Aug. 19, 1952 G. H. HADDEN 2,607,257

ORGAN KEY LOADING DEVICE

Filed Aug. 30, 1950

FIG. 1.

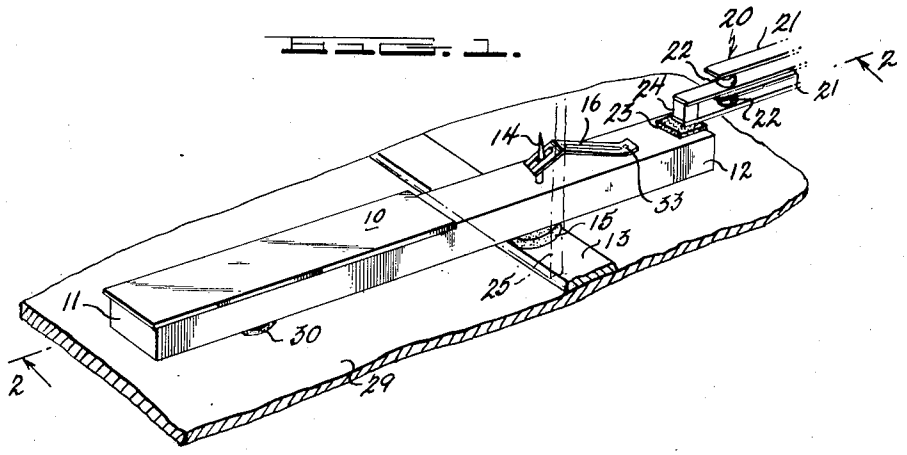


FIG. 2.

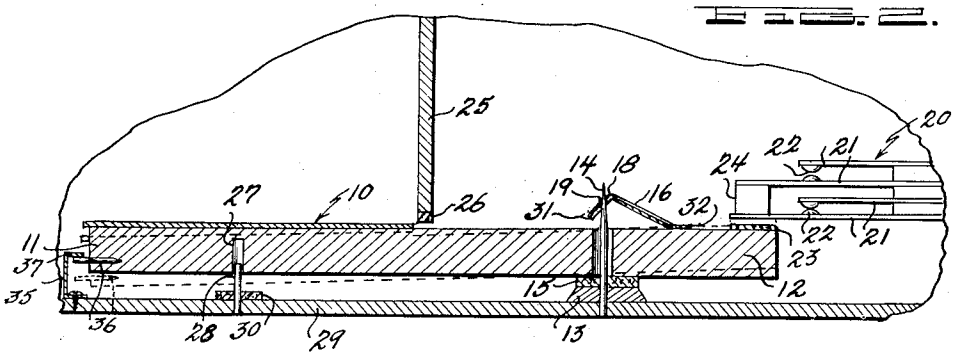
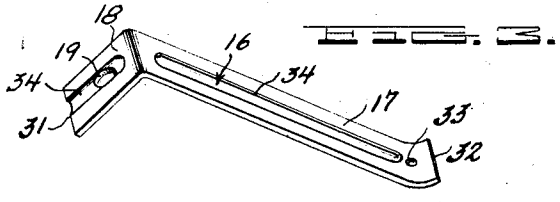


FIG. 3.



INVENTOR

GEORGE H. HADDEN

BY

Semmes, Kegin, Robinson & Semmes

ATTORNEYS

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ORGAN KEY LOADING DEVICE

George H. Hadden, Brattleboro, Vt., assignor to Minshall-Estey Organ, Inc., Brattleboro, Vt., a corporation of Vermont

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8 Claims. (Cl. 84—439)

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This invention relates to means for preloading and maintaining tension in organ keys and has specific reference to means for providing an initial elastic tension and continuing tension on organ keys of the balanced or pivoted type as used in connection with an organ having electronic or electropneumatic pipe actions.

