

Oct. 13, 1970

S. KIRSCHENBAUM
ORTHODONTIA DEVICE

3,533,163

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3 Sheets-Sheet 1

FIG. 1

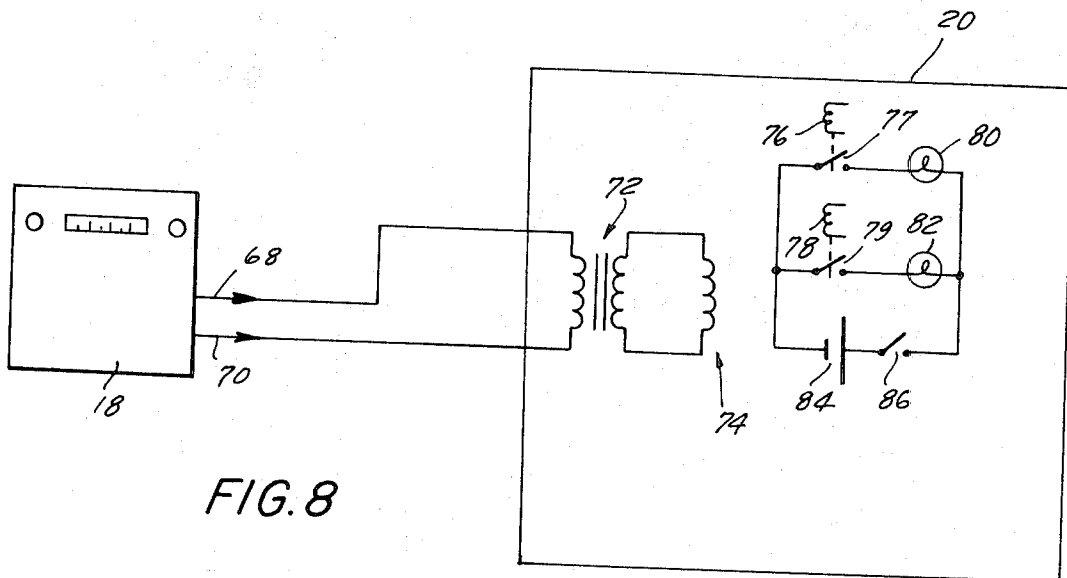
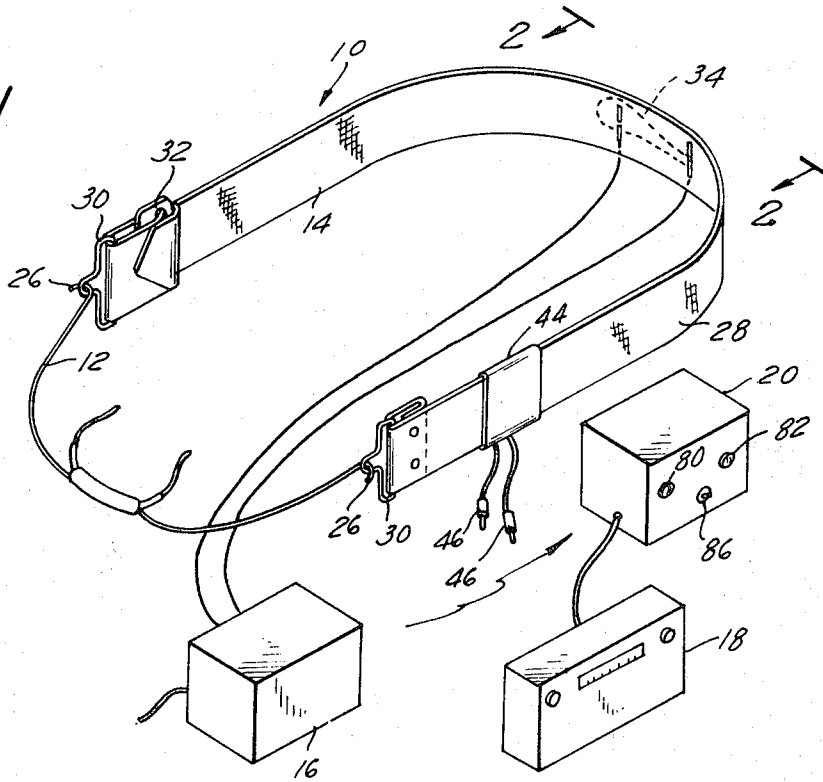


