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(54) DIGITAL REMOTE CONTROL OF ANALOG POTENTIOMETERS FOR GUITAR AMPLIFIERS

(57) The device for remote control of potentiometers (2) for electronic devices, in particular analog musical amplifiers (3), comprising at least one external controller (4) of the potentiometer (2) of the amplifier (3), comprising a removable body (5) mounted by means of a clamping device to the outer surface of the amplifier (3), at least one rotary head (6) adapted to be mounted on the potentiometer (2), connected to the body (5), servo-drive (8) for rotating the rotary head (6) and a control unit (19) for controlling rotation of the servo-drive (8) and for storing the set positions of the servo-drive (8), wherein the device further comprises at least one foot controller (20, 21, 22, 23) fixed or wirelessly connected to the control unit (19) for switching the set positions of the servo-drive (8) stored in the control unit (19).

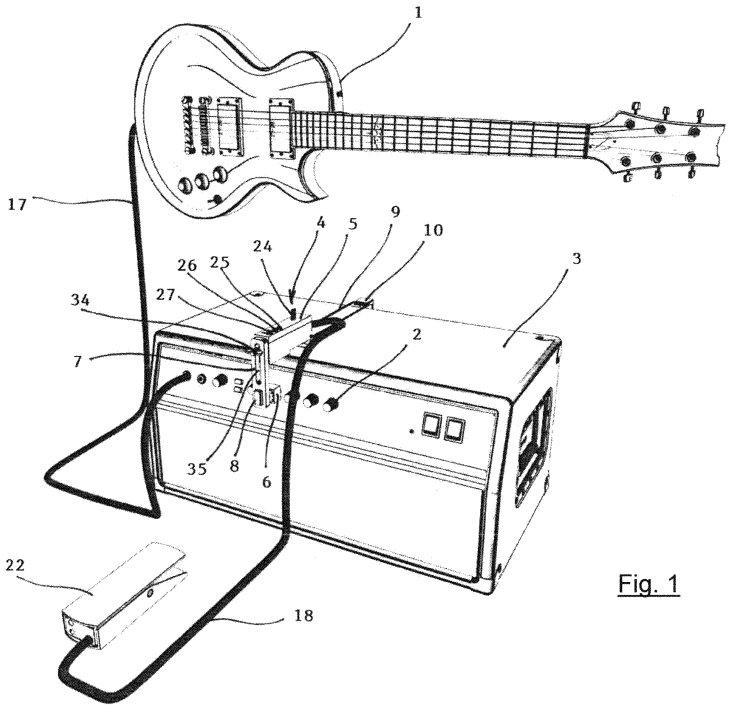

Fig. 1

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Description

Field of the Invention

[0001] The present invention relates to electronics, particularly a device for remote control of potentiometers for electronic instruments, in particular analog musical amplifiers of higher quality class.

Background of the Invention

[0002] In order to minimize the costs, the current mass production is based on SMD components, minimization of PCBs and digitization including multiple use of AD/DA converters. This all has a demonstrably negative effect on sound.

[0003] Digital amplifiers with remote control are commonly known. This segment also includes simulation/modelling devices that try to replace analog amplifiers with digital technologies. They are the instruments based on a combination of synthesis and standard convolution, or more advanced technologies, experimenting with a dynamic convolution analysis. These digital amplifiers are generally perceived by musicians as sound inferior and incomparable with the above tube amplifiers. Because digital amplifiers are light and small, they are used as transitional solutions bringing greater mobility, but at the expense of sound quality. To achieve good sound, their popularity is far below tube amplifiers that have a privileged position in terms of really quality gain.

[0004] Really good amplifiers that are popular among musicians, are largely based on the design principles defined in the 1950s and 1960s in order to achieve the highest possible sound quality. They are equipped with specific components such as film capacitors, ceramic resistors, and the so-called NOS components (New Old Stock) are frequently used. The instruments are designed using conventional methods such as solder ears, use of wires and cables instead of the conductive paths of printed circuits, use of hand-wound transformers, etc. Such amplifiers show a major qualitative difference from the current mass production. In terms of acoustics, the qualitative specifics may include higher proportion of even aliquots, specific hysteresis in the gain given by transient response of tubes, effect of conversion transformers, dynamic range and quality of sound. For all the above reasons, any intervention in the instrument is absolutely unacceptable for the vast majority of the owners of such quality musical amplifiers.

[0005] Other solutions to remote control for musical analog amplifier, or lamp or transistor combo are known, wherein the term "combo" means an amplifier with a loudspeaker in one cabinet. For the purposes of following description, the common term "amplifier" will be used. The remote control controls the selected adjustable parameter such as volume, distortion, bass, treble, etc. The standard procedure for installing a remote control for such an electronic device is to remove a designated controller and replace it with a motorized potentiometer while installing the control electronics in amplifier cabinet. All this, however, is virtually impossible to perform for quality musical amplifiers without the amplifier losing its qualitative sound parameters, for which it is used by musicians. Extended models of lamp and transistor amplifiers with two or three channels are also known. However, in such cases, a compromise is very frequent in the form of joint corrections, i.e. equally set equalizer for these channels. This by itself significantly reduces the possibilities of sound flexibility and without additional effects, the capacity of multi-channel amplifiers is similarly limited as for single-channel amplifiers.

[0006] For quality analog amplifiers, the guitar sounds the best with the simplest possible connection: guitar, cable, and amplifier. Thus set sound is harmonically colourful and very dynamic. It is significantly affected by different playing techniques: fingers, plectrum, flageolets, pulling the strings, etc. There is a transmission of characteristics of the instruments to the overall sound; the used wood of fingerboard, body and neck, height and thickness of strings, used sensors and other factors will be reflected. The fundamental advantage is the overall feeling in playing, when the musician perceives very good response of resulting tone to his/her playing technique.

[0007] The obvious disadvantage is the possibility of having only one set sound setting. This is a big limitation, because at least three basic sounds: clean, distorted and solo, are required for even the simplest styles. For our purposes, it is important to note that the transition between the three sounds "clean-distorted-solo" can be achieved by appropriate setting of Volume potentiometer, possibly together with the Gain (distortion). Most musicians use even greater number of sounds than those 3 basic sounds. This is because of greater variety of colour and better scalability while playing music. Standard options of how to have several sounds are listed below: The musician sets a heavily distorted sound. Then he/she changes the sound by using the Volume potentiometer on the guitar. The disadvantage is that rotating the Volume potentiometers on the guitar will change the quality of sound, because the path will include a capacitor and a resistance load. This change is significant, and it does not satisfy a large number of musicians. The principal disadvantage is the inability to change the sound always the same - we are never able to turn the potentiometer as at the previous point, we have a slightly different sound each time (except for the extreme position). This procedure is also unsuitable for obtaining a proper pure sound, because the path includes a capacitor and a resistance which reduce treble and degrades the tone.

[0008] The musician includes effect devices in the signal path: either between guitar and amplifier, or in the effect loop. The disadvantage is that the sound is not as good as in basic guitar-cable-amplifier connection, signal degradation is heard. The feeling in playing is also degraded. This procedure is most common, but at the expense of sound quality. Such solutions are described, for

example, in patent documents US 7678985 (B2) and US 6881891 (B1).

[0009] The musician has several amplifiers, switches the signal path from the guitar to the selected amplifier. The disadvantage is that there is a crossover in the signal path. The costs of purchasing several amplifiers are very high and it is also a solution with considerable space requirements.

[0010] The object of the invention is to provide such a remote control of potentiometers of the amplifier, which would allow to set different sounds and switch among them, without the use of external effects or several amplifiers, while connecting the guitar through the cable directly to the amplifier, without any intervention in its design and without degradation of its sound. Such a solution would allow extending musical analog amplifiers, and lamp and transistor combos to include a remote control and change of sounds without adverse effect on quality.

Summary of the Invention

[0011] The task deals with a device for remote control of potentiometers for electronic instruments, in particular analog musical amplifiers according to the present invention. The device consists of at least one external controller of the potentiometer of the amplifier that has a foot controller and turns the potentiometer of the amplifier, e. g. volume or distortion, allowing the musician to change the volume or timbre while playing. The external controller comprises a removable body mounted by means of a clamping device to the outer surface of the amplifier, at least one rotary head adapted to be mounted on a potentiometer, connected to the body, servo-drive for rotating the rotary head, and a control unit for controlling rotation of the servo-drive and for storing the set positions of the servo-drive. The device further comprises at least one foot controller fixed or wirelessly connected to a control unit for switching the set positions of the servo-drive stored in the control unit.