The organ key to which the present invention is applicable is an elongated key having a playing end which is actuated by the fingers of the organist and a working end which opens and closes electric contact switches as the key is played. Intermediate the two ends of the key is a fulcrum on which the key is more or less balanced. It is desirable that a certain initial elastic tension be expressed through the playing end of the key when in normal non-playing position and a constant tension be maintained therein at all times while the key is being depressed into the playing position. This not only provides the restoring tension in the key to restore the key to the non-playing position when the player's finger is removed but it constitutes the "touch" or playing tension thereof.

It may appear feasible in the interests of economy to utilize the spring tension of the blades of the contact switches to apply the required restoring torque to the key. However, for numerous reasons relating in particular to the construction of leaf switches and their mode of operation, it is undesirable to rely upon the switch blades or leaves to provide the required tension. If switch blade tension constitutes the total key tension as well as the initial tension, the required short switch blade, which is necessarily of heavier gauge material, exhibits a noticeable increase of tension or resistance to the musician's fingers as the key is depressed from normal position to full depression or playing position. Also, considering the production problems, the slight differences in switch blade gauge, adjustment, etc. manifest themselves as a variation of "touch" or key tension, from key to key. Such a condition is extremely annoying to organists.

Finally, it is well known that a spring operated through a range or distance of displacement somewhat removed from its rest position exhibits negligible change in restoring torque throughout said range as compared with a spring operated over a similar range where one of the range limits is the rest or normal position of said spring. Due to the methods of fabricating and assembling multiple stack switches, and the requirements for critical contact spacing adjustments in the switch, little or no initial tension could be

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incorporated into a production design of organ keys where switch blade tension constituted total key tension, and therefore a consequent undesirable increase of key tension relative to key depression will occur.

It is, therefore, a primary object of this invention to provide in an organ of the character described a means for preloading the keys thereof which have electric contact switches associated therewith without requiring that said switches supply any of the force of tension.

Another object of this invention which is of primary value is the simplicity of the key loading device and its adaptability to an organ in mass production and assembly line techniques.

Another object of this invention is to provide in an organ of the character described means for maintaining an almost constant load on the keys initially and during depression thereof, which is independent of the electric contact switches associated therewith so that said switches may be made of light material to improve the characteristics of the multiple switch arrangement.

Still another object of this invention is to provide in an organ of the character described a spring member for the keys thereof which is cheap to manufacture in quantity and which is readily assembled.

A still further object of this invention is to provide in an organ of the character described key loading means comprising a spring member having slight concavity along its longitudinal axis in order to give an initial stronger tension upon first depressing the key and a lighter tension on continued depression of the key.

With these and other objects and advantages in view, which will become more apparent during the course of the following description, the invention consists in the features and combinations hereinafter set forth.

In order to make the invention more fully understood, preferred embodiments thereof have been made the subject of illustration in the accompanying drawings in which:

Figure 1 is a perspective view of an organ key with the preloading and tension element of this invention in position thereon;

Figure 2 is a longitudinal cross section of the organ key of Figure 1; and

Figure 3 is the spring or preloading member of this invention.

Briefly, the present invention contemplates an improvement in a key operated instrument of the electric type having keys with a playing end

and a working end, the latter of which actuates an electric contact, of means for preloading such keys and maintaining lasting tension therein. Accordingly, a fulcrum is provided for pivoting said key between the ends thereof, and a spring member is fixed at one of its ends in a position adjacent said key, so that the other end thereof will exert a tension against the key to preload the playing end and maintain tension during depression thereof while at the same time removing all tension from the contacts at the working end.

Referring in particular to the drawings, Figure 1 shows a balanced or pivoted key 10 of the type used in electric or electropneumatic pipe organs. This key is usually of some length greater than the portion exposed to the organist, and the key has a playing end 11 and a working end 12. A fulcrum point 13 is provided along with a fulcrum pin 14 extending upward therefrom. The pin 14 passes through the lateral center of the key 10 intermediate the ends thereof. A felt washer 15 is usually included to provide a suitable bearing point. The fulcrum point can be provided at a place along the key as determined by the total displacement or movement required at the working end of the key remote from the playing end.

