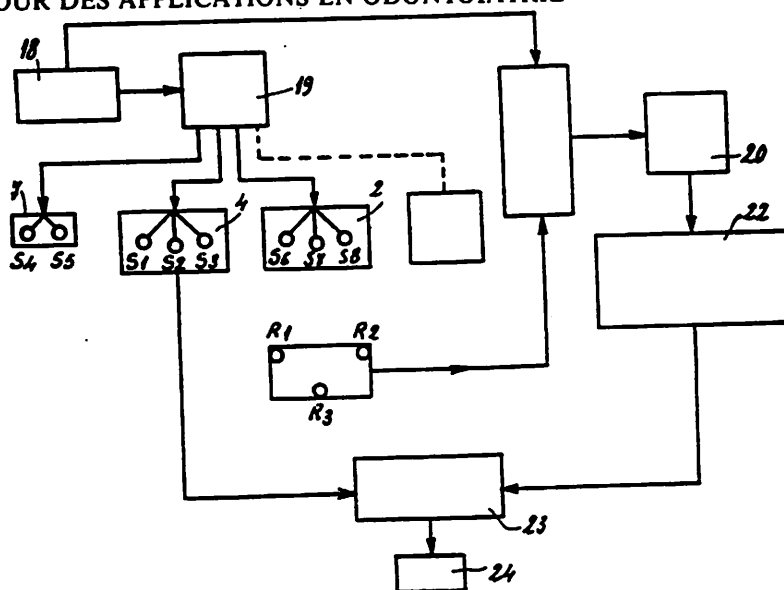
GERMAIN et MAUREAU

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Brevets - Marques - Modèles

(54) Title: DEVICE FOR THE CORRELATION OF THREE-DIMENSIONAL ACQUISITION DATA OF HUMAN ORGANS, ESPECIALLY FOR APPLICATIONS IN ODONTIATRIA

(54) Titre: DISPOSITIF DE CORRELATION DES SAISIES TRIDIMENSIONNELLES D'ORGANES HUMAIN, NOTAMMENT, POUR DES APPLICATIONS EN ODONTOIATRIE



(57) Abstract Device including at least three transmitters (S1-S8) and at least two receiver, (R1-R3) fitted to the part of the organ to be analyzed, to a data acquisition camera, and/or to a plotting probe and/or to a stationary support, a pulse clock (18) connected to a pulse generator (19) causing the different transmitters (S1-S8) to emit in sequence, and to the receivers (R1-R3) in order to indicate to which transmitter corresponds the received signal, a converter (20) for transforming the information received by each probe into a numerical value, a computer (22-23) for determining the coordinates of each transmitter in relation to each receiver, storing the information according to each image, and deriving, based on one of the images serving as a reference, correlations of each image in relation to the reference image, in order to obtain a three-dimensional image of an organ. Application in odontology.