[0012] The device is designed as an external non-invasive device. The basic principle is based on mechanical attachment of the external controller to the amplifier and on transmission of torque from a motorized servo-drive shaft via a rotary head to a potentiometer of an amplifier. This does not necessarily include a musical amplifier; the solution can be used for various electronic instruments equipped with potentiometers, which need remote foot control. With respect to the above specific requirements of high-quality audio devices, the present solution meets the conditions of intervention-free installation in the instrument and attachment to the instrument without mechanical damage.

[0013] The clamping devices can be of various designs known to the expert, e.g. hook-and-loop fasteners, gluing, screws and other fasteners, etc. In terms of simplicity and non-intervention in the amplifier design, it is preferable when clamping devices for removable clamping of the body to the amplifier comprise at least one elastic element provided with a hook at the end, which is hooked to the edge of the side of the amplifier. Removal and installation are fast and sufficiently strong.

[0014] Such interconnection of the rotary head and the body, and location of the servo-drive for rotating the rotary head can have a number of designs. In the preferred embodiment, a rotary head is connected to a body through a carrier arm, which forms, with the body, the shape of the letter "L", with the body being mounted on the side of the amplifier other than the potentiometer of the amplifier; the carrier arm extends to the side of the amplifier, where the potentiometer of the amplifier is arranged, and a rotary head with a servo-drive is mounted on the carrier arm.

[0015] Since the distances of potentiometers from the edge of the side of the amplifier are different for different amplifiers, it is preferable that the rotary head with the servo-drive is mounted on the carrier arm with the possibility of sliding adjustment of its position on the carrier arm.

[0016] It is also preferable when a carrier arm is divided and is provided with a joint for tilting the portion of the carrier arm carrying a rotary head with a servo-drive. If a musician wants to control the potentiometer by hand, he/she does not have to take off the whole external controller, it is only sufficient to tilt the hinged part of the carrier arm and the controller will remain attached to the amplifier.

[0017] The rotary head is preferably adjusted for fitting on the potentiometer of the amplifier so as to form an inner shaped recess therein whose shape corresponds to the outer shape of the potentiometer of the amplifier. The rotary head is thus simply fitted on the potentiometer, surrounding it closely, and because the potentiometer is generally provided with projections, the head has grooves corresponding to these projections, or a force is transferred by adhesion. Alternatively, the rotary head could be clamped to the potentiometer in other ways such as clamps, magnets, hook-and-loop fasteners, etc.

[0018] In one preferred embodiment, at least two external controllers of the potentiometer are separately mounted with the possibility of sliding movement on a common prismatic rail, which is provided with a clamping device for clamping to the surface of the amplifier, comprising an elastic element provided with a hook at the end. This allows to place several external controllers on a prismatic rail per single clamping, whose positions are adjusted by sliding along the rail to the position and pitch of potentiometers of the amplifier.

[0019] In another preferred embodiment, at least two external controllers are integrated into an integrated body to which an adjustable carrier arm is attached, on which a carrier strip is mounted carrying at least two rotary heads with servo-drives. This embodiment has fixed pitches of rotary heads and is designed for a specific type of amplifier where the musician buys two or three or more rotary heads with servo-drives and fits them on the slots in the carrier rail in positions corresponding to potenti-

ometers, which he/she wants to control. Preferably, the integrated body is mounted on the support foot and provided with a clamping device for clamping to the surface of the amplifier, comprising an elastic element provided with a hook at the end.

[0020] The control unit includes a processor, a memory for storing the set values of the position of the servo-drive and a software tool for controlling storage of the set values and controlling the movement of the servo-drive between the set values according to an output signal from at least one foot controller, connected with the control unit via a control cable or bus or wirelessly; the control unit further comprises an output to the servo-drive, an input from the servo-drive and controls for setting and storing the set values of the position of the servo-drive.

[0021] In the preferred embodiment, the control unit is mounted in the body where it is protected, but it could be essentially mounted anywhere else outside the body, e. g. in the foot controller. In the simplest embodiment, mechanical-electrical controls are housed in the body in addition to the control unit for setting and storing the set values of the position of the servo-drive. These devices form an adjusting potentiometer for manual positioning of the servo-drive, push button to select the first set position of the servo-drive, push button to select the second set position of the servo-drive, and push button to save the set values in memory. By rotating the adjusting potentiometer, the servo-drive rotates and through the rotary head rotates the potentiometer of the amplifier up to the position that the musician wants to save. Saving is made by simultaneously pressing the push button to select the first set position of the servo-drive or the push button to select the second set position of the servo-drive, and the push button to save the set values in memory.

[0022] In another preferred embodiment, the control unit is connected via the MIDI protocol or USB port to an external computer, tablet or is wirelessly or via the USB port connected to a smart phone, which includes software control tools for setting and storing the set values of the position of the servo-drive in the control unit or in its memory.

[0023] The foot controller is preferably formed by a two-position switch or a multi-position switch or a continuous pedal or a MIDI type controller.

[0024] The essential advantage of the present device is that it allows the use for musical instruments of higher classes, where traditional additional installation of remote control with intervention in the instrument is unacceptable. Other than manual control is not possible. On the other hand, the possibility of remote control significantly expands their acoustic palette. It finds its use especially in playing live: changing the volume, setting the level of distortion and possibly changing the equalizer bands, etc.

[0025] Other advantages of the present device are based on the above mentioned principles, which have been taken into account in the design. Installation requires neither mechanical nor electronic interventions in the amplifier. Attachment to the amplifier is without mechanical damage, and it is easy and fast. The design includes testing for being able to place the device on as many types of amplifiers as possible. It is easy to transport, has a compact design, without specific requirements on the knowledge of the operator. The advantage is also the mobility of the user who does not need to be fixed to the space within range of the device while using the device. Another benefit is possible program setting of individual positions in time. The solution allows precise repeated positioning of the regulating element, beyond the reach of the human hand. The device eliminates the need to connect any additional instruments (effect devices: floor or rack effects). This consequentially brings simplification of the signal chain where it is not necessary to connect devices between the instrument and the amplifier, which cause certain degradation of the signal and additional costs. It is therefore acceptable for instruments of the highest quality class.

Explanation of drawings

[0026] The invention will be explained in detail by drawings where the following is illustrated:

- Fig. 1 shows a front perspective view of the amplifier with potentiometers on the front panel, with one external controller fitted on volume potentiometer, and with the foot controller of continuous pedal type, with the guitar connected via cable directly to the amplifier,
- Fig. 2 shows a perspective view of the amplifier with potentiometers on the top panel, with two external controllers fitted on volume and distortion potentiometers, and with the foot controller of MIDI type, with the guitar connected via cable directly to the amplifier,
- Fig. 3 shows a rear perspective view of the amplifier according to Fig. 1, showing the clamping devices for clamping the external controllers to the edge of the side of the amplifier,
- Fig. 4 shows a front perspective view of the external controller sliding-mounted on the prismatic rail,
- Fig. 5 shows a front perspective view of the external controller mounted on the support foot,
- Fig. 6 shows a front perspective view of three external controllers sliding-mounted on the common prismatic rail on the amplifier with potentiometers on the front side,
- Fig. 7 shows a front perspective view of five external controllers integrated in the integrated body, mounted on the amplifier with potentiometers on the front side,
- Fig. 8 shows a conical potentiometer with grooving and projection,
- Fig. 8' shows a rotary head with a recess for the potentiometer as shown in Fig. 8,

Fig. 9 shows a conical potentiometer with grooving,
Fig. 9' shows a rotary head with a recess for the potentiometer as shown in Fig. 9,
Fig. 10 shows a conical potentiometer without grooving,
Fig. 10' shows a rotary head with a recess for the potentiometer as shown in Fig. 10,
Fig. 11 shows a potentiometer with a wedge-shaped projection,
Fig. 11' shows a rotary head with a recess for the potentiometer as shown in Fig. 11,
Fig. 12 shows a flow diagram of the device of the invention

