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(54) **Mechanical vibrato device, especially for electric guitars and bass-guitars.**

(57) The mechanical vibrato device, especially for electric guitars and bass-guitars, according to the present invention is made so that no one of its elements, except for a removable vibrato handle (16), exceeds the level of any clamped and taut string (28), and comprises a bed plate (1) together with a stationary block (3) in which mating grooves (22) and slits (4) are provided. The bed plate (1) carries multi-membered articulated clamping blocks of which one part, i.e. holder (2), enters by its feather (25) the groove (22) and the slit (4) in the bed plate (1) and the block (3), respectively. Apart from this the vibrato device comprises a lock (30) situated at the rear side of the bed plate (1) and consisting of a head and a sleeve which are both-sidedly flattened.

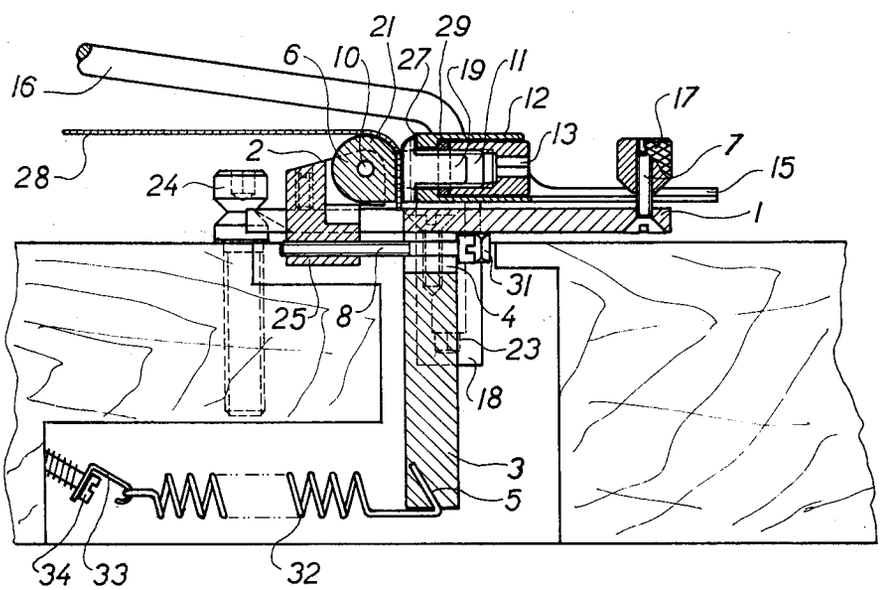

FIG.1

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The electric guitar play, particularly in case of top players' performances, requires a perfectly and constantly tuned instrument. For this purpose, there have been developed the so-called vibrator devices of various types and embodiments. Most of them consist of a bed plate with string attaching mechanisms, and a block secured to said plate from under. Such a stationary block is connected with tension springs attached to the guitar body and enabling the prestress to be varied. The bed plate is attached to the upper surface of the guitar body by means of anchor screws so that it can be tilted. With some devices the string attaching mechanism is made in such a way that the string is caught by its eyed end whereupon, when tuning, the slider together with the attached string is displaced by the screw. These devices are disadvantageous in that the sliders are not sidedly fixed so that their eventual deviations may negatively influence the string length from the attachment point up to the zero board and, consequently, impair the tone quality. Such relatively simple devices are besides not provided with means for finely tuning the tuned string since it is passed through from under over the block.

Apart from this, there have been developed some more complicated and sophisticated devices designed for masterly instruments. They are already provided with two-member articulated attaching devices with a thrust plate for string attachment, said plate being displaceable forward and backward together with the string attaching screw; in the elevated rear portion of the bed plate a fine tuning screw is situated so that it bears on said string attaching screw. A drawback of such devices consists in that they comprise some elements, above all fine tuning screws, that exceeds over the string level so that they cause the player to have his hand in a higher position causing fatigue effects. The adjustment for displacing the string attaching system is controlled by a screw secured in a fork of front portion of said system, i.e. below the string, which causes the player, when adjusting, to thrust the string aside. Under these conditions, the tuning process is troubled and decelerated, especially when in case that the displacement along the fork is insufficient, the screw has to be unscrewed and replaced in another threaded hole provided in the bed plate. Also when compensating the tension of strings to be tuned and of the springs it is not easy to obtain simultaneously the tension balance and the correct string tuning.

So it is necessary to proceed empirically by tightening and releasing both strings and tension springs so as to reach the correct tuning. Such a troublesome process will cause then some players to displace the vibrato block so as to bear on the wall of a recess in the guitar body so that the vibrator device can be tilted in one direction only.