FIG 3

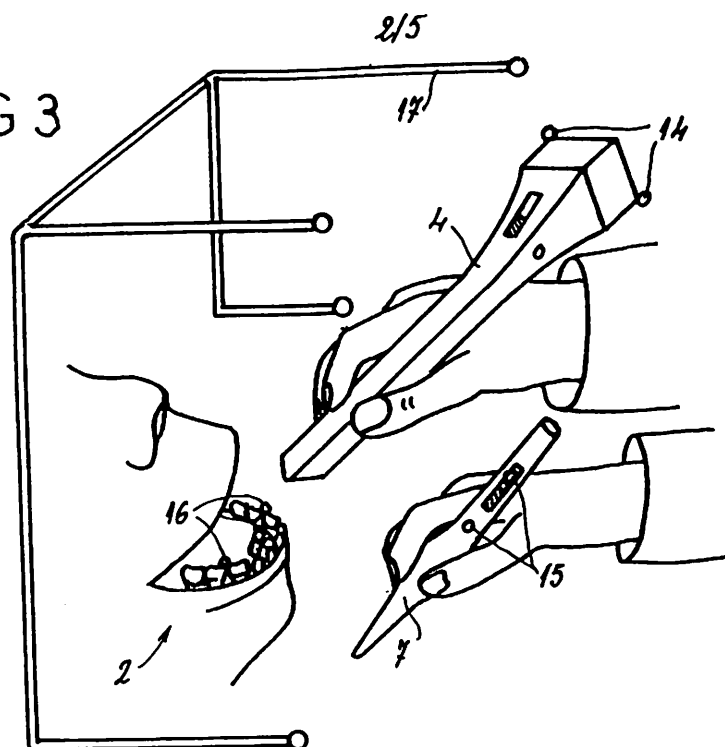
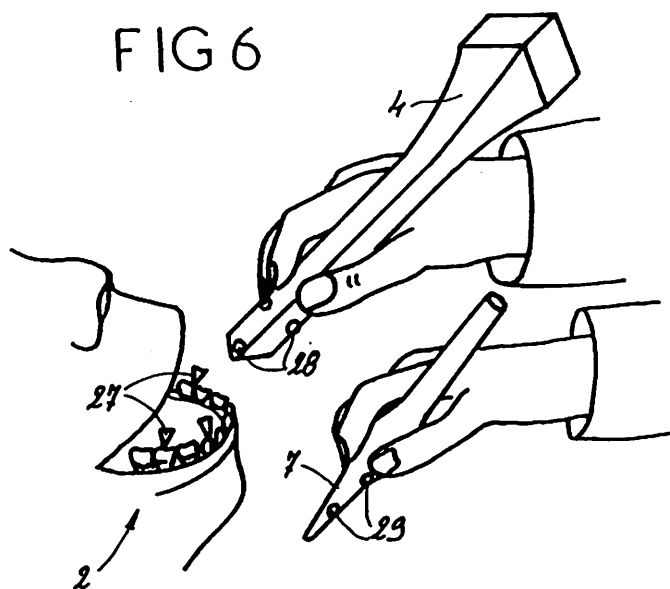