Examples of the invention embodiments

[0027] The first example shown in Fig. 1 illustrates a front perspective view of the amplifier **3** with potentiometers **2** on the front panel, with one external controller **4** fitted on volume potentiometer **2**, and with the foot controller of continuous pedal type **22**, with the guitar **1** connected via connecting cable **17** directly to the guitar output of the amplifier **3**. The continuous pedal **22** is shown in Fig. 1 by way of example only, the foot controller may also consist of the two-position switch **20** or the multi-position switch **21** or the MIDI type controller **23**. The control cable **18** runs from the foot controller to the body **5** of the external controller **4**. Connection can also be made as wireless, as described below. The body **5** is mounted on the top plate of the amplifier **3** and using the elastic element **9** with a hook **10**, it is attached to the rear edge of the top plate of the amplifier **3**. The elastic element **9** is formed by a rubber rope. Attachment is also possible using the cover plates of control panels, side edges, or the main handle for carrying the amplifier **3**. The control unit **19** with a processor **28** is mounted in the body **5**, which comprises a memory **29** for storing the set values of the position of the servo-drive **8**, and the software tool **30** for controlling storage of the set values and controlling the movement of the servo-drive **8** between the set values according to the output signal from the foot controller **20**, **21**, **22**, **23**, as shown in the diagram in Fig. 12. The controllers run from the body **5** for setting and storing the set values of the position of the servo-drive **8**, which consist of the adjusting potentiometer **24** for manual positioning of the servo-drive **8**, the push button **26** to select the first set position of the servo-drive **8**, the push button **27** to select the second set position of the servo-drive **8** and the push button **25** to store the set values in memory **29**. In this embodiment, the controllers are suitable for two-position switch **20**. If the multi-position switch **21** was used, other non-illustrated push buttons would be used on the body **5** to select the third to n-th set position of the servo-drive **8**. The carrier arm **7** is attached to the body **5** at right angles, which extends to the front plate of the amplifier **3** up to the volume potentiometer **2**, not visible in Fig. 1 because it is mounted in the rotary head **6**. The carrier arm **7** has an oval hole **35**, through which the fastening screw passes from the body **5** and is attached to this screw by means of the wing nut **34**. This attachment enables positioning of the carrier arm **7** so that the end of the carrier arm **7** reaches the potentiometer **2**. Attachment of the carrier arm **7** to the body **5** can be performed using a number of other methods known to the expert. At the end of the carrier arm **7**, there is the servo-drive **8**, which is connected to the rotary head **6** by fixed or flexible connection by means of a non-illustrated Bowden cable. The rotary head **6** is adjusted for fitting on the potentiometer **2** of the amplifier **3** so as to form an inner shaped recess **12** therein whose shape corresponds to the outer shape of the potentiometer **2** of the amplifier **3**. Examples of the shape possibilities are shown in Fig. 8 to Fig. 11'. The servo-drive **8** is connected to the control unit **19** in the body **5** via the output **32** from the control unit **19** to the servo-drive **8** and the input **33** to the control unit **19** from the servo-drive **8**. These cables are not seen in Fig. 1 because they are installed in the carrier arm **7**, but are illustrated in the diagram in Fig. 12.

[0028] The device of Fig. 1 works so that the body **5** is attached to the amplifier **3** and the rotary head **6** is mounted on the volume potentiometer **2**. Rotating the adjusting potentiometer **24** controls the servo-drive **8**, which via the rotary head **6** rotates the potentiometer **2** of the amplifiers **3** as if rotated manually by a musician. The position corresponding to a lower volume will be selected, and simultaneously pressing the push button **26** to select the first set position of the servo-drive **8** and the push button **25** to store the set values, this position will be stored by means of software tool **30** in memory **29** of the processor **28** of the control unit **19**. Further rotating the adjusting potentiometer **24** will select the position corresponding to a higher volume and simultaneously pressing the push button **27** to select the second set position of the servo-drive **8** and the push button **25** to store the set values, this position will be stored by means of software tool **30** in memory **29** of the processor **28** of the control unit **19**. Where several position push buttons are installed, several selected set positions of the servo-drive **8** can be thus stored. During performance, the musician switches between the set positions of the servo-drive **8** and therefore between the lower volume and the higher volume with the use of the foot controller **20**, **21**, **22**, **23**, having free hands and still using natural quality sound of the amplifier **3**. The foot controller **20**, **21**, **22**, **23** is generally passive and does not require power supply, but it can supply power to the external controller **4**, or the external controller **4** can have own power supply, e.g. battery supply.

[0029] The second example of Fig. 2 and Fig. 3 shows a front perspective view of the amplifier **3** with potentiometers **2** on the top plate, with two external controllers **4** fitted on volume and distortion potentiometers **2**, and with the foot controller of multi-position switch **21** type. The guitar **1** is connected via the connecting cable **17** directly to the guitar input of the amplifier **3**. The multi-

position switch **21** is connected via the control cable **18** to the bodies **5** of both external controllers **4**, whose design is the same as in the first example of embodiment. The bodies **5** are mounted on the support feet **16** on the rear plate of the amplifier **3** and attached by means of elastic elements **9** with hooks **10** to its rear edge. The carrier arms **7** extend to the potentiometers **2** on the top plate of the amplifier **3**. The design of the external controllers **4** is the same as in example 1, each can store at least two set positions of the servo-drive **8**, which are then switched by foot switches on the multi-position switch **21**. Storage, switching and power supply are solved as in the first example of the embodiment. This example is suitable for the simultaneous control of two potentiometers **2**, e.g. volume and distortion. The musician can store the sounds given by the combinations of set positions of the individual potentiometers. The body **5** is made in the form of a narrow box, with a width of approximately 2 cm. The normal pitch between the potentiometers **2** of the amplifiers **3** is 3 to 4 cm for easy access for control and enough space. The quality analog amplifiers **3** are big because there are space-consuming components inside the chassis such as transformers, lamps, film capacitors, etc. Therefore, several external controllers **4** can be simultaneously placed next to each other on one amplifier **3** without problems. For detail of one independent external controller **4** see perspective view in Fig. 5, which shows the joint **11** for tilting the end portion of the carrier arm **7** with the servo-drive **8** and the rotary head **6**.

[0030] The third example of Fig. 4 and Fig. 6 illustrates the embodiment comprising three external controllers **4**, whose design is the same as in the first and second examples but which are sliding-mounted on the common prismatic rail **13** on the amplifier **3** with potentiometers **2** on the front side. The support foot **16** of the body **5** fits in one of two prismatic grooves **15** on the prismatic rail **13**. Moving the bodies **5** along the prismatic rail **13** finds the position of the rotary head **6** corresponding to a particular potentiometer **2**, e.g. volume, distortion, and bass or treble. Mounting the external controllers **4** is performed by placing the prismatic rail **13** on the amplifier **3** and fixing it with the elastic element **9** with a hook **10** to the edge of the top plate of the amplifier **3**. The bodies **5** are slid or snapped in the prismatic grooves **15** and are moved therein along the axis parallel with the edge of the amplifier **3** so that the rotary heads seat on the potentiometers **2**. Storage, switching and power supply are solved as in the first example of the embodiment. The musician can store the sounds given by the combinations of set positions of the individual potentiometers **2** and control their switching by means of the selected foot controller **20**, **21**, **22**, **23**.

[0031] The fourth example of Fig. 7 shows a front perspective view of five external controllers **4** integrated in the integrated body **5**, mounted on the amplifier **3** with potentiometers **2** on the front plate. The external controllers **4** do not have separate bodies **5**, but are placed in the integrated body **5'**, to which the adjustable integrated carrier arm **7'** is attached, on which the carrier strip **14** is mounted carrying five rotary heads **6** with the servo-drives **8**. The carrier strip has slots **36**, into which the servo-drives **8** are snapped carrying the rotary heads **6**. The musician chooses the slot **36** to fit and the potentiometer **2** to control using the selected foot controller **20**, **21**, **22**, **23**. The integrated body **5'** is mounted on the support foot **16** and provided with a clamping device for clamping to the surface of the amplifier **3**, comprising an elastic element **9** provided with a hook **10** at the end. Storage, switching and power supply are solved as in the first example of the embodiment. It is a compact solution for the use of several external controllers **4** at once and thereby for setting rich combinations of sounds. For the individual most widespread types of amplifiers **3** such as Fender, Marshall, Vox, Bogner, there are the shape- and pitch-adapted carrier rails **14**, enabling quick installation of the assembly on the amplifier **3** and its removal.

[0032] Switching between the set positions of the servo-drive **8** is controlled through the selected foot controller **20**, **21**, **22**, **23**. The two-position switch **20** allows switching between the two sounds, which is the simplest variant of the solution. It requires no extra sophisticated devices. In connection with the multi-channel amplifier **3**, it will allow to completely cover the requirements for the basic types of sounds. The multi-position switch **21** is made in the form of a rail, on which there are several foot switches. Depressing them switches the external controller **4** to the programmed position for the respective set position of the servo-drive **8**. The variants of three, five or even more foot switches in several rows are available. The foot continuous pedal **22** allows for remote continuous change of the position of the potentiometer **2**. The MIDI controller **23** transmits data, whose structure and frame are generally defined by the MIDI standard. This MIDI protocol is a standard in the field of musical instruments. It will allow to connect any MIDI foot pedal (e.g. Rocktron, Voodoo Lab) via the standard MIDI cable **31** to the control unit **19**. On the body **5**, there will be the non-illustrated MIDI IN, and MIDI Out or MIDI Thru connector for chaining other MIDI devices.