FIG. 8

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FIG. 2

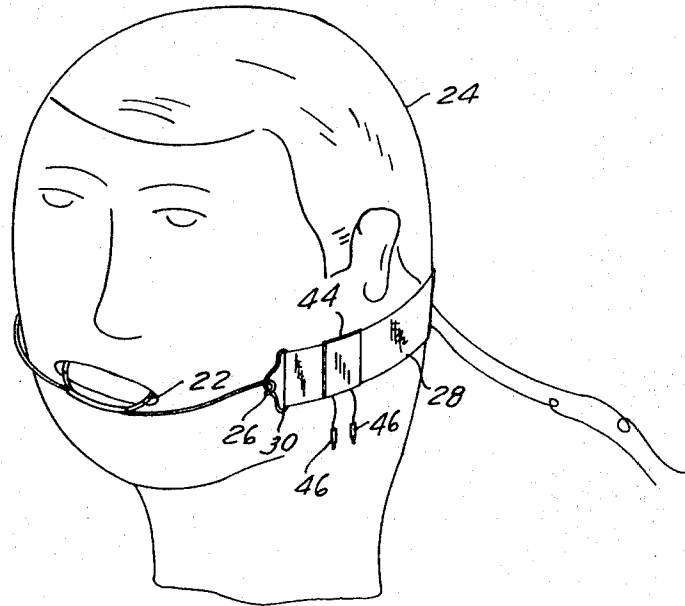


FIG. 3

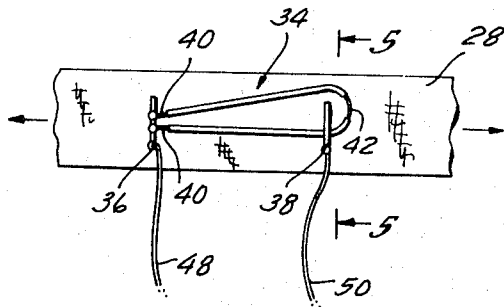


FIG. 4

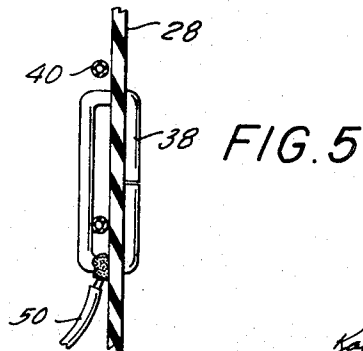
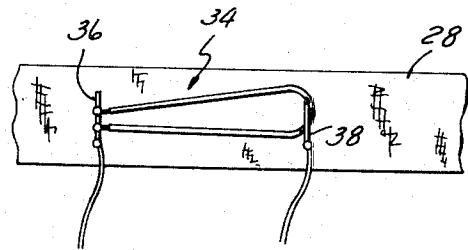