FIG 6



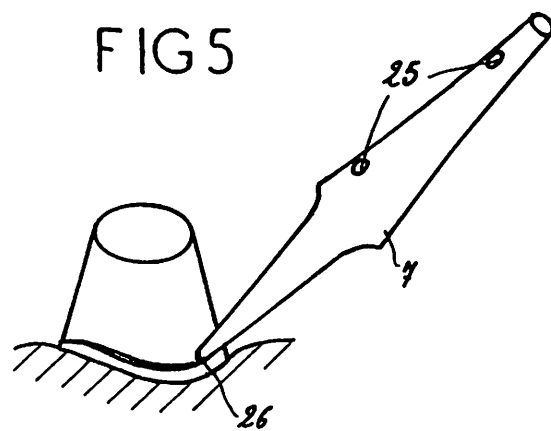
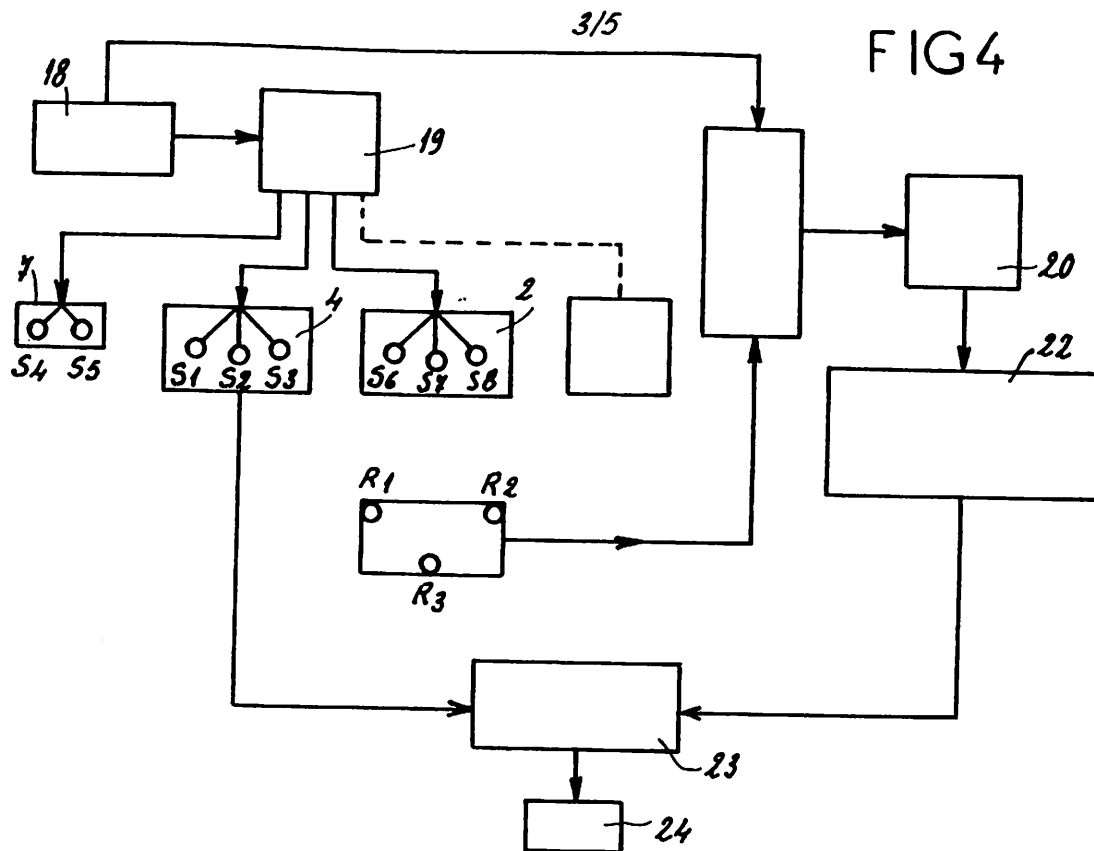


FIG 7

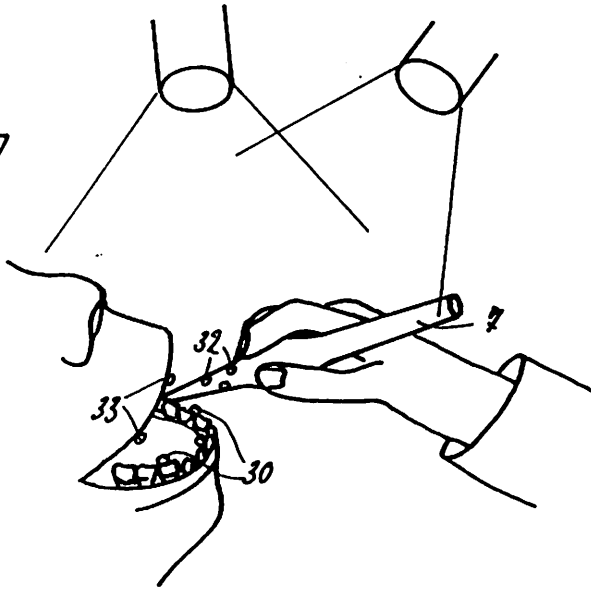


FIG 8

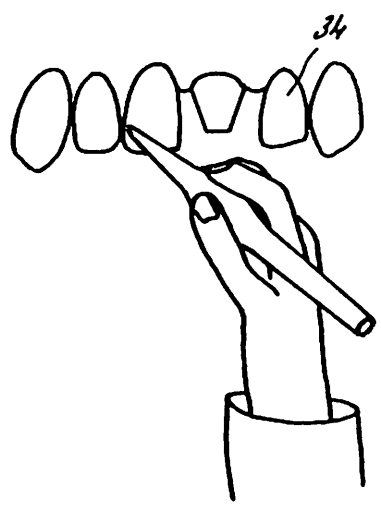
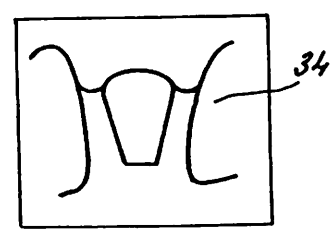