Thus it is necessary that a vibrator handle of electric guitar be safely fixed, during the play, in a desired position, and that it may be possible to easily change this position. Some devices of prior art serving to this purpose have consisted in that to the bed plate there is secured, by means of a nut provided on the top plate surface, a box with inner thread cut through in its bottom part in form of a transverse groove, and that such a created beak is slightly bent upward. The vibrato handle is provided at its attachment end with thread and screwed in the box. The thread of the bent beak assumes then the function of a clamp element. Disadvantages are in slow screwing, in the necessity of using a spanner for holding the entire box together with the nut while overcoming the resistance in the thread of the bent portion. Other devices are provided with a blind threaded hole in the block secured to the bed plate, the hole bottom carrying a spring-loaded ball while the vibrato handle being also threaded. Disadvantageous is here again the slow screwing and unscrewing of the vibrato handle, a play in threading playing also a negative role. The locking moment is directly proportional to spring power that must not be alike with all of the springs. Still other devices use a clamp system called "jack" in electrotechnics; in this case it is difficult to adjust the locking moment of the wire spring, which cannot be practically changed by the player. Finally, there are also applied devices wherein the attaching end of the vibrato handle carries a cap nut under which there is provided a pin in a transverse opening of the handle, which pin is clamped between the inner front of said cap nut and the upper front of the box secured to the bed plate. A drawback of such a system resides also in a slow removal of the vibrato handle, since it is necessary to completely unscrew the cap-nut. Disadvantageous is also the wearing of the pin as well as the fact that the cap nut cannot be removed but after pulling out the pin.

The present invention is to eliminate the disadvantages of prior art as hereinabove set forth and to provide an improved vibrato device wherein no elements thereof, except for a removable vibrato handle, exceed the level of any clamped and taut string on the instrument, and which comprises a bed plate together with a stationary block, string clamping and adjusting systems separate for each of the strings, and a vibrato handle. The bed plate connected with the stationary block carries multimembered clamping articulated blocks mounted for swinging and reciprocation thereon. Each of said clamping blocks comprises a holder, a slider, a jaw, a grip and a nut with a washer. In the bed plate there are provided grooves longer than the thickness of the stationary block in which slits are

provided correspondingly with the grooves of the bed plate. The body of each of the holders is shaped at its bottom side to form a feather to enter the grooves and the slits. Via the slider mounted for swinging in a fork of the holder, the holder is adjustably coupled with the grip in the form of a prism having central stepped hole with a nut provided at one end with inner hexagon and a washer. The portion of the grip which is turned away from the holder is lowered and shaped to form a fork with an elongate radiused recess merging into its central hole. In the groove is situated a clamping screw screwed in the bed plate and provided with a fine tuning nut. The bed plate carries also a chucking nut so that it is screwed on a bush shaper to form a chuck with outer threading, the bush being screwed in the threaded hole of the bed plate provided therefor. From the lower side of the bed plate, also a lock nut is screwed on the bush, and the latter receives the shorter arm of the vibrato handle. The mechanical vibrato device comprises also a lock consisting of a screw joint with a head having an internal hexagon and of a sleeve which both are both-sidedly flattened. The lock is situated at the side opposite the vibrato handle and opposite the clamping blocks, at the bed plate so that the non-flattened parts of the head and sleeve of the lock extend to above and under said bed plate.

Another feature of the invention consists in that the slider has a prism-like head having an axial radiused groove and a cylindrical shank which is provided with threading and in which there is provided an axial vertical longitudinal groove extending up to the adjacent portion of the slider head so that the groove end continuously merges into said portion.

According to the invention, the front portion of the grip facing the slider is provided with a vertical groove extending in the axis of its central passing-through opening.

Further, the width of the groove in the slider shank and that of the vertical groove in the grip are the same, and the thickness of the jaws in T-form of which arms are either rounded or chamfered, does not exceed the widths of said grooves into which it is inserted, the width of the jaw body not exceeding the minor diameter of the shank threading.

Still other feature of the invention resides in that the outer threading of the bush receiving one end of the vibrato handle is shaped at its top portion to form a cone and that the chucking nut is provided with internal chucking webs.

In the block secured to the bed plate there is provided a blind hole receiving from under upward one after the other a lower stepped ring, a bevel ring and an upper stepped ring which are arranged so that they bear on one another by their front portions. In the bed plate there is further provided a threaded hole in which a clamp nut with central nut is screwed, said nut bearing by its lower portion on the upper flat front of the upper stepped ring. In the hole of the clamp nut, in holes of the stepped rings and the bevel ring, one end of the vibrato handle is inserted.

Finally, the holder is provided on its part turned away from the slider and grip with two vertical threads receiving thrust screws bearing on the bed plate. The feather of the holder is provided with a horizontal, longitudinally and axially oriented threading with an eye bolt which bears by its head on the front of the block at the side turned away from the holder. In its front facing the head of the slider, a groove receiving said head is provided.

The progress obtained by the vibrato device of the invention consists above all in providing the hitherto best string attachment surface, since the jaw secured in the grip groove cares for the parallelism of its clamping surface to the clamping surface of the slider rear portion Simultaneously the thickness of the jaw and the width of the groove for string in the slider are chosen so that even at a partial flattening of the string the jaw does not bear on the slider. Thus the string is uniformly stretched by the entire clamping surface so that it is not exposed to any demaging while being clamped in the vibrato lock formed here by the slider, the jaw and the grip so that unlike well-known devices the delicate string clamping process may be disregarded.

Another substantial advantage is in the arrangement of all of the elements immediately on the flat bed plate while the eye bolt is situated below said plate. In this way all of the elements overlapping the instrument plate are omitted which means that no elements are situated higher than the strings so that the player need not hold his hand in an elevated position. This positively influences the hand position fatigue effects and improves consequently the play ergonomy.