FIG. 5

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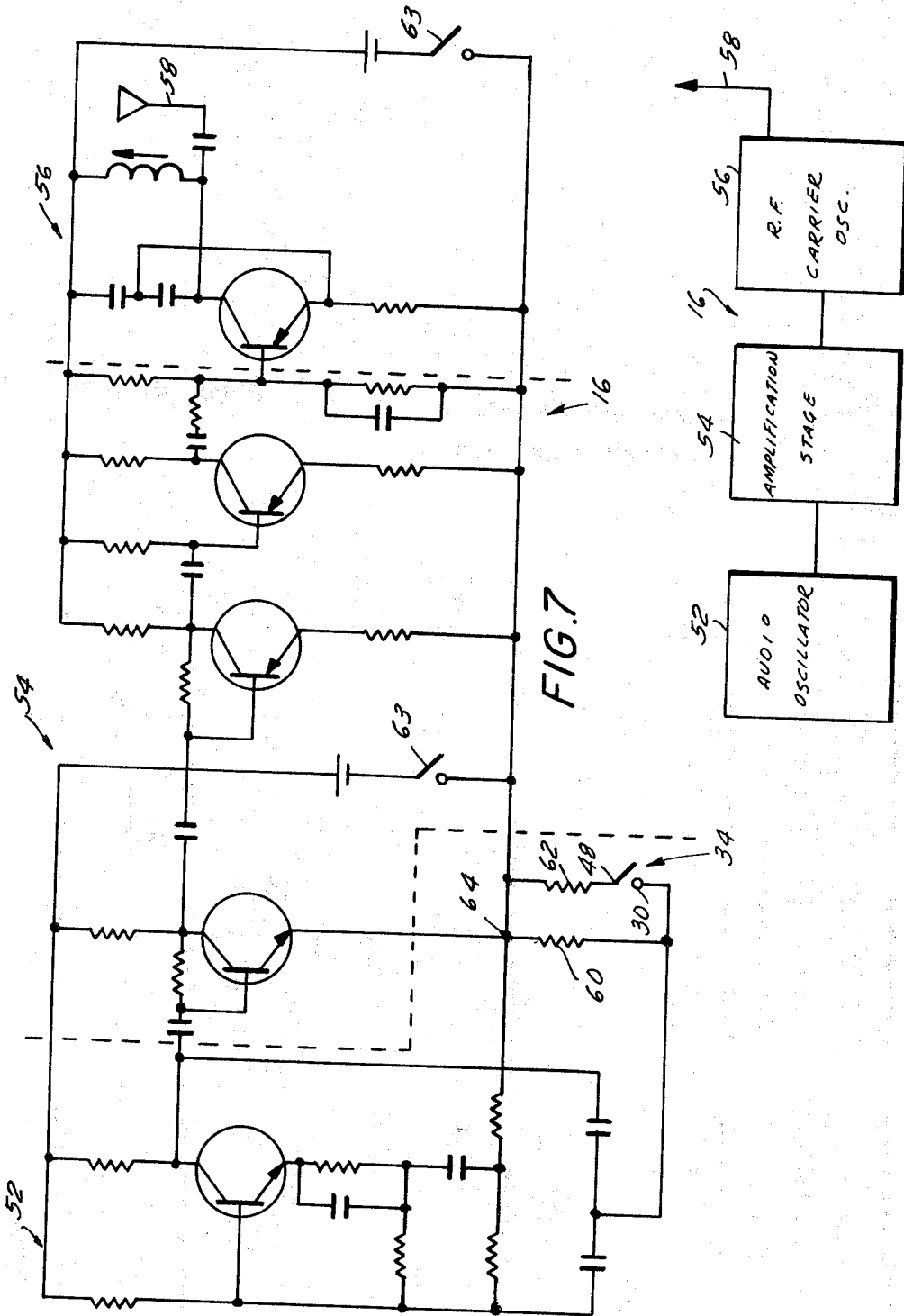


FIG. 7

FIG. 6

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ORTHODONTIA DEVICE

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8 Claims

ABSTRACT OF THE DISCLOSURE

An orthodontia appliance is provided including a face bow and elastic retaining band designed to exert a predetermined force on the bow when the bow is positioned in the mouth of a patient. The appliance further includes alarm means coupled to the elastic band and adapted to give a warning signal if the band is relaxed or exerts less than the predetermined force.

BACKGROUND OF THE INVENTION

During the initial phase of treatment of an orthodontia patient a mouth brace is used for some period of time. In the final phase of treatment the mouth brace is removed and a head brace, which is only used during sleeping hours, is substituted therefor.

In view of the fact that most people requiring orthodontia work are teenagers, there is a considerable lack of cooperation and self-control on the part of the patient in wearing the head brace and keeping it on throughout the night. The teenager will often remove the unit subconsciously during the course of his sleeping hours even when he is cooperative.

