

Nov. 15, 1949

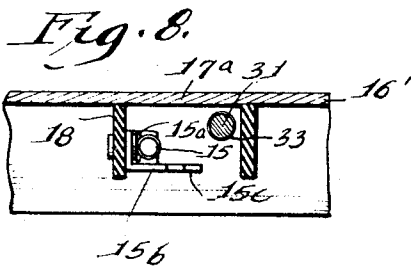
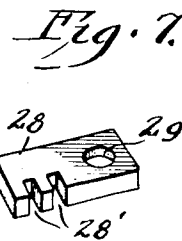
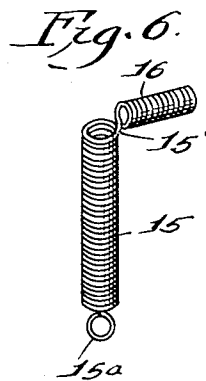
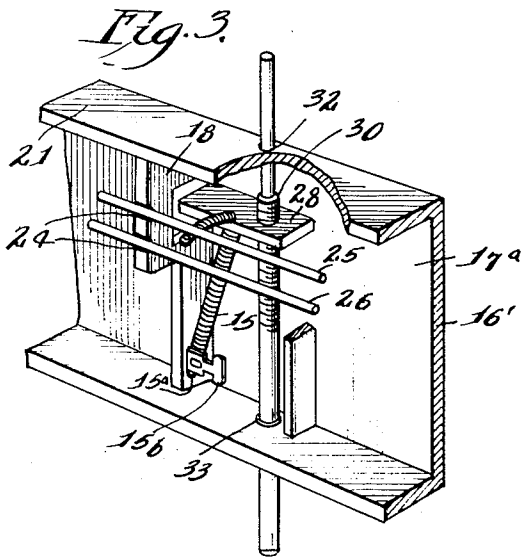
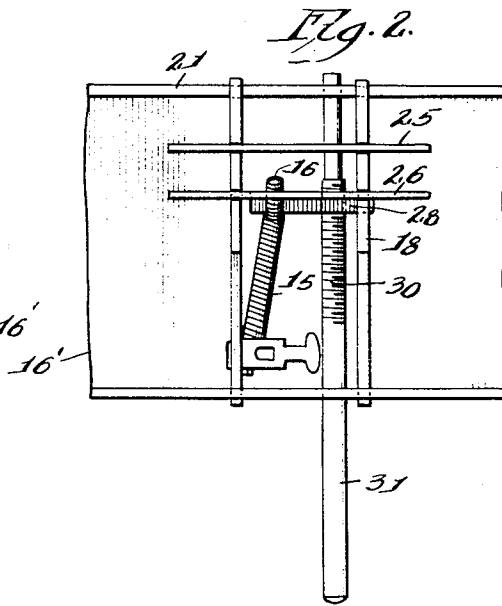
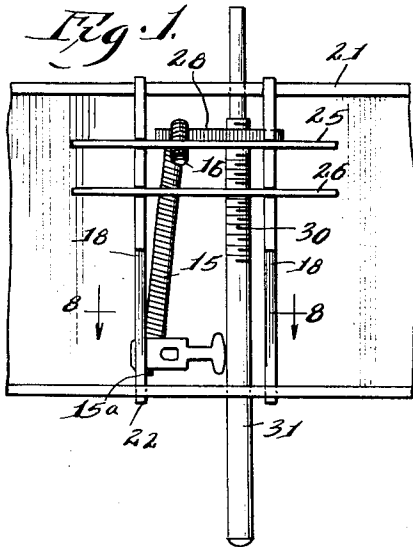
M. J. LARSEN ET AL

2,487,977

ELECTRIC SWITCH

Filed Dec. 11, 1948

2 Sheets-Sheet 1



Inventors
Merwin J. Larsen.
Norman B. Erickson.
Walter J. Anderson.

By. James A. G. Koehl.
Attorney.