A length of tempered steel ribbon of suitable gauge and approximately ¼ inch wide is bent into a spring or preloading member 16 as shown in Figure 3. This member has a forward bearing portion 17 and a rear angular portion 18. A hole 19, having sharp edges, is drilled in the portion 18 and is of sufficient diameter to fit freely over the fulcrum pin 14 when the plane of the portion 18 is at right angles to the axis of the pin but firmly when the portion 18 is inclined from perpendicular to the pin. The fulcrum pin protrudes through the key for a distance in excess of the actual key thickness which is sufficient for positioning of the spring member of this invention.

Adjacent the working end of the key and parallel therewith are electric contact switches 20 consisting of switch blades 21 and contact points 22. A bearing point 23 is positioned on the working end of the key for pressing against the lower switch blade 21 of the switch 20. A spacer 24 transmits the bearing pressure on lower blade 21 to the next to the highest blade 21 when the key is depressed at the playing end thereof.

Positioned between the fulcrum point and the playing end of the key is an instrument panel 25 having a felt bearing surface 26 on its lower edge. A recess 27 beneath the key at the playing end thereof coacts with guide pin 28 to align the key properly on the playing manual 29. A felt washer 30 cushions the key when the playing end thereof is depressed.

For best results when incorporating the spring member of this invention, the fulcrum pin should be made of some soft metal such as brass. The spring member 16 is lined up with its rear edge 31 facing toward the playing end of the key and its forward edge 32, bent to form a bearing surface, placed over the fulcrum pin as shown. In assembling the spring to the soft metal pin in mass production instruments, the spring need merely be pressed down over the pin until the rear edge 31 thereof touches the key 10. A slight upward pull on the playing end 11 of the key applies a force at the rear edge 31 of the spring 16 which in turn tends to straighten out the spring and therefore allows the spring to slide upward on the soft metal pin. A nominal clearance between the rear edge 31 of the spring and the surface of the key 10 is thus obtained, and this clearance is necessary to avoid binding of the key by the rear edge of the spring. In rapid assembly, however, various methods of obtaining the said clearance can be employed, such as placing a shim of suitable thickness between the key and rear edge 31, when the spring is being pressed over the fulcrum pin 14, such shim limiting the extent to which the spring is pressed down over said fulcrum. The shim can then be removed and inserted behind the next spring preparatory to assembly to its respective fulcrum pin. The upward limit of the playing key 10 is determined by the pin 36 in conjunction with the upper right angle bend portion 37 of key rail 35. The pin 36 is driven into the front lower face of the playing key 10 with a suitable jig for positioning of said pin, thus ensuring correct alignment of the front playing end of all keys when in the normal undepressed position. A similar technique taking slightly different form is employed in limiting the upward movement of the sharps (not shown). The instrument panel located over the keys is usually positioned directly behind the sharps so that a small clearance is provided between lower surface 26 and the top surface of the playing keys when in undepressed position, said position being determined as previously described.

In normal operation, the prevailing tension of the spring member against the key is of such nature as to increase the angular disposition of the spring portion 18 relative to the axis of the fulcrum pin and thus cause the hardened metal edges of the hole to bind tightly against the pin. In time, the pin will be cut into and thus the spring will be locked securely in position thereon. As the key is depressed during playing of the organ, this tendency is increased, that is: the further the key is depressed, the greater the tendency to bind and lock the spring upon the pin.