Parents invest a considerable amount of money for orthodontia work and desire to see their investment result in success. Parents, therefore, constantly badger their children to put their braces on but have no way of knowing if the braces were removed during the night. Constant parental vigil, such as by visual inspections during the night, are tedious and may possibly have a negative effect on the youngster if he were awakened.

It is therefore the principal object of the present invention to provide a low cost transmitting device built into a head brace capable of transmitting an alarm signal that would notify the parent when the device is being improperly worn.

SUMMARY OF THE INVENTION

This and other beneficial objects and advantages are attained in accordance with the present invention by providing an improved orthodontia appliance comprising a face bow and elastic containing band. The face bow includes a mouth brace adapted to be positioned within the mouth of an orthodontia patient and to engage certain teeth of the patient. The bow is further provided with band lugs on both sides of the mouth brace adapted to remain outside the patient's mouth when the bow is in use. An adjustable elastic band extends between the band lugs. The resiliency of the band is such as to cause the mouth brace to impart a predetermined force on the patient's teeth when the brace is positioned in the patient's mouth. Alarm means are coupled to the elastic band and are adapted to give warning in the event the band is not stretched sufficiently to cause the mouth brace to exert the predetermined force.

To this end the alarm means includes switch means coupled to the elastic band. The switch means are adapted to be shifted between a first position, when the band is stretched sufficiently to impart the desired predetermined force to the mouth brace, and a second position when the band relaxes or is not sufficiently stretched. Radio transmitting means including an audio oscillator are provided.

The switch means are connected in the regenerative path of the audio oscillator so that when the switch means is in its first position a signal of first predetermined frequency is generated and when the switch means is in its second position no signal or a signal of differing frequency is generated.

In the preferred embodiment of the present invention the transmitting means is further provided with an RF oscillator so that by tuning a standard AM radio to correspond to the frequency of the RF carrier an audible tone will be produced through the radio speakers indicative of the position of the elastic band and hence, give warning remote from the patient, as to whether or not the head brace is being properly worn.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a perspective view of an orthodontia device in accordance with the present invention;

FIG. 2 is a perspective view illustrating the orthodontia device in position;

FIGS. 3 and 4 are fragmentary elevational views of the switch means utilized by the orthodontia device illustrating respectively the relative position of the switch elements when the device is and is not worn;

FIG. 5 is a sectional view taken along reference lines 5-5 of FIG. 3 in the direction indicated by the arrows;

FIG. 6 is a block diagram representation of the transmitter utilized by the orthodontia device;

FIG. 7 is a circuit diagram illustrating a typical audio oscillator, modulator, amplifier, and carrier oscillator that may be employed in the practice of the present invention; and

FIG. 8 is a block diagram illustrating the circuit required for obtaining visual, as well as or in place of an audible alarm, in the event that the device is not properly worn.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention is illustrated in the accompanying drawings wherein similar components bear the same reference numeral throughout the several views. Reference is now made to the drawing and to FIG. 1 in particular wherein an orthodontia device 10 in accordance with the present invention is illustrated as including a face bow 12 and retaining strap 14 as well as a radio transmitter 16, an AM receiver 18 and a visual alarm unit 20.

The face bow 12 consists of an elongated metallic frame, usually formed of stainless steel, having a mouth brace 22 positioned between its ends. Mouth brace 22 is designed to alleviate and help cure the orthodontic problem of a particular patient and hence the details of its construction will vary from patient to patient. However, generally speaking, the mouth brace 22 is designed to exert a constant rearward pressure on certain teeth of the patient and to this end is designed to fit in the mouth of the patient and engage those teeth. The orthodontia appliance is worn by the patient 24 in the manner illustrated in FIG. 2.