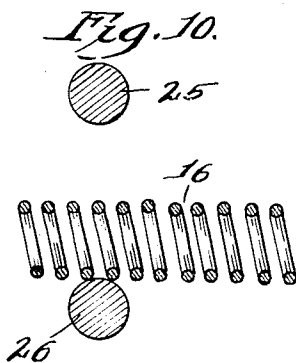
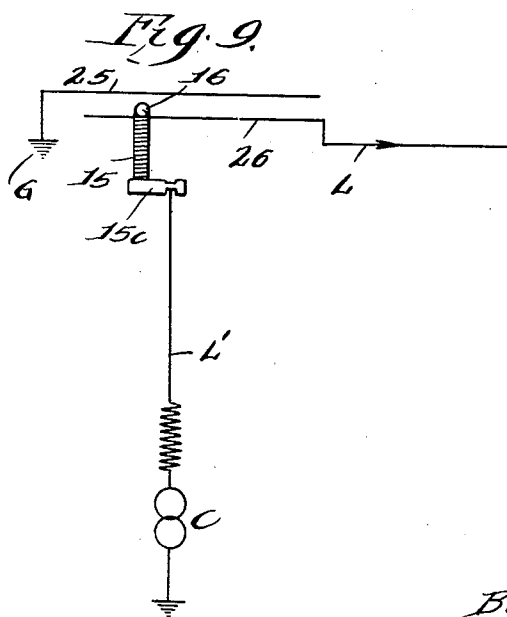
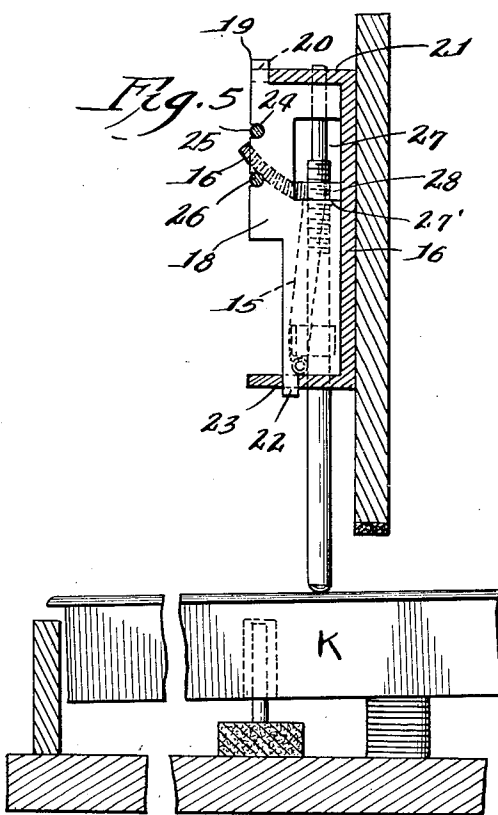
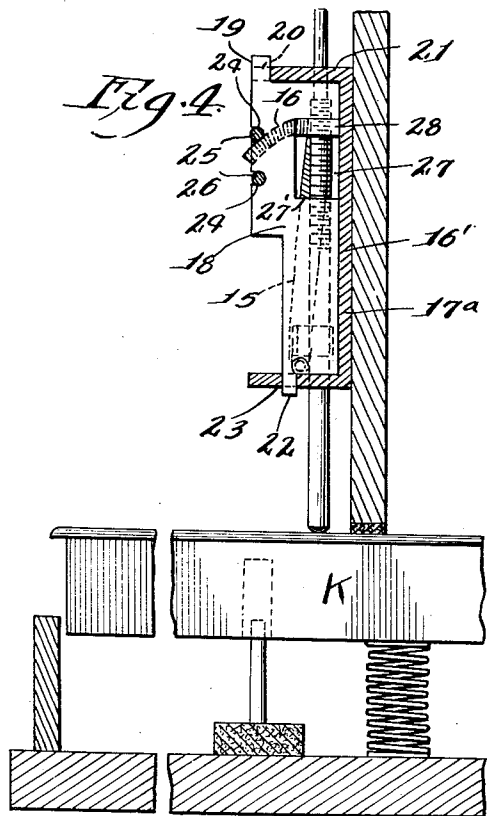
Nov. 15, 1949

M. J. LARSEN ET AL
ELECTRIC SWITCH

2,487,977

Filed Dec. 11, 1948

2 Sheets-Sheet 2



Inventors
Merwin J. Larsen,
Norman B. Erickson,
Walter J. Anderson.

By James A. G. Koehl
Attorney.

UNITED STATES PATENT OFFICE

2,487,977

ELECTRIC SWITCH

Merwin J. Larsen, Villa Park, Norman B. Erickson, Chicago, and Walter J. Anderson, Elgin, Ill., assignors to Central Commercial Company, Chicago, Ill., a corporation of Illinois

Application December 11, 1948, Serial No. 64,784

8 Claims. (Cl. 200—16)

1

This invention relates to electric switches generally.