Advantageous is the arrangement of the clamping and controlling system in the groove of the bed plate and the block which prevents the system from wobbling during the string attachment and makes it possible to attach it without being necessary to use either special devices or steadily holding it by the other hand, which all positively influences the speed, accuracy and easiness of the string attachment. The preferable application of the vibrato lock consisting of a screw and sleeve with both-sidedly flattening, considerably simplifies and accelerates the global adjustment of the instrument so that, due to the immobilisation of the bed plate, a situation occurs as if the instrument be provided with a stable bridge. After adjusting and unlocking the vibrato device, the fine adjustment of the lower

tension springs is already an easy affair. This advantage manifests itself positively if some string has to be quickly exchanged whereby no substantial detuning of already tuned strings occurs.

Another advantage of the vibrato device consists particularly in simple change of clamping force by merely tightening either the chucking nut or, according to the alternative embodiment, the clamping nut while even an eventual wear of the conical bush threading (first variant) or of bearing surfaces of the rings (second variant), including the threadings of the nuts and their bearing surfaces, does not influence the device operation. Also the removal and insertion of the vibrato handle is easy and quick, and does not depend but upon the turning of the respective nut.

The vibrato device of the invention is easily applicable to the existing instruments of "Stratocaster" type. Finely, a not negligible progress brought about by the device lies in the global structure thereof and in the attachment of the individual elements to the bed plate, which does not cause any fading of string sound so that a long sound reverberation (so-called "sustain") is obtained. This is very important with instruments of this type.

Some preferred embodiments of the invention will hereinafter be described with reference to the accompanying schematic drawings in which

- Fig. 1 is a front view of the mechanical vibrato device;
- Fig. 2 is a top view of the same;
- Fig. 3 is a lateral view of the same;
- Fig. 4 is a front view showing, partially in section, an alternative attachment of the vibrato handle; and
- Fig. 5 is a top view of the vibrato handle shown in Fig. 4.

As can be seen in the drawings, and particularly Fig. 1 thereof, the mechanical vibrato device comprises a bed plate 1 which forms an integral part with a stationary block 3 and on which there are mounted for swinging and reciprocation, respectively, holders 2 and grips 12 connected by means of sliders 6, jaws 19 and nuts 13 with an internal hexagon. In the bed plate 1, grooves 22 are provided, and in the block 3 slits 4 corresponding to the grooves 22. The lower end of each of the holders 2 is shaped to form a longitudinally oriented feather 25 to engage in said grooves 22 and slits 4. Each grip 12 is mounted for reciprocation on the top surface of said bed plate 1, and its body has the form of a prism with a central stepped hole receiving a nut 13 with the internal hexagon, washer 29, shank 11 of the slider 6 and web of the jaw 19, and with its rear portion lowered and forming a fork 15 with a longitudinal radiused recess merging up to said central hole. The front portion of the grip 12 is provided with a vertical groove 27, and by means of a groove of its fork 15 it is coupled with a clamping screw 7 screwed in a threaded hole of the bed plate 1 and provided with a fine tuning nut 17. The jaw 19 inserted by its web in the shank 11 of the slider 6, engages by lower parts of its arms in the groove 27 of said grip 12 while upper parts thereof bear on a string 28 passing through a groove in the shank 11 and through a radiused groove 26 in a head 21 of the slider 6. The head 21 is shaped to form a prism whose front portion merges into a radiused surface provided with said radiused groove 26 sloping, from the half of the upper surface, downward, a connecting pin 10 passing through axial opening provided in the slider 6. The shank 11 of the slider 6 has the form of a cylinder provided with threading and is cut-through in the form of a vertical axial groove extending up to the rear end of the head 21. The head 21 is situated in a fork provided in the holder 2, the fork walls being also provided with a transverse hole for a connecting pin 10. In the front portion of the holder 2 there are also provided two vertical threaded holes for thrust screws 9 bearing on the top surface of the bed plate 1, and the feather of the holder 2 is provided with a horizontal elongate thread in which an eye bolt 8 is screwed. The assembly comprising the holder 2, slider 6, jaw 19, grip 12, nut 13, washer 29, connecting pin 10, thrust screws 9, eye bolt 8, clamping screw 7 and fine tuning nut 17, constitutes a clamping unit system for the string 28 of which fulcrum is formed by said pin 10 while the lateral and positional orientation is cared for by the feather 25, the jaw 19, thrust screws 9, eye bolt 8 of the holder 2, clamping screw 7 and the fine tuning nut 17. Apart from the nuts 22 there are provided on the front portion of the bed plate 1 two both-sidedly beveled radiused recesses entering by their bevels the slits in heads of anchor screws 24, further a threaded hole for a bush 18 in the form of a chuck with an internal, in the upper part conical threading, the bush 18 being from the lower side of the bed plate 1 secured by a lock nut 31 and carrying on the top a chucking nut 20 with internal chucking webs. The bush 18 receives the shorter arm of a vibrato handle 16, said shorter arm being provided with a hexagonal socket spanner. An alternative attachment of the vibrato handle 16 (Figs. 4 and 5) consists in that in the block secured to the bed plate there is provided a blind hole 38 receiving from under upward one after the other a lower stepped ring 36, a bevel ring 37 and an upper stepped ring 36 which are arranged so that they bear on one another by their front portions. In the bed plate 1 there is further provided a threaded hole in which a clamp nut 35 with central hole is screwed, said nut bearing by its lower portion on