The ends of face bow 12 are spaced apart sufficiently to wrap around the cheeks of the patient and terminate in hooked lugs 26. An elastic band or harness 28 is provided which has at its ends buckle like connectors 30, each adapted to engage one of the lugs 26. The elastic band 28 is adjustable, and to this end, one or more of the buckles 30 may include a take-up roller 32 to permit adjustment of the over-all length of the band. In use, the band is adjusted such that it may be stretched for positioning about the patient's head and the natural tendency of the elastic band to relax causes the mouth

brace to apply the desired force to the patient's teeth. It should be obvious that when the orthodontia device is positioned as illustrated in FIG. 2 the force exerted by the mouth brace is determined by the adjusted length of band 28.

A switch 34 is coupled to band 28 such that when the band is stretched beyond a predetermined amount the switch will be in a conducting state and when band 28 relaxes, switch 34 will be open. This is accomplished by providing two spaced apart terminals, 36 and 38, coupled to band 28. The terminals may comprise, for example, electrically conducting rivets or staples. A length of electrically conductive wire encased in a Teflon sleeve or other insulating material has its free ends 40 connected to the proximal terminal 36 and is looped around the distal terminal 38. The insulation for a short length of the wire at the apex 42 of the loop is removed. The length of the loop of wire is greater than the distance between terminals 36 and 38 when band 28 is relaxed as shown in FIG. 3. This prevents the exposed wire at the apex 40 of the loop from making electrical contact with the distal terminal 38 and thereby opens switch 34. However, when band 28 is stretched, as shown in FIG. 4, the distance between terminals 36 and 38 is increased, and if band 28 is sufficiently stretched, the uninsulated apex 42 of the wire loop will be brought in contact with terminal 38 thereby closing the circuit between terminals 36 and 38 through the wire loop as shown in FIG. 4. By properly adjusting the length of elastic band 28 and choosing a material for the elastic band having the proper resiliency, it is possible to design a band that will exert the required force on mouth bow 22 and will stretch sufficiently to cause switch 34 to close when the device is positioned in the patient's mouth.

As treatment of the patient progresses, band 28 may be adjusted to increase or decrease the force that must be applied to the mouth bow. To facilitate this task, a strain gage 44 is coupled to band 28. Such a strain gage may, for example, include a piezodielectric element. Thus a measure of the electrical resistance across terminals 46 of the strain gage is an indication of the force being exerted on the patient's teeth when the orthodontia device is worn and the orthodontist may vary the force applied by adjusting the length of the band.

The present invention contemplates the use of an alarm, audible and/or visual to give warning in the event that the orthodontia device is improperly worn or removed. To this end, terminals 36 and 38 of the band are connected through leads 48 and 50 in series with the regenerative path of the feedback loop of an audio oscillator 52. As shown in the block diagram comprising FIG. 6, the output of audio oscillator 52 is amplified through amplification stages 54 and then transmitted at a radio frequency determined by the RF carrier oscillator 56 through antenna 58. In FIG. 7, a circuit design for a typical transmitter is illustrated. It should be realized that FIG. 7 is merely for illustrative purposes and that the various components can take on many other embodiments than that shown. Accordingly, it is contemplated that the entire transmitter may be micro-miniaturized and carried on band 28 in the form of a wafer or disc. It should also be obvious that the illustrated circuit of FIG. 7 is well known and hence need not be explained in detail with the exception of the regenerative path of the audio oscillator which has been modified for the present application. Accordingly, the regenerative path of the audio oscillator includes two parallel resistors, 60 and 62, which are of equal value. Switch 34 is in a series with resistor 62. Thus when switch 34 is opened the resistance between junctions 64 and 66 is twice that as when switch 34 is closed and when power is applied by closing power switch 63 the frequency of the audio oscillator 52 with switch 34 open is less than that when switch 34 is closed. By properly choosing components, two easily distinguishable tones, as for example 266 Hz. and 313 Hz., may be used

for the open switch and close switch frequencies. The tones generated by oscillator 52 may be audibly monitored by means of a standard AM receiver 18 tuned to the frequency of the RF carrier oscillator 56.