The invention has particular reference to electric switches primarily but not necessarily designed for use in the keying circuits of audio signal transmission systems, such, for example, the electrical networks of electronic organs or other keyboard musical instruments employing sources producing tone frequencies or output waveforms of frequencies having the vibration frequencies of different notes of the chromatic scale, which said frequencies or waveforms of frequencies are then translated into audible sounds for musical expression.

An important object of the invention is the provision of a compact organization of electrically coactive elements in which the elements are designed and constructed to insure a self cleaning action of said elements in response to actuation of the switch.

A still further object is the provision of a switch, the "on" and "off" positions of the coactive elements of which are controlled respectively by a mechanism which is responsive to actuation of the playing-key of a piano or other keyboard musical instrument.

Another object is the provision of means enabling adjustment of the actuating mechanism to insure a correct relationship thereof to an associated playing-key.

A still further object is the provision of a switch, the operation of which is practically noiseless.

A still further object is the provision of a switch, which, in addition to compactness of parts is exceedingly simple and inexpensive of construction, structurally sturdy and not apt by long and rough usage to get out of order.

Another object is the provision of a switch, motion of the effective contact elements of which is synchronized with actuations of the playing-key of a musical instrument to an extent that motion of the key is transferred to a controlling mechanism, which, in turn, actuates said elements in a dependable manner regardless of the number of times the key is depressed per second.

Other objects and advantages of the invention will be manifest upon reference to the following description and accompanying drawings, in which:

Figure 1 is a front elevation of the switch, showing same in an "off" condition;

Figure 2 is a view similar to Figure 1, showing the switch in an "on" condition;

Figure 3 is a sectional perspective view showing the switch in an "off" condition.

2

Figure 4 is a view partly in vertical section showing an application of the switch to the playing-key of a musical instrument;

Figure 5 is a view similar to Figure 4, showing the switch in an "on" condition;

Figure 6 is a perspective view of the coiled electrically conductive member;

Figure 7 is a perspective view of the follower and coactive adjustable pin separated from each other;

Figure 8 is a section taken on line 8—8 of Figure 1;

Figure 9 is a schematic view of the switch showing same connected in a transmission network; and

Figure 10 is a schematic view showing the manner of establishing a two point contact of the short coil with a coating conductor of the switch.

The herein disclosed switch is adapted primarily, but not necessarily, for use in combination with the musical instrument disclosed and claimed in Letters Patent, No. 2,250,065, issued to James A. Koehl on July 22, 1941. The invention disclosed in said patent comprises in combination with a piano, means such as vacuum tube generators of tone frequencies or wave forms of tone frequencies, which said means is connected in an electrical network in such manner that given switches connect preassigned generators with given playing keys of the keyboard of said piano, whereby upon depressing any selected key a sustained musical tone having the same pitch as the note associated with said key will be produced. By means of said invention, a piano is capable of producing tones characteristic of the piano as well as sustained tones typical of the organ. These tones may, at the discretion of the player, be sounded separately or together.

We have discovered that a single length of wire of suitable kind and gauge when formed into a first coil having the resilient properties of a retractile spring and a second coil which is a continuation or integral part of the first coil, can, as taught herein, be readily combined with other elements of an electric switch (including spaced apart contact elements and an actuator) to provide a simple, practically noiseless, positively acting, self cleaning, compact switch organization which is highly dependable, fast in operation and adaptable to an instrument of the class aforementioned. A single length of wire formed with plural coils as above stated constitutes a current conductor when connected in a transmission network, the first coil being coactive with spaced apart contact elements in a manner insuring good electrical contact and a cleaning

action of the coil and said contact during operation of the switch.

In carrying the invention into practice, use is made of an electrical conductor consisting of a single length of phosphor bronze wire or equivalent metal which is formed into a first coil 15 and a second coil 16, the latter being of somewhat smaller diameter and of shorter length than coil 15 and disposed at an acute angle thereto. Coil 15 has the properties of a retractile spring for a purpose to appear presently. A single length of wire characterized by two conjoined coils 15 and 16 is preferably silver plated as a protection against corrosion or oxidization.

16' is a mounting comprising a channel member. Placed transversely of said member and within the channel thereof is a flat strip of insulating material 18 of suitable thickness, the back edge of which abuts the vertical wall 17a of said member. The front vertical edge of said strip is substantially flush with the open side of said member, and as shown, the upper end of the strip has a flat lug 19 which is received in a notch 20 in the front edge of the upper flange 21 of said member, the lower end of said strip having a depending lug 22 received in a hole 23 in the lower flange of said member. By this means, the strip is rigidly mounted in the channel of said member.