the upper flat front of the upper stepped ring 36. In the hole of the clamp nut 35, in holes of the stepped rings 36 and the bevel ring 37, one end of the vibrato handle 16 is inserted. At the rear side of the bed plate a lock 30 of the vibrato device is situated in the guitar body, said lock consisting of a screw with both-sidedly flattened sleeve and head. The space between the head and the sleeve of this screw forms a groove whose width is greater than the thickness of the bed plate 1, and the lock 30 of the vibrato device is situated so that in the position where the non-flattened portion is adjacent the bed plate 1, said lock embraces said portion. Holes provided from under in the body of blocks 3 receive each one end of springs 32 attached by their other end in a spring holder 33 secured by screws 34 to the wall of a recess in the guitar body.

In operation, if the strings 28 are to be attached and the guitar tuned, the bed plate 1 is at first locked by turning the non-flattened portion of the lock 30 toward said plate whereby the vibrato device is prevented from being deviated by the tension of springs 32 or the strings 28 to be attached whereupon due to the loosening of the nut by the socket spanner 23, the slider 6 is released and the jaw 19 is displaced away from the rear portion of the head 21 of the slider 6. Thus, a space for the string 28 is provided between the jaw 19 and said rear portion. The string 28 freed of its catching eye is then laid into said space so as to lie simultaneously in the groove 26 of the head 21 of the slider 6, and it will be stretched by re-tightening the nut 13 of the jaw 19. By its other end the string 28 is attached to a device on the guitar head or scroll (not shown). The other strings are attached in the same way. By means of a stretching device (not shown) the fundamental tuning will be effected. For this step, the holders 2 are laid by their bearing surface on the top surface of the bed plate 1. The fundamental vertical positioning of entire mechanical vibrato device together with all of the stretched strings 28 is effected by means of anchor screws or bolts 24. The actual vertical adjustment of the individual strings 28 relative to the profile of top surface of the touch-board will then be effected by displacing the individual holders 2 by means of thrust screws 9. After said steps have been accomplished, the position of the bed plate 1 in the groove of the lock 30 is to be checked. If the bed plate 1 is not in the middle of said groove, its position will be adjusted by springs 32 until the correct one is reached. In case the mechanical vibrato device is correctly positioned and the tension of springs 32 and strings 28 is balanced, the bed plate 1 is unlocked and the octave or intonation tuning will be commenced by turning the lock by 90°. This is made for each string separately by tilting the entire vibrato device to the instrument body toward the neck by the vibrato handle 16 and, after loosening the fine tuning nut 17 to a desired extent, by displacing the entire stretching system of string 28 by means of the eye bolt 8. After octave tuning of all strings 28 has been effected, the fine tuning will be made by vertical adjustment of fine tuning nuts 17.

When a string 28 is to be exchanged in the already tuned instrument, the bed plate 1 will be locked again by turning the lock 30 by 90°, the string 28 is loosened by the stretching device (not shown) and be replaced. The new string 28 will be inserted again into the groove 26 of the head 21 of the slider 21, and is attached by re-tightening the nut 13, i.e. by the jaw 19. The other string end will then be secured by said stretching device, and the string will then be tuned as hereinabove referred to. After the tuning, the position of the bed plate 1 in the lock 30 is revised and, by tensioning or releasing the springs 32, respectively, the bed plate 1 will be adjusted to assume the position in the middle of the groove. In this way the original tuning of the not exchanged strings 28 remain unaffected. Now the lock 30 will be unlocked and any necessary fine tuning of the new string 28 will be made by the nut 17.

In the case a string 28 breaks during the play and the performance has to be continued together with the remaining number of strings, the instrument may automatically be detuned even by missing a single string, owing to the reduction of tension relative to the springs 32; this can be prevented by locking the bed plate 1 by the lock 30. Thus its correct position will be fixed and any possible small difference can be eliminated by fine tuning.

If a tilted-out position of the vibrato device is desired while the normal position corresponds to the top surface of the guitar body, a vertical readjustment is effected by turning the lock 30 whereby the fixation of the bed plate 1 in this new position is enabled.

If the instrument is to be transported, the vibrato device has to be completely locked by the lock 30 whereby the danger of damaging it, string break by relentless manipulation, or falling are prevented.

Claims

1. A mechanical vibrato device, especially for electric guitars and bass-guitars, comprising a bed plate together with a stationary block, string clamping and adjusting systems separate for each of the strings, and a vibrato handle,
characterized in
that no one of its elements, except for the