FIG 9



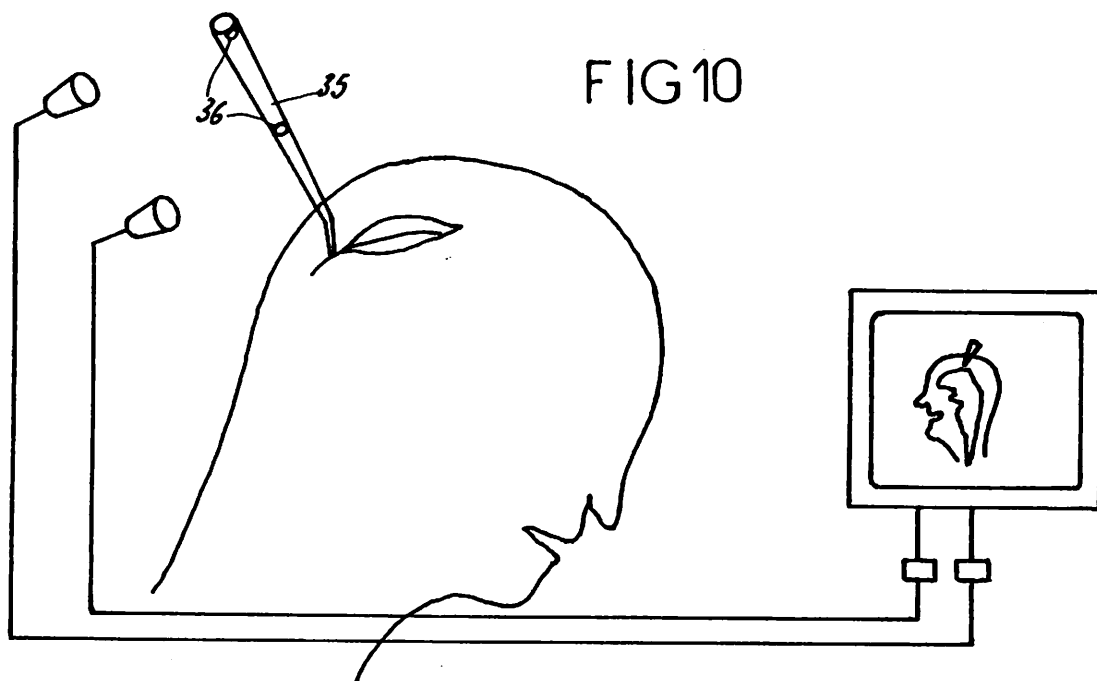


FIG 11

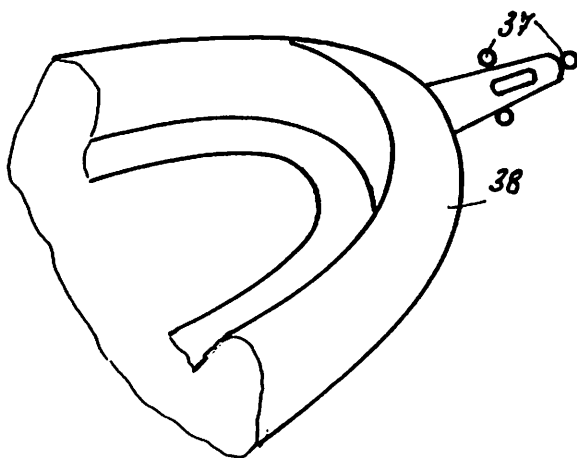
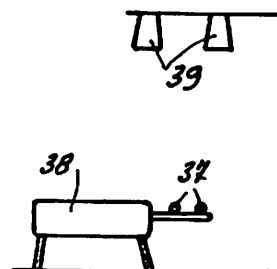


FIG 12



LASER TRANSMITTED INTRAORAL PROBE

**Invention By
Professor Francois Duret
Los Angeles, California U.S.A.**

*Francois
What do you think of
name for probe
Jh*

CONFIDENTIAL INFORMATION

Clarification of the Report on French Patent #92.08128 (6/26/92). The actual report is attached to this clarification statement. The French Report was made to help in understanding the French Patent # 92.08128. The French Patent by Dr. Duret is also attached for reference.