Since the nature of the spring 16 is such that it may be die-punched from ribbon stock and die-formed into the shape described, negligible variation in tension will be experienced by the musician when playing an instrument whose keys are located and spring loaded in the manner according to this invention. Furthermore, by preloading the keys of an organ in accordance with this invention and maintaining lasting tension in said keys throughout their depression other than by tension through the contact switch blades, switch blade material of extremely light but high tempered alloy may be incorporated to ensure good multiple switch construction. Actually the switch itself contributes practically nothing to the key touch or tension and the spring member 16 determines the touch and tension on the keys in their entirety. Switch blades of negligible torque, as described above, permit the use of the mechanical arrangement in which the switch leaves are mounted under the rear working end of the key in such manner as to be displaced to a maximum extent when the key is not depressed. Upon depressing such key, the working end rises and allows the switch blades to straighten, thus opening the contacts. This method employs a key circuit such as described in co-pending application Serial No. 205,689 of Mr. R. H. Campbell, Jr., filed January 12, 1951. This mechanical arrangement permits the use of an adjustment screw which corrects slight

variations in switch blade adjustments, key thickness, etc.

It should also be noted that the spring member **16** may be constructed of a special spring material of ribbon stock having a slight concavity **34** along its longitudinal axis to provide two tensions, i. e. an initial, firm tension upon first depressing the key which prevails for a small fraction of the total key depression, and a prevailing lighter tension upon further depression of the key which "breaks the back" of the spring.

A dual touch of this character is incorporated in many types of larger church organs, but it is accomplished by more expensive means than provided by the present invention. The stronger restoring tension prevailing when the key is around the normal up position insures proper key restoration and provides a firm and positive initial touch. At the same time this concave spring member avoids a heavy touch which would tire a musician when a group of keys were held down simultaneously, for the tension at full depression of the keys will be as light as that in an instrument employing the key loading spring system of lighter initial tension. It is thus seen that the spring having longitudinal concavity provides a differential in tension which ensures a firm, initial tension for positive contact opening (or closing in the case of a shunt-type of keying circuit) without increasing playing tension or exhibiting a heavier tension to the musician than necessary for usual playing requirements.

When used in conjunction with wood keys, a small indentation **33**, punched in the face of the spring, at the point where it rides on the key will suffice to prevent the spring from slipping laterally off the key onto adjacent keys. If plastic keys are used, this indentation will cooperate very well with a longitudinal indentation provided along the key surface adjacent the spring member.

While the invention has been described with reference to particular embodiments, it is contemplated that modifications thereof may be made without departing from the spirit of the invention. Accordingly, it is intended that the scope of the invention be limited only as defined in the appended claims.

I claim:

1. In a key operated musical instrument of the electric type having keys with a playing end and a working end, the latter of which actuates an electric contact, means for preloading said key comprising a fulcrum for pivoting said key between the ends thereof, a spring having a forward bearing portion and a rear angular portion, stationary means adjacent said key for anchoring the angular portion of said spring thereto so that the bearing portion will be in position to exert a tension on the working end of said key to load same at the playing end.

2. In a key operated musical instrument of the electric type having keys with a playing end and a working end, the latter of which actuates an electric contact, means for preloading said key comprising a fulcrum for pivoting said key between the ends thereof, a fulcrum pin extending upward from the center of said fulcrum through an opening defined through the lateral center line of said key, said fulcrum extending above the upper surface of said key, a spring having a forward bearing portion for exerting tension on the key toward the working end thereof to load same at the playing end and a rear angular portion, and means for securing the angular portion of said spring to said pin so that the forward bearing portion will exert a tension on the upper surface of the working end of the key.

3. In a key operated musical instrument of the electric type having keys with a playing end and a working end, the latter of which actuates an electric contact, means for preloading said key comprising a fulcrum for pivoting said key between the ends thereof, a fulcrum pin extending upward from the center of said fulcrum through an opening defined through the lateral center line of said key, said fulcrum extending above the upper surface of said key, a spring having a forward bearing portion for exerting tension on the key toward the working end thereof to load same at the playing end and a rear angular portion, said spring having an opening in the rear angular portion thereof which is slightly larger than the diameter of said fulcrum pin so that said spring may be held in place on said pin by placing the opening of the spring over the pin and expanding the spring to widen the angle therein so that the spring will slide down over the pin, means for holding said spring in fixed position on said pin, and means to limit the upward movement of the playing end of the key resulting from the tension on the working end thereof.

