United States Patent

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[72] Inventor **Seiji Nakada**
Hamamatsu-shi, Japan

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[73] Assignee **Nippon Gakki Seizo Kabushiki Kaisha**
Nakazawa-cho, Shizuoka-ken, Japan

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[31] **43/101650**

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[54] **KEYING SWITCH ASSEMBLY**
9 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** ..... **200/166 H**
[51] **Int. Cl.** **H01h 1/50**
[50] **Field of Search** ..... 200/166 H, 166 C, 166.1, 86.5; 335/193

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Primary Examiner—H. O. Jones
Attorney—Flynn & Frishauf

ABSTRACT: A keying switch assembly operable by means of a key includes a stationary contact member, an elastically bendable contact member having a fixed end and a movable end which is selectively operable to contact the stationary contact, and a flexible shock absorber attached to the bendable contact member for reducing shock noises. An actuator strikes against the shock absorber upon operation of the key so as to cause the bendable contact member to be silently bent, so that the movable end thereof contacts the stationary contact member.

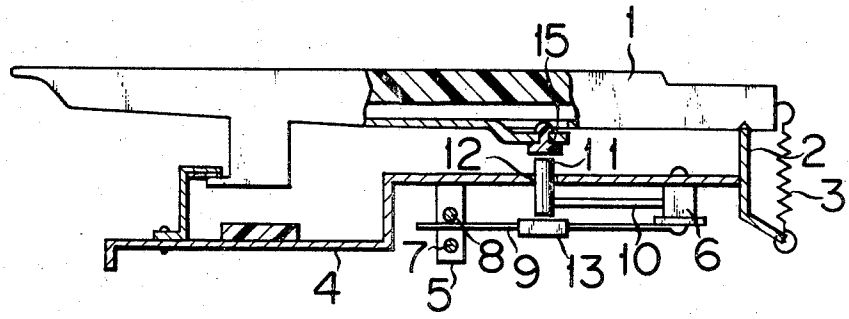


FIG. 1

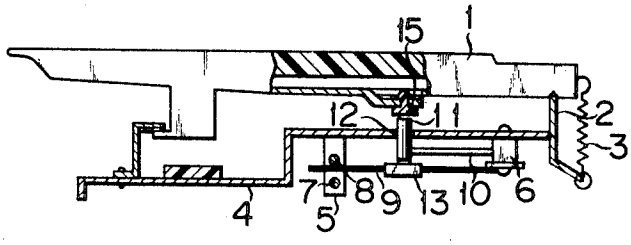


FIG. 2

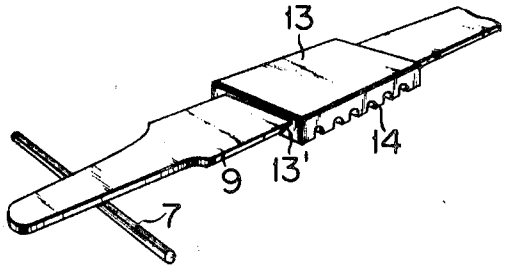
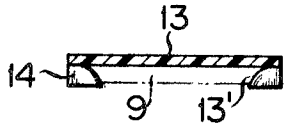


FIG. 3



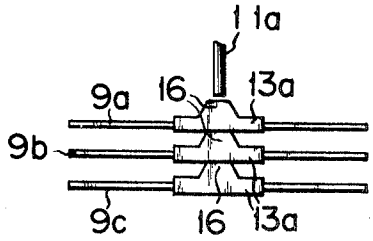


FIG. 4

KEYING SWITCH ASSEMBLY

This invention relates to a keying switch assembly particularly adapted for use in an electronic musical instrument.

As generally known, a keying switch assembly comprises one or more switch units, each of which involves a stationary contact member, an elastically bendable contact member, and an actuator for striking against said latter contact member. For a musical instrument, however, there must be avoided as much as possible the shock noises generated by the actuator striking against the bendable contact member and by the contact between the stationary contact member and the elastically bendable contact member. It is further demanded that the flexibility of the bendable contact member be maintained even if a shock absorber is attached to the bendable contact member in order to avoid the generation of the noise.

An object of this invention is to provide a keying switch assembly so improved as to avoid the generation of noises.

Another object of this invention is to provide a keying switch assembly so improved as to avoid the generation of noises, and at the same time maintaining an elastically bendable contact member with the same degree of flexibility as occurs in the case where the contact member is not provided with a shock absorber.

SUMMARY OF THE INVENTION

According to this invention, the keying switch assembly comprises one or more switch units, each of which comprises a stationary contact member, a leaf-shaped elastically bendable contact member, one end thereof being fixed and the other end thereof being movable, said elastically bendable contact member 9 being selectively movable to contact with said stationary contact member 7; a thin shock-absorbing plate attached to an intermediate position of the body of the bendable contact member and an actuator actuated by the key and striking against the shock absorber to cause the bendable contact member to contact the stationary contact member.

According to a further feature of this invention the shock-absorbing plate has a plurality of parallel-spaced grooves formed at the lower portion thereof and extending in the transverse direction thereof.

These and other objects of this invention as well as the features and advantages thereof will be understood from the following description with reference to the accompanying drawing, in which:

FIG. 1 is a cross-sectional side view of a keying switch assembly embodying the present invention;

FIG. 2 is a perspective view of the essential parts of said keying switch assembly;

FIG. 3 is a transverse cross section of a shock absorber involved in said keying switch assembly; and

FIG. 4 is a side view of another embodiment of a keying switch assembly of the present invention.