removable vibrato handle (16), exceeds the level of the clamped and taut string (28) on the instrument, there being mounted for swinging and reciprocation on the bed plate (1) connected with the stationary block (3) multi-membered articulated clamping blocks of which each comprises a holder (2), a slider (6), jaws (19), a grip (12) and a nut (13) with a washer (29) in such way that in the bed plate (1) there are provided grooves (22) longer than the thickness of block (3) in which slits (4) are provided correspondingly with the grooves (22) and that each body of the holder (2) is shaped in its bottom portion to form a feather (25) to enter the grooves 822) and the slits (4), the grip (12) in the form of a prism having central stepped hole with the nut (13) provided at one end with internal hexagon and the washer (29), being adjustably connected, via the slider (6) swingable in a fork of the holder (2), together with said holder (2), a part of the grip (12) turned away from the holder (2) being lowered and shaped to form a fork (15) with a longitudinal radiused recess merging into the central hole of the grip (12), in which there is situated a clamping screw (7) screwed in the bed plate (1) and provided with a fine tuning nut (17), the bed plate (1) carrying also a chucking nut (20) so that it is screwed on a bush (18) shaped to form a chuck with outer threading, the bush being screwed in the threaded hole of the bed plate (1) provided for it, while on the bush (18) there is screwed from the lower side of the bed plate (1) also a lock nut (31), the bush (18) receiving the shorter arm of the vibrato handle (16), the mechanical vibrato device comprising also a lock (30) consisting of a screw joint with a head having an internal hexagon and of a sleeve which both are both-sidedly flattened, the lock (30) being situated at the side opposite the vibrato handle (16) and opposite the clamping block at the bed plate (1) so that the non-flattened parts of the head and sleeve of the lock (30) extend to above and under said bed plate (1).

2. A mechanical vibrato device according to claim 1, characterized in that the slider (6) consists of a prism-like head (21) having an axial radiused groove (26) and a cylindrical shank (11) which is provided with threading and in which there is provided an axial vertical longitudinal groove extending up to the rear portion of the head (21) so that the groove end merges continuously into said portion.

3. A mechanical vibrato device according to claim 1, characterized in that the grip (12) is provided on its front portion facing the slider (6) with a vertical groove (27) extending in the axis of its passage.

4. A mechanical vibrato device according to any one of claims 1, 2 and 3,
characterized in that the width of the groove in the shank (11) of the slider (6) and that of the vertical groove (27) are the same and that the thickness of the jaw (19) in T-form of which arms are either rounded or chamfered, does not exceed the widths of said grooves into which it is inserted, the width of the jaw body not exceeding the minor diameter of the shank (11) threading.

5. A mechanical vibrato device according to claim 1, characterized in that the outer threading of the bush (18) receiving one end of the vibrato handle (16) is shaped at its top portion to form a cone and that the chucking nut (20) is provided with internal chucking webs.

6. A mechanical vibrato device according to claim 1, characterized in that in the block (3) secured to the bed plate (1) there is provided a blind hole (38) receiving from under upward one after the other a lower stepped ring (36), a bevel ring (37) and an upper stepped ring (36) which are arranged so that they bear on one another by their front portions, there being provided in the bed plate (1) a threaded hole in which a clamp nut (35) with central hole is screwed, said nut bearing by its lower portion on the upper flat front of the upper stepped ring (36) while in the hole of the clamp nut (35), in holes of the stepped rings (36) and the bevel ring (37) one end of the vibrato handle (16) is inserted.

7. A mechanical vibrato device according to claim 1, characterized in that the holder (2) is provided in its part turned away from the slider (6) and the grip (12) with two vertical threads receiving thrust screws (9) bearing on the bed plate (1), that the feather (25) is provided with a horizontal, longitudinally and axially oriented threading with an eye bolt (8) which bears by its head on the front of the block (3) at the side turned away from the holder (2) and that in its front facing the head (21) of the slider (6) there is provided a groove receiving said head (21).