4. In a key operated musical instrument of the electric type having keys with a playing end and a working end, the latter of which actuates an electric contact, means for preloading said key comprising a fulcrum for pivoting said key between the ends thereof, a fulcrum pin extending upward from the center of said fulcrum through an opening defined through the lateral center line of said key, said fulcrum extending above the upper surface of said key, a spring having a forward bearing portion for exerting tension on the key toward the working end thereof to load same at the playing end and a rear angular portion, said spring having an opening in the rear angular portion thereof which is slightly larger than the diameter of said fulcrum pin so that said spring may be held in place on said pin by placing the opening of the spring over the pin and expanding the spring to widen the angle therein so that the spring will slide down over the pin, means for holding said spring in fixed position on said pin, said spring having slight clearance toward its rear end from the top surface of the key to avoid binding of the key.

5. In a key operated musical instrument of the electric type having keys with a playing end and a working end, the latter of which actuates an electric contact, means for preloading said key comprising a fulcrum for pivoting said key between the ends thereof, a fulcrum pin extending upward from the center of said fulcrum through an opening defined through the lateral center line of said key, said fulcrum extending above the upper surface of said key, a leaf spring having a forward bearing portion for exerting tension on the key toward the working end thereof to load same at the playing end and a rear angular portion, said spring having an opening in the rear angular portion thereof which is slightly larger than the diameter of said fulcrum pin so that said spring may be held in place on said pin by placing the opening of the spring over the pin and expanding the spring to widen the angle therein so that the spring will slide down over the pin, means for holding said spring

in fixed position on said pin, said spring having slight clearance toward its rear end from the top surface of the key to avoid binding of the key, and means to limit the upward movement of the playing end of the key resulting from the tension on the working end.

6. In a key operated musical instrument of the electric type having keys with a playing end and a working end, the latter of which actuates an electric contact, means for preloading said key comprising a fulcrum for pivoting said key between the ends thereof, a soft metal fulcrum pin extending upward from the center of said fulcrum through an opening defined through the lateral center line of said key, said fulcrum extending above the upper surface of said key, a leaf spring having a forward bearing portion for exerting tension on the key toward the working end thereof to load same at the playing end and a rear angular portion, said spring having an opening with sharp edges in the rear angular portion thereof which is slightly larger than the diameter of said fulcrum pin so that said spring may be held in place on said pin by placing the opening of the spring over the pin and expanding the spring to widen the angle therein so that the spring will slide down over the pin, the sharp edges of the opening in said spring biting into the soft metal when the spring is released to anchor same in one position on the pin, said spring having slight clearance toward its rear end from the top surface of the key to avoid binding of the key, and means between the playing end of the key and the fulcrum to limit the upward movement of the playing end of the key resulting from the tension on the working end.

7. In a key operated musical instrument of the electric type having keys with a playing end and a working end, the latter of which actuates

an electric contact, means for preloading said key comprising a fulcrum for pivoting said key between the ends thereof, a leaf spring member fixed at one end of said member in a position adjacent said key so that the other end thereof will exert a tension against the key to preload the playing end and at the same time remove all tension from the contacts at the working end, said spring member being concave along its longitudinal axis to provide a firm and positive initial tension and a lighter prevailing tension.

8. In a key operated musical instrument of the electic type having keys with a playing end and a working end, the latter of which actuates an electric contact, means for preloading said key comprising a fulcrum for pivoting said key between the ends thereof, a leaf spring member, stationary means adjacent said key for anchoring one end of said spring member so that the other end thereof will be in position to exert a tension against the working end of the key to preload the playing end and at the same time remove all initial tension from the contact at the working end of the key, said spring member being concave along its longitudinal axis to provide a firm and positive initial tension and a lighter prevailing tension.

GEORGE H. HADDEN.

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