[0033] The method of signal transmission between the foot controller **20**, **21**, **22**, **23** and the actual external controller **4** can be performed using the control cable **18** as shown in the attached drawings. Depending on the type of foot controller **20**, **21**, **22**, **23**, the two-core or multicore control cable **18** will be used. Is it possible to use the serial interface with USB connectors. The non-illustrated wireless connection can be also used, such as Bluetooth protocol, WiFi, etc.

[0034] The method for programming and setting the positions of the servo-drive **8** can be solved manually, as illustrated in the attached drawings and described above, i.e. the controllers for setting and storing the set values of the position of the servo-drive **8** are arranged in the body **5** and forms the adjusting potentiometer **24** for manual positioning of the servo-drive **8**, the push but-

ton **26** to select the first set position of the servo-drive **8**, the push button **27** to select the second set position of the servo-drive **8**, and the push button **25** to store the set values in memory **29**.

[0035] In other non-illustrated examples of embodiment, the controllers for setting and storing the set values of the position of the servo-drive position **8** can be remote. The control unit **19** may be wirelessly or via the non-illustrated USB port connected to the non-illustrated external computer or tablet, which includes software controls for setting and storing the set values of the position of the servo-drive **8**. Alternatively, the control unit **19** is wirelessly connected to a smart phone that contains software control tools for setting and storing the set values of the position of the servo-drive **8**. The application installed in the smart phone will allow to store the set positions in the memory, transfer them between the foot controllers **20**, **21**, **22**, **23**, update firmware, and perform manual regulation, etc.

[0036] Through the application installed in the smart phone, the user moving his/her finger across the screen will change the position of the servo-drive **8**. After achieving the desired position, it will be stored in smart phone memory. The set positions will be automatically transferred to the control unit **19**. Therefore, the smart phone will not be required during musical production. Switching between the saved sounds will continue to take place through the foot controllers **20**, **21**, **22**, **23**, as mentioned above. The method for storing positions in the memory **29** will change. Preferably, it will be possible to change remotely the settings stored in the memory **29**, without having to stand right next to the amplifier **3**. Furthermore, it will be possible to store the settings of the positions of several servo-drives **8** in one memory position at once. Recalling the stored memory **29** thus leads to simultaneous readjustment of several servo-drives **8** at once, which will be suitable for embodiments of the third and fourth examples. This will allow for a more complex change in the sound at a time.

[0037] The power supply for the external controller **4** is solved by a non-illustrated battery mounted in the body **5**, e.g. 9V, an internal rechargeable battery, or non-illustrated external adapter or via the powered foot controller **20**, **21**, **22**, **23**.

Industrial Applicability

[0038] The device of the invention can be used for remote control of the potentiometers of electronic instruments, in particular analog musical amplifiers of higher quality class.

List of Reference Numerals Used in the Drawings

[0039]

1 guitar
2 amplifier potentiometer
3 analog musical amplifier
4 external potentiometer controller
5 body
5' integrated body
6 rotary head
7 carrier arm
7' integrated carrier arm
8 servo-drive
9 elastic element
10 hook
11 joint
12 inner shaped recess
13 prismatic rail
14 carrier strip
15 prismatic groove
16 support foot
17 connecting cable
18 control cable
19 control unit
20 foot controller - two-position switch
21 foot controller - multi-position switch
22 foot controller - continuous pedal
23 foot controller - MIDI type controller
24 adjusting potentiometer
25 push button to save the set values in memory
26 push button to select the first position of the servo-drive
27 push button to select the second position of the servo-drive
28 processor
29 memory
30 software tool
31 MIDI cable
32 output from the control unit to the servo-drive
33 input to the control unit from the servo-drive
34 wing nut
35 oval hole
36 slot

Claims

1. The device for remote control of potentiometers (2) for electronic devices, in particular analog musical amplifiers (3), **characterized in that** it comprises at least one external controller (4) of the potentiometer (2) of the amplifier (3), comprising a removable body (5) mounted by means of a clamping device to the outer surface of the amplifier (3), at least one rotary head (6) adapted to be mounted on the potentiometer (2), connected to the body (5), servo-drive (8) for rotating the rotary head (6) and a control unit (19) for controlling rotation of the servo-drive (8) and for storing the set positions of the servo-drive (8), wherein the device further comprises at least one foot controller (20, 21, 22, 23) fixed or wirelessly connected to the control unit (19) for switching the set positions of the servo-drive (8) stored in the control unit (19).

2. The device according to claim 1, **characterized in that** the clamping device for removable clamping of the body (5) to the amplifier (3) comprises at least one elastic element (9) provided with a hook (10) at the end.

3. The device according to claim 1 or 2, **characterized in that** at least one rotary head (6) is connected to the body (5) through the carrier arm (7), which forms, with the body (5), the shape of the letter "L", wherein the body (5) is mounted on the side of the amplifier (3) other than the potentiometer (2) of the amplifier (3); the carrier arm (7) extends to the side of the amplifier (3), where the potentiometer (2) of the amplifier (3) is arranged, and the rotary head (6) with the servo-drive (8) is mounted on the carrier arm (7).

4. The device according to claim 3, **characterized in that** the rotary head (6) with the servo-drive (8) is mounted on the carrier arm (7) with possibility of sliding adjustment of its position on the carrier arm (7).

5. The device according to claim 3 or 4, **characterized in that** the carrier arm (7) is divided and is provided with a joint (11) for tilting the portion of the carrier arm (7) carrying the rotary head (6) with the servo-drive (8).

6. The device according to any of claims 1 to 5, **characterized in that** the rotary head (6) is adjusted for fitting on the potentiometer (2) of the amplifier (3) so as to form an inner shaped recess (12) therein whose shape corresponds to the outer shape of the potentiometer (2) of the amplifier (3).

7. The device according to claims 3 to 6, **characterized in that** at least two external controllers (4) of the potentiometer (2) are separately mounted with the possibility of sliding movement on a common prismatic rail (13), which is provided with a clamping device for clamping to the surface of the amplifier (3), comprising an elastic element (9) provided with a hook (10) at the end.

8. The device according to any of claims 3 to 6, **characterized in that** at least two external controllers (4) are integrated into an integrated body (5'), to which an adjustable integrated carrier arm (7') is attached, on which a carrier strip (14) is mounted carrying at least two rotary heads (6) with servo-drives (8).

9. The device according to claim 8, **characterized in that** the integrated body (5') is mounted on the support foot (16) and provided with a clamping device for clamping to the surface of the amplifier (3), comprising an elastic element (9) provided with a hook (10) at the end.

10. The device according to any of claims 1 to 9, **characterized in that** the control unit (19) includes the processor (28), the memory (29) for storing the set values of the position of the servo-drive (8) and the software tool (30) for controlling storage of the set values and controlling the movement of the servo-drive (8) between the set values according to an output signal from at least one foot controller (20, 21, 22, 23), connected with the control unit (19) via the control cable (18) or MIDI cable (31) or wirelessly; the control unit (19) further comprises the output (32) to the servo-drive, the input (33) from the servo-drive (8) and controls for setting and storing the set values of the position of the servo-drive (8).

11. The device according to claim 10, **characterized in that** the control unit (19) is mounted in the body (5) and the controls for setting and storing the set values of the position of the servo-drive (8) are also arranged in the body (5) and consist of adjusting potentiometer (24) for manual positioning of the servo-drive (8), push button (26) for selecting the first set position of the servo-drive (8), push button (27) for selecting the second set position of the servo-drive (8), and push button (25) for storing the set values in the memory (29).

12. The device according to claim 10, **characterized in that** the control unit (19) is via the MIDI protocol or USB port connected to the external computer or tablet, which includes software controls for setting and storing the set values of the position of the servo-drive (8).

13. The device according to claim 10, **characterized in that** the control unit (19) is wirelessly or via the USB port connected to the smart phone, which includes software controls for setting and storing the set values of the position of the servo-drive (8).

14. The device according to claims 1 to 13, **characterized in that** the foot controller comprises the two-position switch (20) or the multi-position switch (21) or the continuous pedal (22) or the MIDI type controller (23).