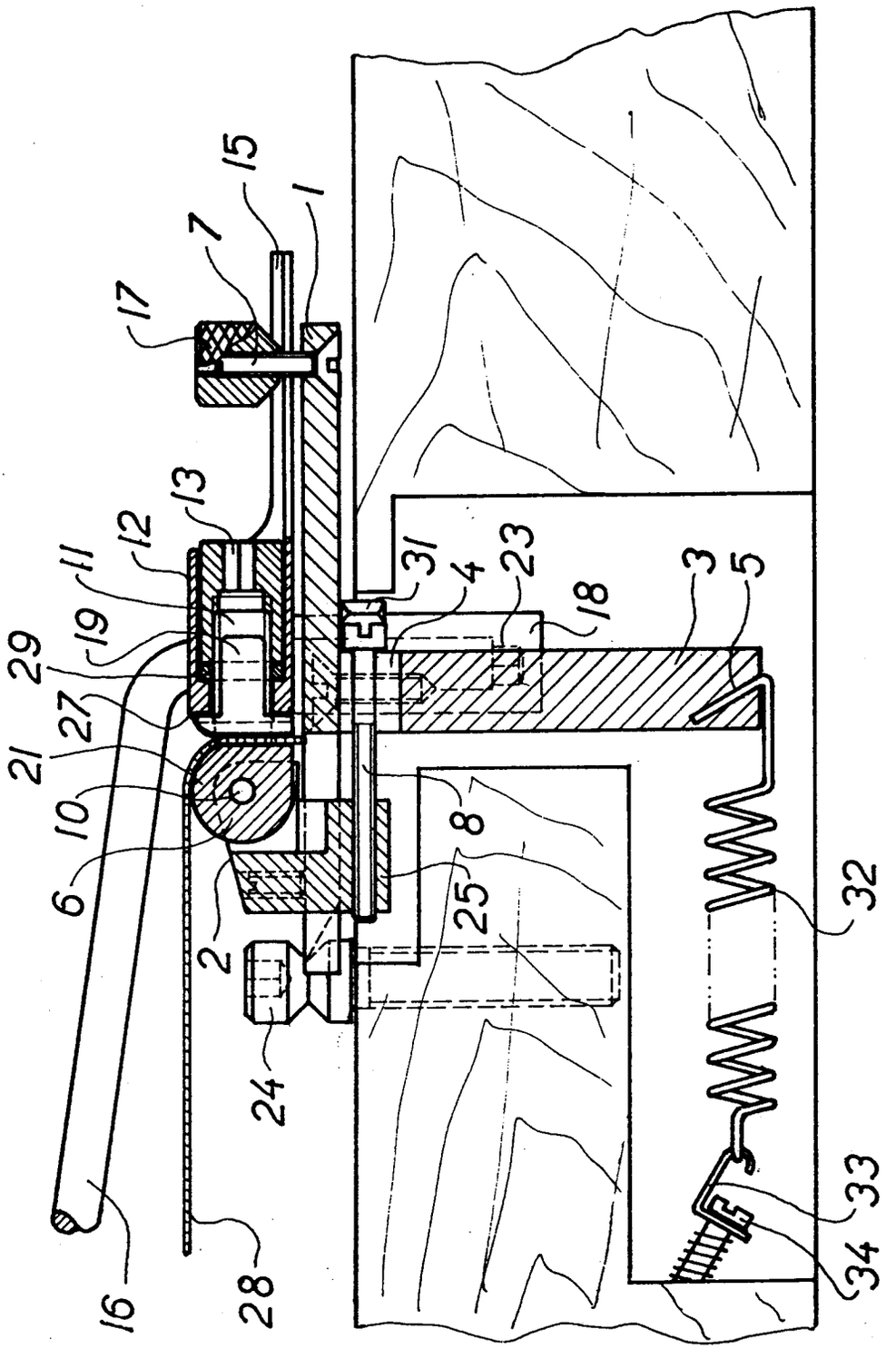

FIG. 1

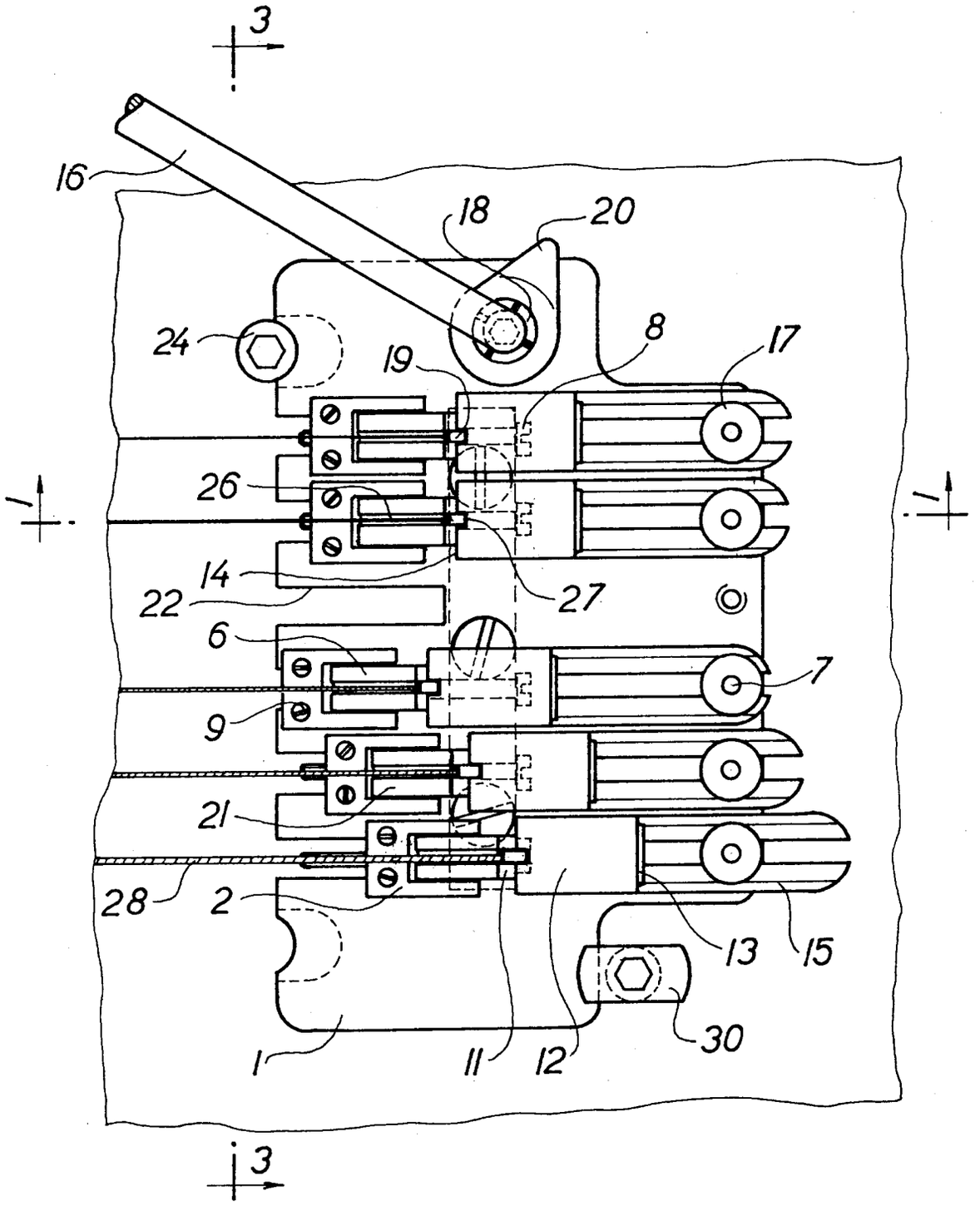

FIG.2

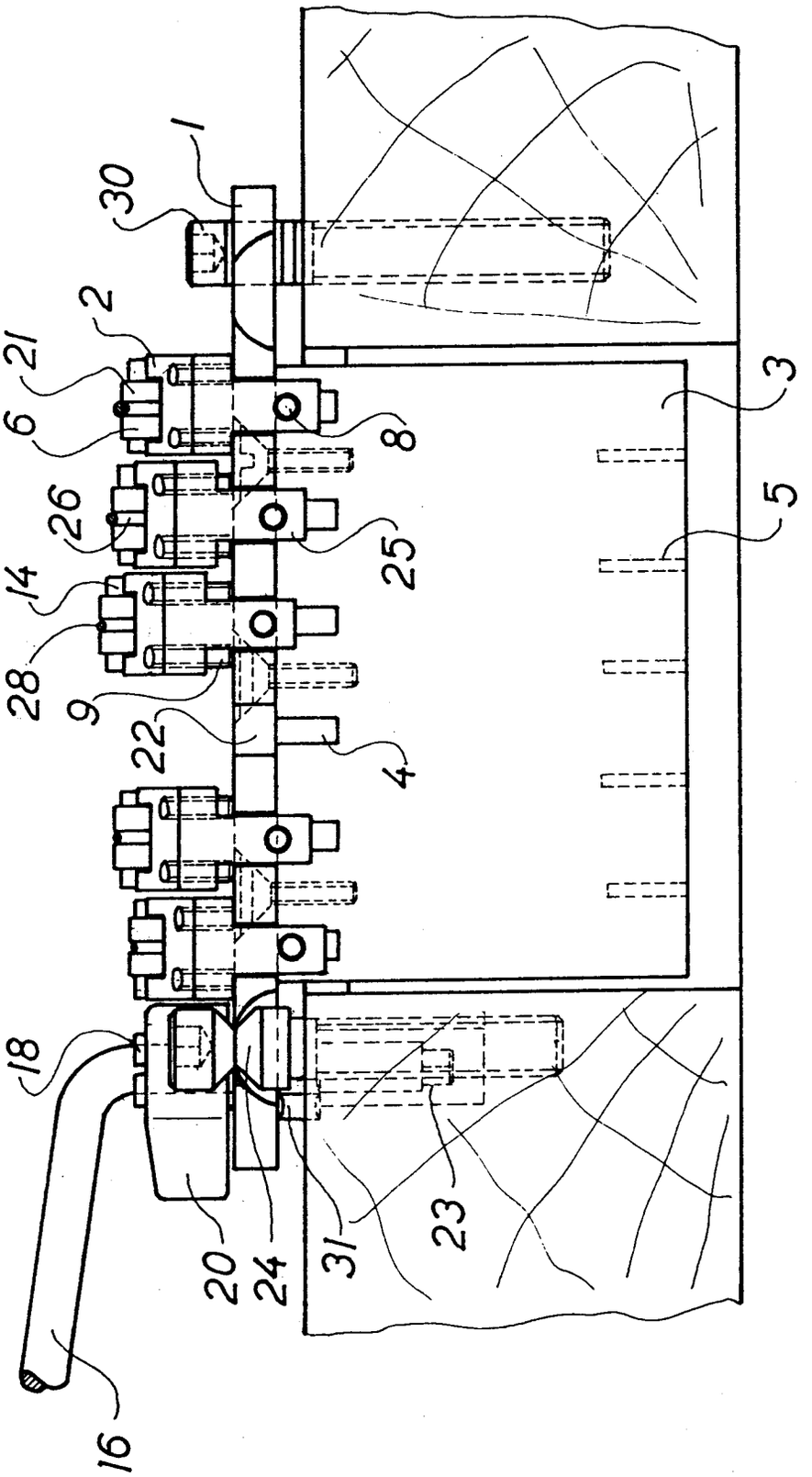

FIG.3

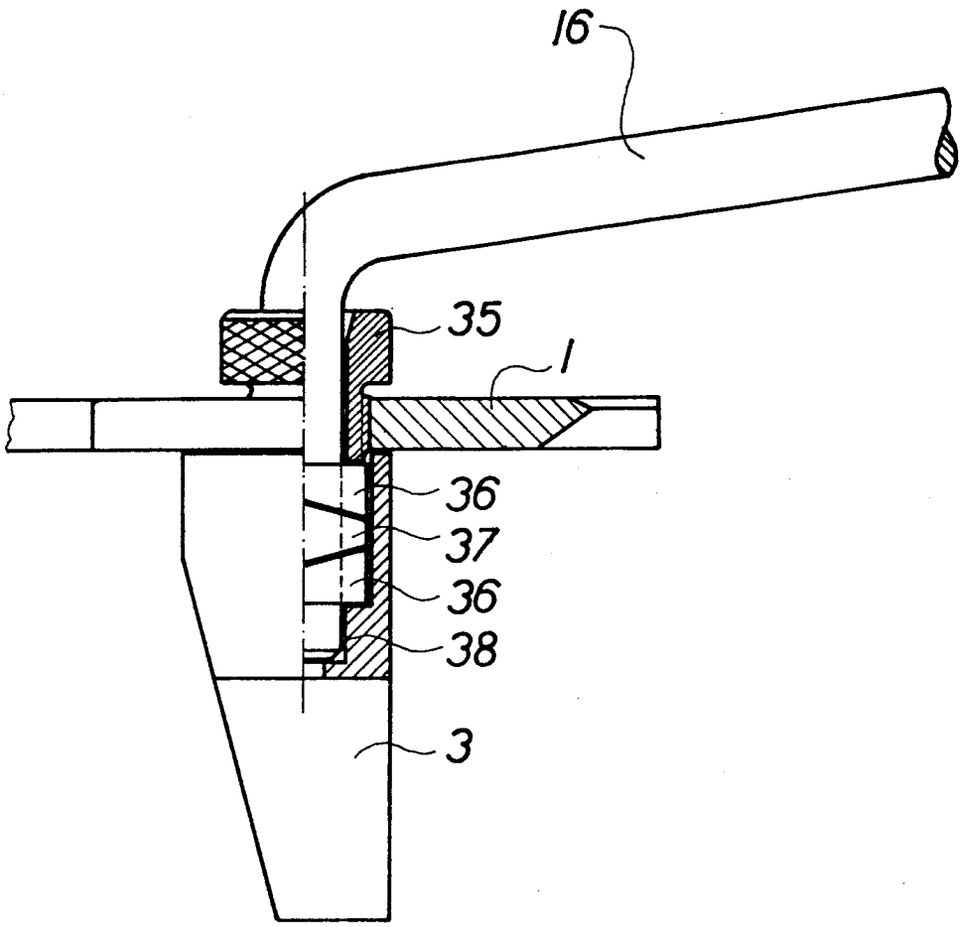

FIG.4

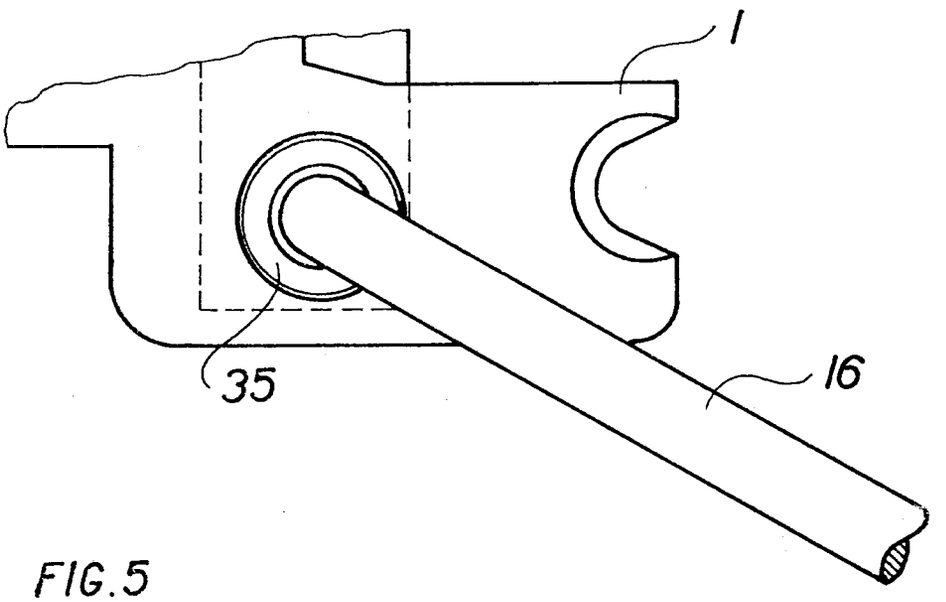

FIG.5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 10 3084

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	WO-A-8 604 716 (FENDER MUSICAL INSTRUMENTS) * page 2, line 6 - page 5, line 13; figures 1,2 * ---	1	G10D3/14 G10H3/18
A	EP-A-0 249 464 (FENDER) * column 4, line 18 - column 6, line 9; figures 2,3 * ---	1	
A	GB-A-2 116 768 (FLOYD DALE ROSE) * page 3, line 21 - line 126; figures 2,3 * ---	1,2	
A	US-A-4 796 505 (TAKEUCHI) * column 3, line 26 - line 61; figure 3 * ---	1,6	
A	US-A-4 867 031 (FENDER) * column 3, line 7 - column 4, line 4; figures 2-5 * -----	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

G10D
G10H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 OCTOBER 1991	PULLUARD R.J.P.

CATEGORY OF CITED DOCUMENTS

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