FIGS. 1 to 3 indicate a keying switch assembly comprising one switch unit in corresponding relationship with each of a plurality of key members. Each of said key members 1 is swingably supported by causing a V-shaped groove formed at the rear end thereof to engage with the upper edge of a vertically disposed supporting plate 2. Said supporting plate 2 has a rearwardly bent lower portion, and a coiled spring member 3 bridges the rear ends of said supporting plate and key member. Said supporting plate 2 is attached to the rear end of a key bed frame 4, at the lower side of which are disposed first and second supporting members 5 and 6 of electric insulating material such as synthetic resin. To the first supporting member 5 are attached bar-shaped stationary contact members 7 and 8 extending in the transverse direction of said key member 1 and extending parallel to each other. A leaf-shaped elastically bendable contact member 9 is attached to the lower end of said second supporting member 6 and forwardly extends therefrom in a manner to cause its forward end portion to contact the contact member 8. Said contact member 9 is

preferably made of phosphor bronze or nickel silver. Arranged above and parallel to said contact member 9 is an elastically bendable supporting member 10 which forwardly extends from said supporting member 6. An actuator 11 formed as a short bar member is attached to the forward end of said supporting member 10 and vertically extends through a bore 12 formed in the body of said key bed frame 4.

A thin shock-absorbing plate 13 is attached to an intermediate position of said bendable contact member 9. Said absorbing plate 13 consists of a flexible member, for example, of soft synthetic resin or rubber, and improved so as to maintain the flexibility of the bendable contact member 9, thereby permitting said bendable contact member to be bent through said absorbing plate 13. Said absorbing plate 13 is preferably provided with a dovetail groove 13' opening at the lower side thereof and extending in a longitudinal direction of the bendable contact member 9. Said bendable contact member 9 has a dovetail cross section to be fitted into said dovetail groove. The contact member 9 is thus easily and firmly engaged in the dovetail groove 13' of the absorbing plate 13 even after the contact member 9 is attached to the supporting member 6. Said shock absorber 13 preferably has a plurality of parallel spaced grooves 14 so as to maintain the same flexibility as occurs in the case where said contact member 9 is not provided with said shock absorber 13. In operation the actuating bar 11 will strike against the upper surface of said shock absorber 13 by the swinging motion of said key member 1. In this case, said key member 1 preferably has a cushion member 15, for instance, of soft rubber which is attached to the lower portion thereof and abutting against the top of said actuating bar 11 when the key member is pushed down.

In operation, the swinging motion of said key member 1 causes the actuator 11 noiselessly to strike against the shock absorber 13 and thus bend the body of said bendable contact member 9 until the forward end portion of said contact member 9 contacts the stationary contact member 7 so as to be electrically connected therewith. When the force applied to said key member is released, said key member 1 automatically returned by the action of the spring member 3 so that the actuator 11 is removed from the upper surface of said shock absorbing plate 13 by the reaction of said supporting member 10 and the contact member 9 is returned to the original position by its own reaction, electrically disconnecting the contact members 7 and 9 from each other. Although the shock absorber 13 is attached to the bendable contact member 9, it will not so act due to its thin and flexible body as to obstruct the contact member 9 from being fully bent when the key is lightly touched by the player.

FIG. 4 indicates another embodiment of the keying switch assembly wherein many switch units corresponding to one key member are arranged in such a manner that elastically bendable contact members 9*a*, 9*b* and 9*c* involved in said switch units respectively are operated only by a common actuating member 11*a*, and there is attached a flexible shock absorber 13*a* to each of said contact members. In this case, said flexible shock absorber 13*a* has a protrusion 16 integrally formed on the upper portion thereof, said protrusion 16 contacting the lower surface of the adjacent contact member positioned thereabove, and the uppermost protrusion being in abutment against the lower end of the actuating member 11*a*. The height of the shock absorber 13*a* is, at the protrusion portion, substantially equal to the distance between the adjacent two of the elastically bendable contact members.

What I claim is:

1. A keying switch assembly operated by a key comprising:
   a stationary contact member (7);
   a leaf-shaped elastically bendable contact member (9), one end thereof being fixed and the other end thereof being movable, said elastically bendable contact member (9) being selectively movable to contact with said stationary contact member (7);
   a shock absorbing member (13) of flexible material attached to said elastically bendable contact member (9) at

a position thereof intermediate said fixed and movable ends; and

an actuator (10, 11) actuated by said key (1) and striking against said shock absorbing member (13) to bend said elastically bendable contact member (9) into contact with said stationary contact member (7).

2. The keying switch assembly claimed in claim 1 in which said shock absorbing member (13) is made of rubber.

3. The keying switch assembly claimed in claim 1 in which said shock absorbing member (13) has a dovetail groove (13) extending in the longitudinal direction of said elastically bendable contact member (9), and said elastically bendable contact member has a dovetail cross section which is fitted into said dovetail groove.

4. The keying switch assembly claimed in claim 1 in which said shock absorbing member (13) has a plurality of parallel spaced grooves (14) formed at the lower portion thereof and extending in the transverse direction thereof.

5. The keying switch assembly claimed in claim 3 in which said shock absorbing member (13) has a plurality of parallel-

spaced grooves (14) formed at the lower portion thereof and extending in the transverse direction thereof.

6. The keying switch assembly claimed in claim 1 in which said shock absorbing member (13) has a protrusion (16) integrally formed on the upper portion thereof.

7. The keying switch assembly claimed in claim 1 wherein said stationary contact member (7) extends transversely of said elastically bendable contact member (9), and said shock absorbing member (13) is disposed between said stationary contact member (7) and said fixed end of said elastically bendable contact member (9).

8. The keying switch assembly claimed in claim 1 wherein said actuator (10,11) comprises an elastically bendable support member (10) having one end fixed, and an actuator member (11) connected to the other end of said elastically bendable support member (10).

9. The keying switch assembly claimed in claim 1 wherein said shock absorbing member (13) is generally in the form of a plate.