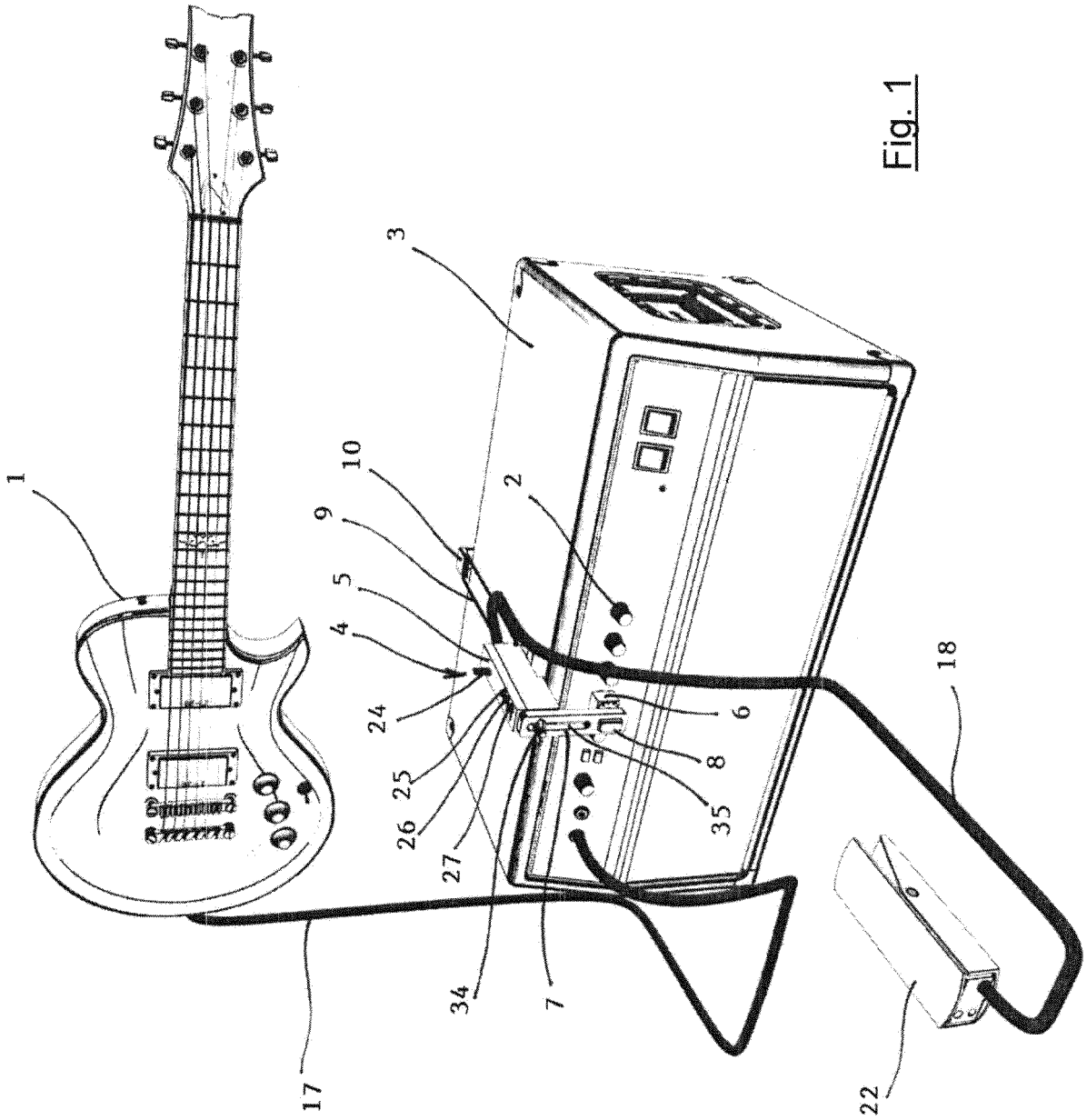

Fig. 1

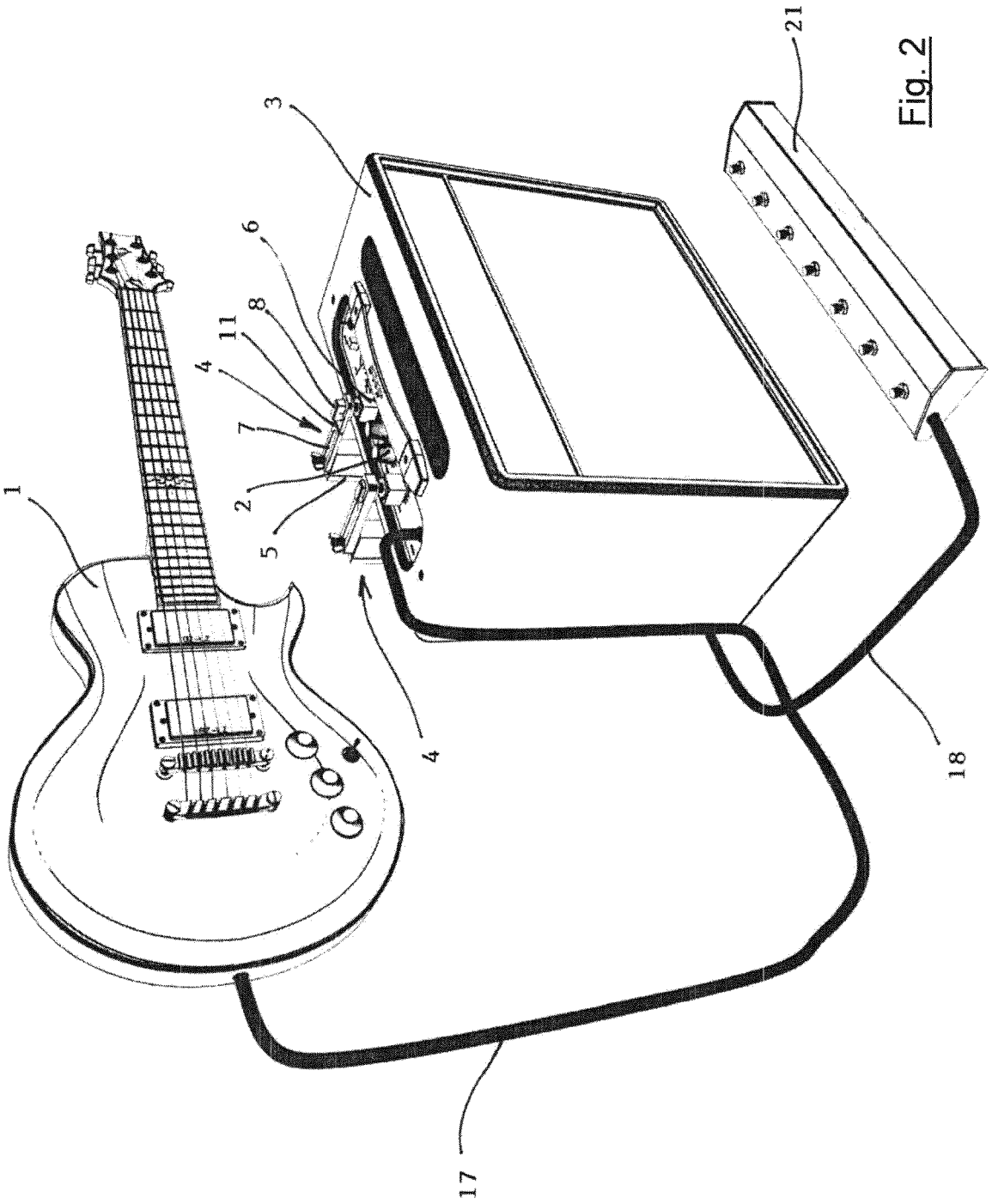

Fig. 2

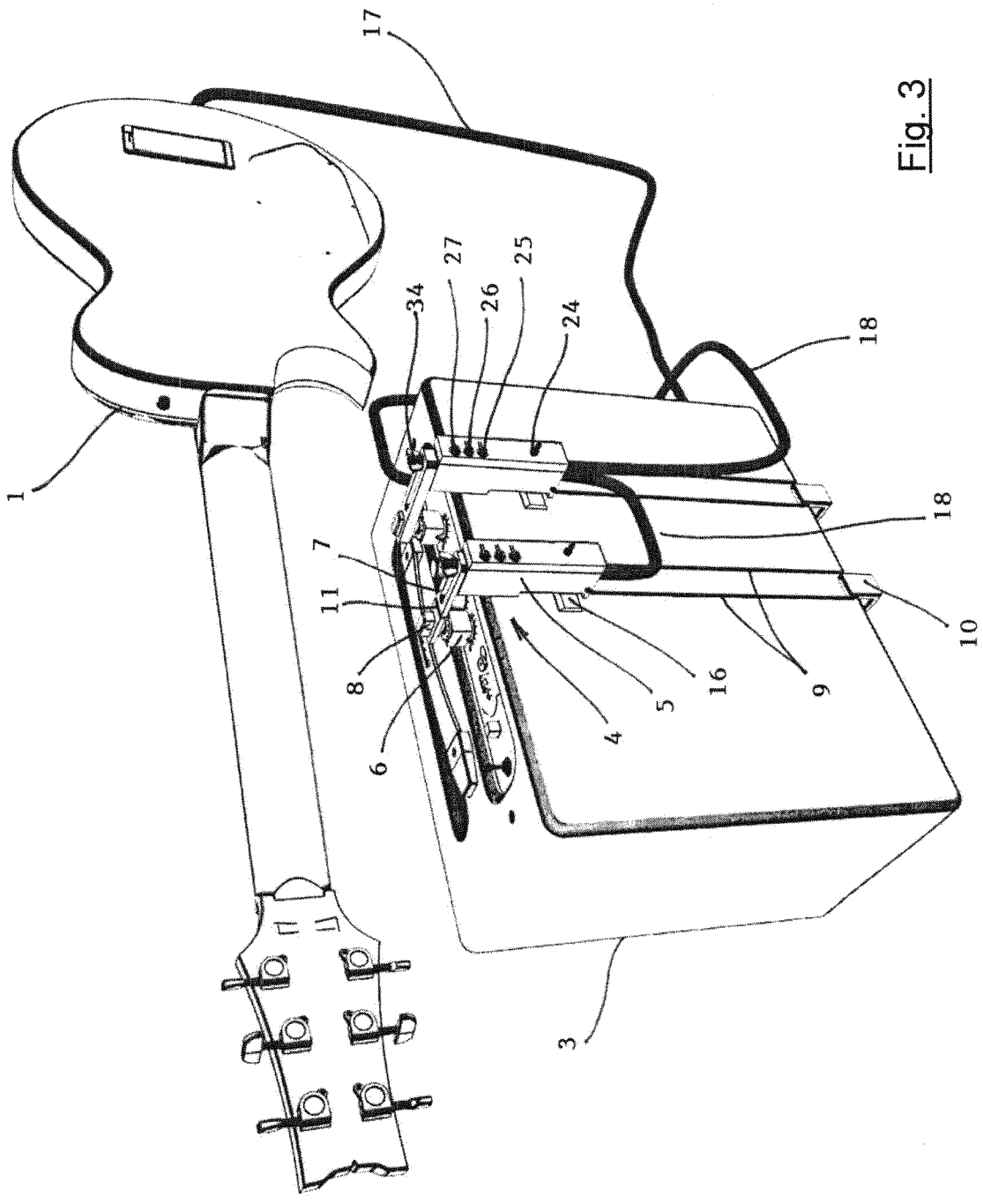

Fig. 3

Fig. 5

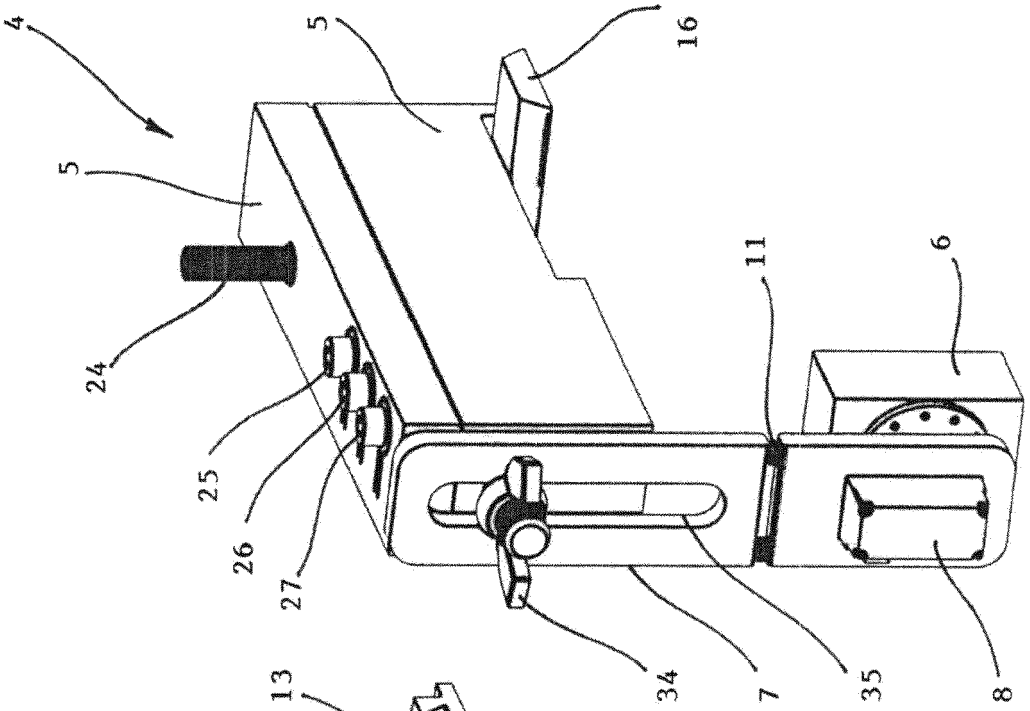