Report on French Patent # 92-08126 (6/26/92)

Apparatus for Optical Three Dimensional Impression of Human Organ (Teeth)

This invention describes an apparatus and method for the correlation of different optical 3 dimensional impression of human organs (for example teeth) with the possibility to indicate some specific points of reference. This apparatus especially proposes a method which uses the respective position of the analytical instrument (camera or probe) in comparison with the position of the organ and eventually with a fixed reference.

Today we have different techniques to obtain a three dimensional impression

1. Traditional impression (using silicone materials) however, all of the structures required for restoration must be taken by this impression material.
2. The micro palpation (proposed by Mushabec, Rêkow) but no correlation method has been proposed.
3. The x-ray, CT scanner or MRI, but only Dr. Duret has proposed a correlative method in his French Patent # 83-07840 (RX-RVG)
4. The last method is the optical impression and in this way we have different technologies like: stereoscopic method and interferometry. Where only the correlation by spheres has been previously proposed. With this method we must draw all the points or lines on the screen of the computer.

All of the optical methods we know and read about are currently relevant to the mandibular movement.

The aim of this appartus is to simplify and considerably increase the correlation of dental and medical 3 dimensional optical impressions of one object, a part of one object in comparison with another part of an object without knowing the position of the camera and the object by the computer prior to obtaining the location and exact measurement. Another objective is to indicate a specific area or point on an object like the margin of a preparation, grooves, cusp and contact area location of the opposing dentition when fabricating a prosthesis. This new technique can obtain

this information either directly from the model or the patients mouth without the use of the computer monitor.

The new apparatus uses various means of operation

1. A minimum of 3 transmitters and 2 receptors fixed on the object, the camera and /or the probe and/or fixed support.
2. A timer connected with receptors and transmitters.
3. A computer to calculate the position in space of each of the elements.

In this new apparatus we have different possibilities

1. Light emission with CCD or diode receptors by triangulation
2. Ultrasound emission and receptors that can measure the speed of sound.
3. Magnetic emission and receptor by Hall effect

Description of pictures in the patent.

Picture 1: Light correlation with 3 light emission (#5) in the mouth, 3 light emissions on the probe (3), two on the probe (6) and to external receptors (8)

Picture 2: Ultrasound system with the same number but here it is possible to cover each emission (9-10-12) and receptor (13) because ultrasound goes through the body easily. It easier to use.

Picture 3: Magnetic system with only two poles (north & south) and the antenna on the wall or around the face (17) to have the Hall effect.

Picture 6: Same concept for each one, without antenna or receptors outside the camera, probe and mouth. The receptor can be one of them.

Picture 4: General concept of the system with clock (18) generator of impulse (19). (R) means receptors and (S) emission source. (20) is analog/digital converter card. (22) is the computer and (24) the CAD-CAM

Picture 5: Is the probe where only two emitters are enough (25) to indicate to the computer the 3 dimensional location of the margin.

Picture 7: Explains that we can indicate all the information directly in the mouth with the probe without having a computer screen (monitor). All three systems can be used like light, ultrasound or magnetic effect.

Picture 8: Indicates that it is possible to indicate the profile of a tooth, like the incisor (34) if we want to help the CAD during the design of the external part of the crown.

Picture 9: Explains that it is possible to control the trajectory of the scalpel directly on the computer screen where we see it by digital x-ray. This is important for implants and surgery where it is necessary to preserve the surrounding tissue.