In FIG. 8 a circuit is illustrated for the visual alarm unit 20 of the present invention. In this connection, two leads, 68 and 70 are connected to the output transformer terminals of the speaker of radio receiver 18. Leads 68 and 70 are connected to the primary of an input transformer 72, the secondary of which is connected to the primary winding of a transformer 74 for a frequency sensitive relay (resonant reed switch) 74. The secondary of relay 74 serves to energize solenoid 76 to close switch 77 at the low frequency of transmitter 16 and to energize solenoid 78 to close switch 79 at the high frequency of transmitter 16. Switches 77 and 79 each have connected in series therewith a lamp 80 and 82 respectively, which appear on the front panel of the visual alarm. The lamps are each connected in series with a power supply 84 through switch 86. Thus, when power is applied to unit 20 and transmitter 16 and radio 18 are turned on, one switch, 77 or 79, will close depending on the mode of the orthodontic device, thereby in turn causing either bulb 80 or 82 to glow. Suitable colored lenses may be placed over the bulbs to facilitate the determination of the mode of the visual unit.

Thus in accordance with the above, the aforementioned objects and advantages are effectively attained.

Having thus described the invention what is claimed is:

1. An improved orthodontia appliance comprising: a face bow, said bow including a mouth brace adapted to be positioned within the mouth of an orthodontia patient and to engage certain teeth of the patient and band lugs on both sides of said brace adapted to remain outside the mouth of the patient when the bow is in use; an elastic band extending between said band lugs, the resiliency of said band being such as to cause said mouth brace to impart a predetermined force on said certain teeth when said brace is positioned in the mouth of the patient and the band is positioned about the head of the patient; and alarm means operatively coupled to said band and adapted to generate an alarm signal in response to the stretching or relaxing of said elastic band.

2. The invention in accordance with claim 1 wherein said alarm means includes switch means coupled to said elastic band, said switch means being adapted to be shifted between a first mode when said band is stretched sufficiently to cause said mouth brace to exert said predetermined force and a second mode when said band relaxes or stretches less than the amount required to exert said predetermined force wherein said alarm signal is responsive to the mode of said switch means.

3. The invention in accordance with claim 2 wherein said alarm means further comprises radio transmitting means, said transmitting means being adapted to transmit signals of differing, predetermined frequencies when power is applied thereto and said switch means is in said first and second modes, and radio receiving means responsive to said transmitting means whereby the mode of said receiving means is indicative of the mode of said switch means.

4. The invention in accordance with claim 3 wherein said transmitting means includes an RF oscillator adapted to generate a carrier signal in the AM band range and said receiving means comprises an AM radio receiver adapted to be tuned to the frequency of said RF oscillator.

5. The invention in accordance with claim 1 wherein said transmitting means includes an audio oscillator, a regenerative feed back loop of said audio oscillator, a resistive element in said feed back loop, and said switch means comprises a part of said feed back loop whereby when said switch means is in said first mode, said resistive element assumes a first value and when said

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switch means is in said second mode said resistive element assumes a second value.

6. The invention in accordance with claim 5 wherein said switch means is adapted to switch the output of said audio oscillator between two frequencies and said alarm means further comprises a first light bulb connected to a power source in series with a first frequency sensitive relay switch, a second light bulb connected to a power source in series with a second frequency sensitive relay switch, and said first and second relay frequencies correspond to the output frequencies of said audio oscillator.

7. The invention in accordance with claim 2 wherein said switch means includes a first terminal coupled to said band; a second terminal coupled to said band spaced apart from said first terminal in the longitudinal stretch direction of said band; a length of insulated electrically conducting wire; a first end of said wire connected to said first terminal, said wire overlying and making contact with said second terminal; a portion of said wire extending past said second terminal; and an uninsulated

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section of said wire portion, wherein when said band relaxes, said insulated wire makes contact with said second terminal whereby to open the circuit between said terminals and when said band is stretched said uninsulated section of wire makes contact with said second terminal whereby to close the electric circuit between said terminals.

8. The invention in accordance with claim 1 wherein said elastic band is adjustable and further comprising strain gage means coupled to said band in line with the stretch axis of said band.

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