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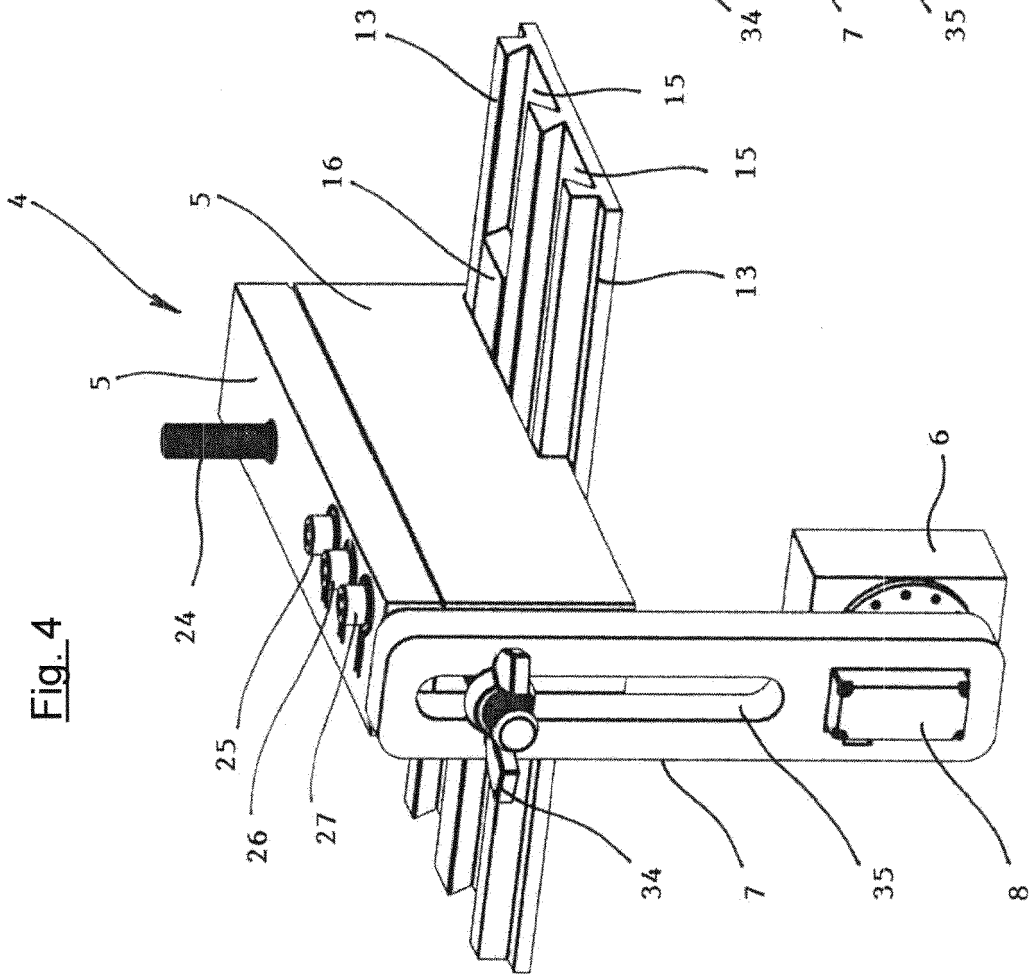
Fig. 4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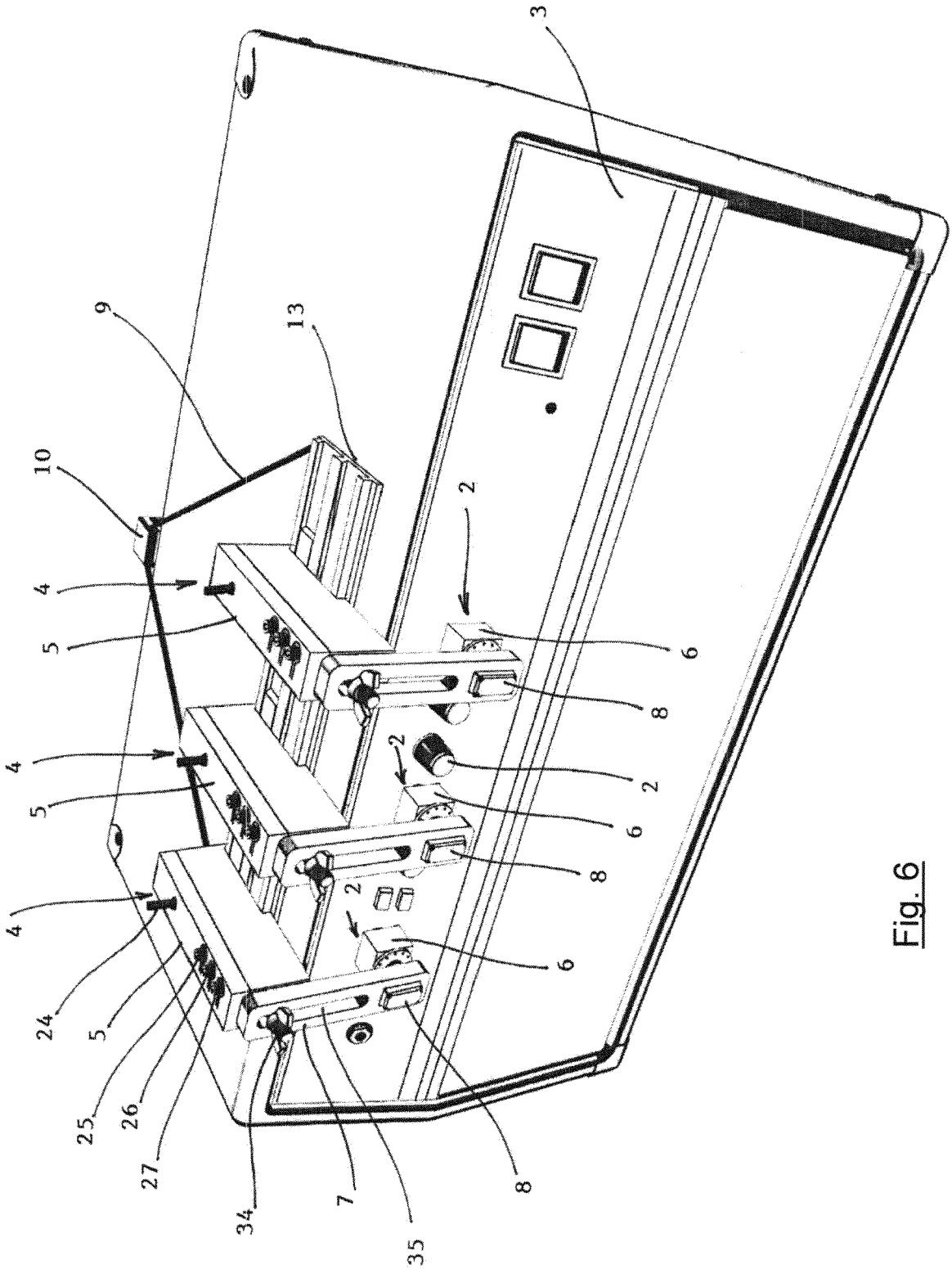