Picture 11: Explains that it is possible to use the probe not only in the mouth but also on the impression or model during the utilization of the opticast.. We can also know the position of the model if we read the emitters on the model (or tray) with the camera (39)

CLAIMS:

1. Apparatus for correlation of 3 dimensional impression with: 3 or more emissions and 2 or more receptors fixed on camera, tooth, probe and fixed support.

Clock of pulsation connected to emissions and receptors to indicate the timing.

Convert analog/digital card

Computer correlates the information

2. Apparatus with light emission
3. Apparatus with ultrasound
4. Apparatus with magnetic effect
5. Apparatus using a triangulation technology
6. Apparatus using speed of sound information
7. Apparatus using the Hall effect

8. Apparatus used to correlate the optical 3 dimensional impression and the information for the apparatus as stated in (Claim 1)
9. Apparatus with a continuous series of correlations and automatic indicators when we take the optical 3 dimensional impression.
10. Apparatus which switch on the correlation when we take the 3 dimensional view.
11. and 12 explain with or without the storage of the view.



University Of Southern California

Dept of Oral and Maxillofacial Imaging
section of Restorative Imaging

PROF. Francois DURET

*Facet
2/5/93*

Rapport On French Patent # 92.08128 (6/26/92)

"apparatus for optical 3D impression of Human organ"

This invention describes an apparatus and method for the correlation of different optical 3D impressions of human organs with possibility of indicating some specific points. Especially this apparatus proposes a method which uses the respective position of the analyses' instrument (camera or explorer) in comparison with the organ and eventually with a fixed reference.

To day we have different techniques to take 3D impressions:

- traditional impression (like the silicones...) and all the organ must be taken in the same impression.

- the micro palpation (like Mushabec, Rekow) but no correlation method has been proposed.

- the XR , Scanner or IRM, but only Dr Duret has proposed a correlative method in his Patent # Fr 83-07840 (RX-RVG)

- the last method is the optical impression and in this way we have different technologies like:

- + stereoscopy

- +interferometry

Where only the correlation by spheres' lecture has been proposed. and with this method, we must draw all the point or line on a video screen of the computer.

All the optical methods that we know are only for the lecture of the mandibular Movement.

The target of this apparatus is to simplify and increase considerably the correlation of Dental and medical 3D optical impressions of one object, a part of one or one in comparison with another one without the knowledge of the position of the camera and the object by the computer before the measure. The target is also to indicate some specific area or point on the object like Margin, grooves, cusp, contact area or opposite informations for building a prosthesis. Especially, this technique gives the possibility to indicate these informations directly on the model or in mouth without to use the video screen.

For this fonction, this apparatus use:

- a minimum of 3 transmitters and 2 receptors fixed on the orgene, the camera nad/or the explorer and / or a fixe support.
- A clock connected with receptors and transmetters.
- a computer to calculate the spacial position of each elements.

In this apparatus, we have different possibility:

- light emission with CCD or diode receptors dy triangulation
- ultrason emission and receptors by speed of sound
- magnetic emission and receptor by Hall effect

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claims:

- 1) apparatus for correlation of 3D impressions with:
 - 3 or more emissions and 2 or more receptors fixed on camera, organ , explorer and support fixe
 - clock of pulsation connected to emissions and receptors to indicated the timing
 - converted A/D card
 - computer to correlated each information
- 2) apparatus with light emission
- 3) apparatus with Ultrasound
- 4) apparatus with magnetic effect
- 5) apparatus using a triangulation technology
- 6) apparatus using the speed lecture
- 7) apparatud using hall effect for lecture
- 8) apparatus for correlated the optical 3D impression and the information from the apparatus of lecture of correlation (claim 1)
- 9) apparatus with a continuous lecture of correlation and automatic indication when we take the optical 3D impression.
- 10) apparatus which switch-on the correlation lecture when we take the 3D view
- 11) and 12) explain with or without stokage of the view