Fig. 6

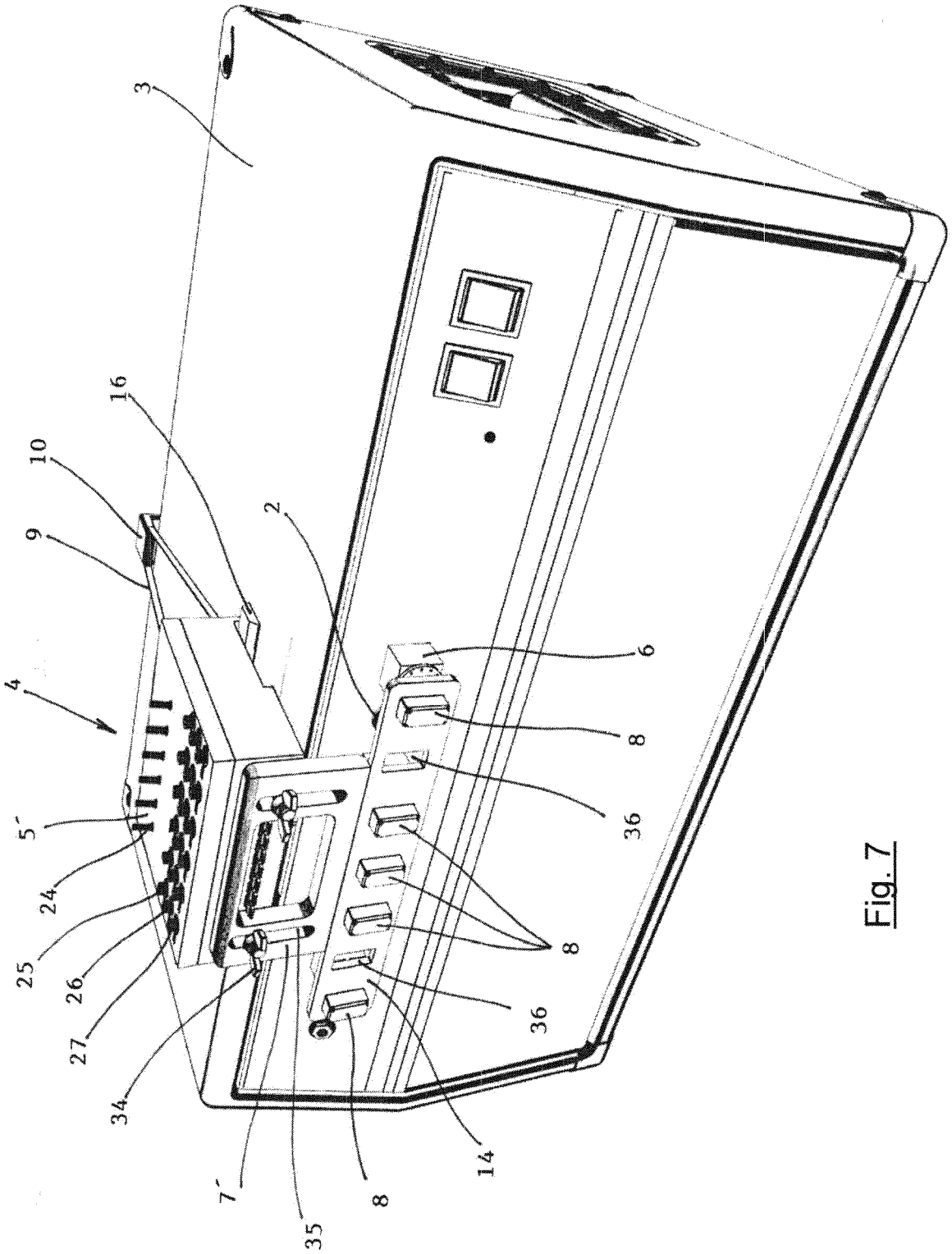

Fig. 7

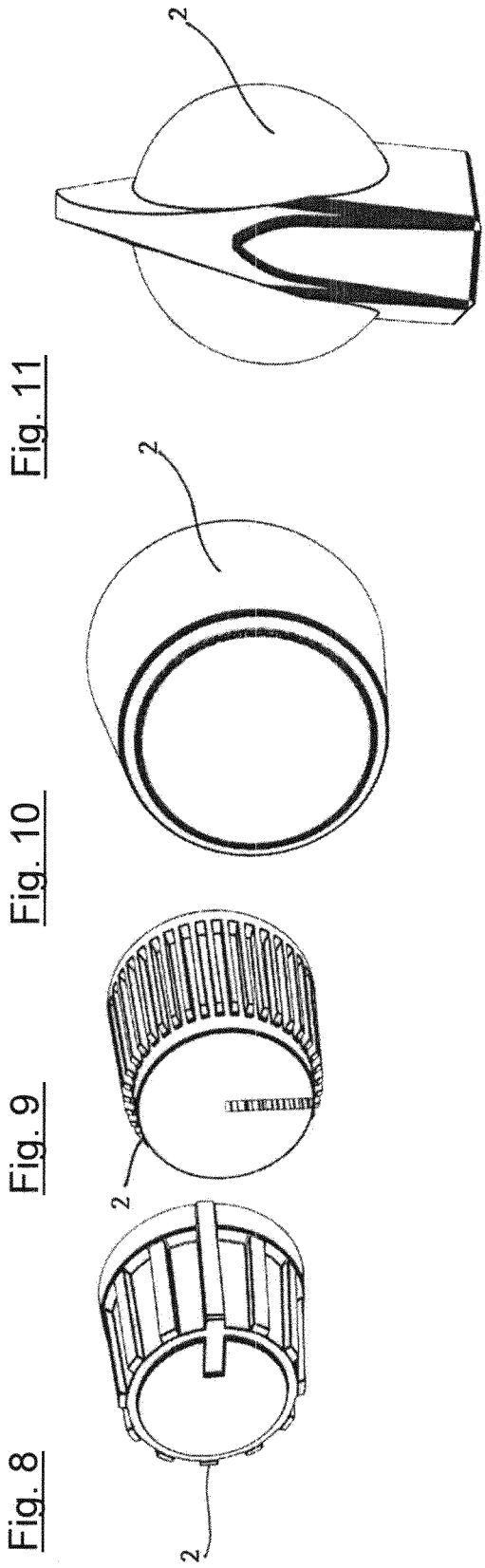

Fig. 8 Fig. 9 Fig. 10 Fig. 11

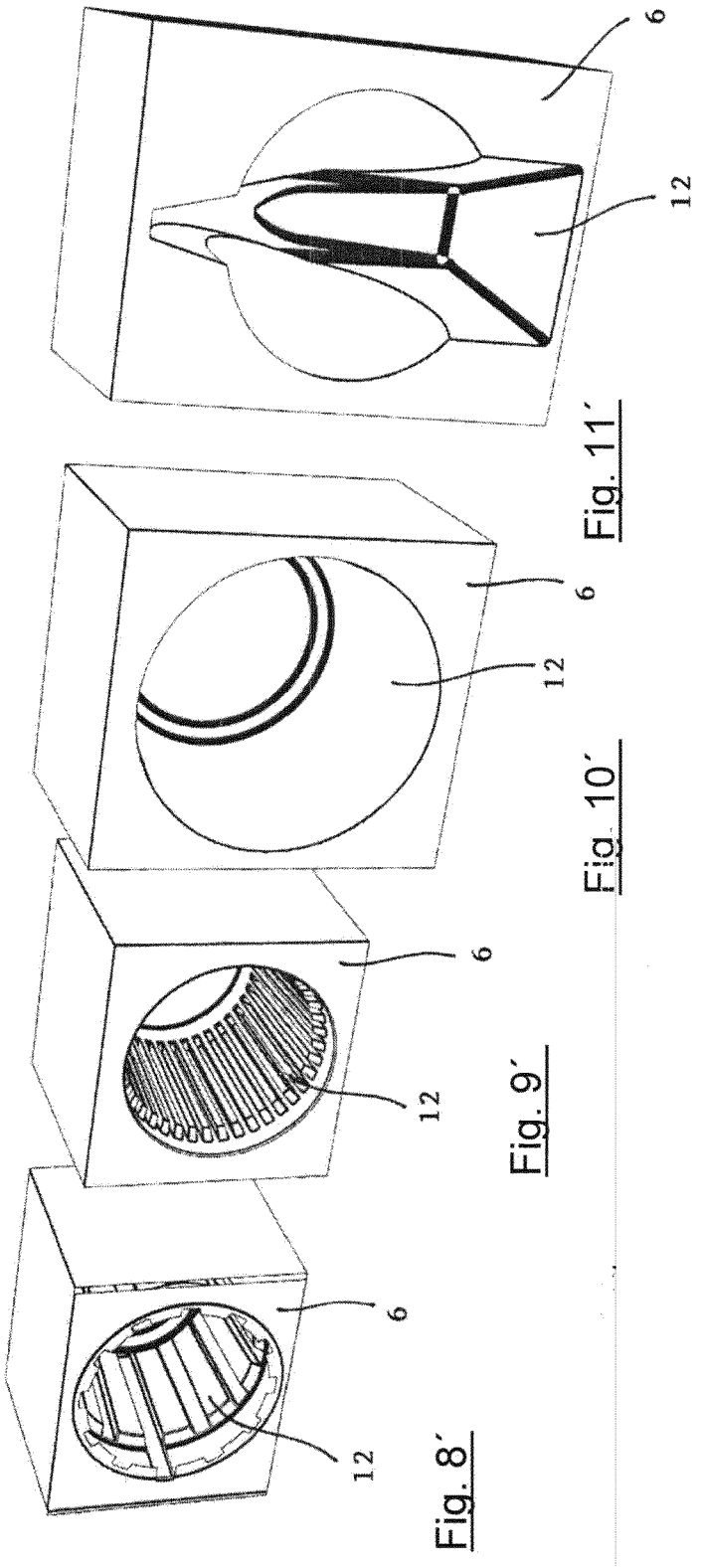

Fig. 8′ Fig. 9′ Fig. 10′ Fig. 11′

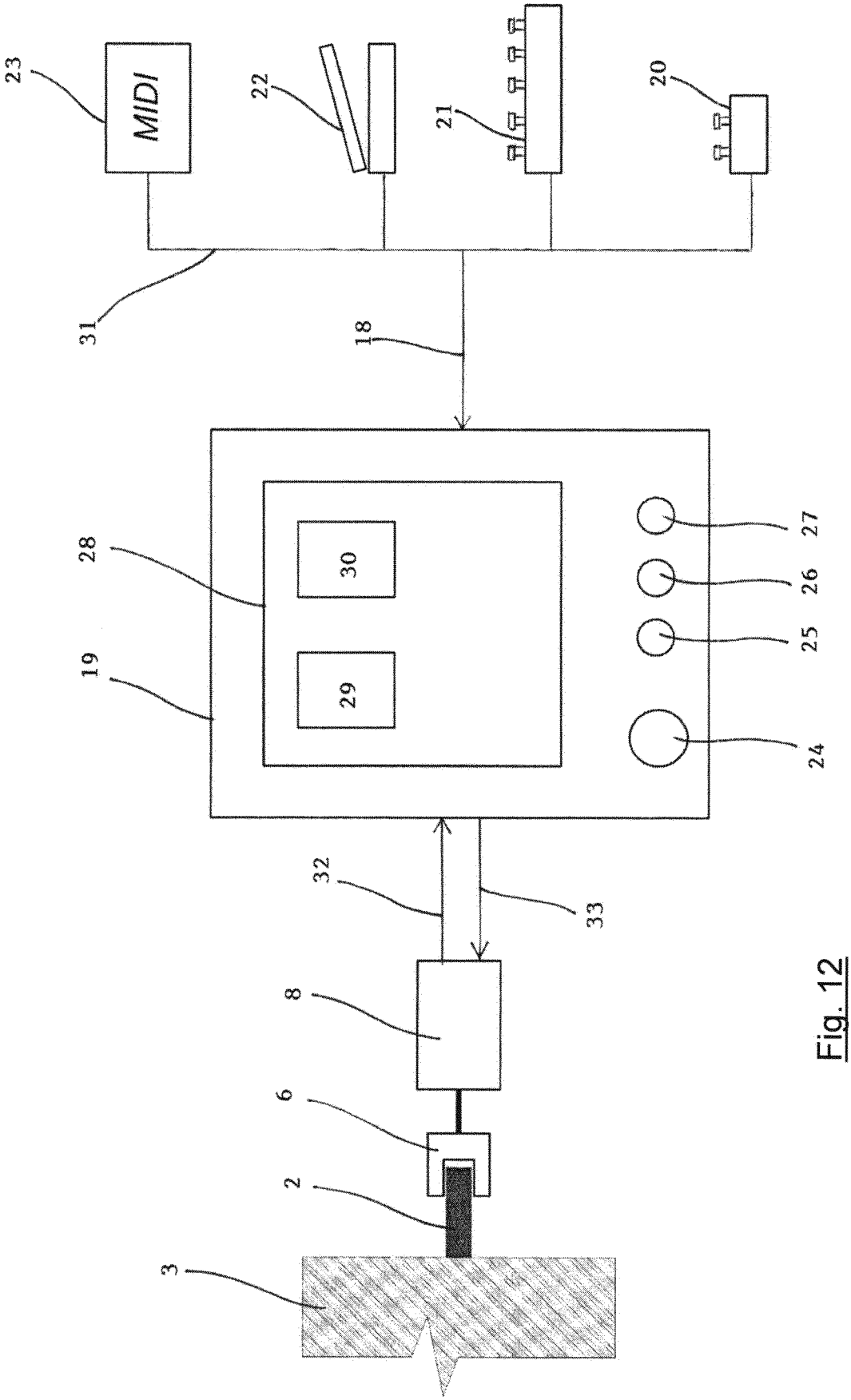

Fig. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 19 16 0447

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y A	US 9 589 549 B1 (MCKAY II BUCHANAN M [US]) 7 March 2017 (2017-03-07) * Applies to amplifiers; column 5, line 1 - line 15; figures 1A, 3B * * column 4, line 39 - line 47; figure 3A * -----	1-3,10, 12-14 4-9,11	ADD. G10H1/00
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G10H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 September 2019	Glasser, Jean-Marc

CATEGORY OF CITED DOCUMENTS

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11-09-2019

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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