The front vertical edge of strip 18 is formed with a pair of spaced apart notches 24 in which longitudinally disposed electrical conductors 25 and 26 are respectively received. Conductor 25 provides a grounding terminal for the switch and conductor 26 a circuit making terminal, which said terminals are formed and disposed for electrical coaction with coil 16 as will be explained presently.

The back edge of strip 18 is formed with a U-shaped notch 27, the open side of which is closed by the vertical wall or said channel member 17. Mounted in said notch is a nut or follower 28, the hole 29 in which is threaded for accommodation of the threaded portion 30 of a vertically adjustable pin 31. Said pin has its upper end freely received in a guide hole 32 in the upper end of the aforementioned channel member 17, and as shown, the lower end of the pin passes through a guide hole 33 in the lower flange of said channel member. At this point in the description it is noted that said notch 27 serves to hold the follower 28 against rotational motion while allowing the follower to move vertically, the lower wall 27' of said notch functions as a stop to limit downward motion of said follower.

The front edge of the follower 28 is formed with notches 28'. The helix 15' at the juncture point of coils 15 and 16 is passed into these notches and secured to the follower by cement. The coil 16 is normally at an acute angle to the long axis of coil 15 and when the switch parts are assembled, the short length, small diameter coil projects forwardly and through the space between conductors 25 and 26. When the playing-key K is elevated, coil 16 is flexed downwardly and effectively engages grounded conductor 25. When depressing the playing-key, coil 16 disengages conductor 25 and effectively engages conductor 26 and is flexed upwardly. The lower end of coil 15 is formed with a loop 15a which is secured to an eyelet 15b at the lower end of said strip 18, the eyelet serving also to attach a terminal member 15c to said strip. In this manner coil 15 is tensioned when pin 31 is at the upper limit of its movement due to upward spring tension

on the playing-key, which tension is in excess of that of the coil 15. As the key is depressed pin 31, the lower end of which freely rests upon the upper surface of the key, follows the downward motion of the key and causes coil 16 to leave conductor 25 and engage conductor 26, thereby closing the circuit in which the switch is connected.

We find that by predetermining the gauge of conductors 25 and 26 and the gauge of the wire from which coils 15 and 16 are formed more than one wound portion of coil 16 engages such conductor that is contacted at any instance thus giving double assurance that an electrical contact is established. In practice each conductor 25, 26 may be .032" gauge and the wire from which coils 15 and 16 are formed .007" gauge.

We stress that feature of our invention which consists in the provision of coil 16 which is laterally resilient and free to flex and wipe against said conductors, thereby keeping both the conductors and said coil clean and free of foreign matter. See Figure 10.

As shown in Figure 9, conductor 25 is connected to ground G. Conductor 26 is connected to an output lead L which may connect to an audio amplifier, not shown. Terminal member 15c on strip 18 connects with a signal supply source C via lead L'. Thus, when short coil 16 is engaged with conductor 25, signal voltage from source C is to ground. When the coil is moved onto conductor 26 the flow of signal voltage is through conductor 26, as will be understood.

What we claim as our invention is:

1. An electric switch comprising laterally spaced apart grounding and signal output terminals respectively; a contactor of resilient electrically conductive material adapted to be connected to a signal transmission circuit and disposed between said terminals for movement first into electrical engagement with one and then the other thereof; mechanism by means of which motion is adapted to be transmitted to said contactor in a direction to cause electrical engagement thereof with said ground terminal; and resilient means coactive with said mechanism and tending to urge said contactor in a direction to cause electrical engagement thereof with said output terminal, said contactor comprising a coil, laterally flexible spring, and said resilient means comprising a continuation of said coil and formed to provide a retractile spring.

2. An electric switch as set forth in claim 1, wherein said contactor consists of a coil spring and said resilient means consists of a continuation thereof and is coiled to form a retractile spring and wherein means are provided for mounting the coil comprising said contactor and the coil comprising said retractile spring to dispose the first named coil at an angle to the last named coil.

3. An electric switch comprising a single length of wire forming a continuous coil, a first portion of which constitutes a retractile spring adapted to be connected to the output of a tone signal supply source and a second portion which is angularly related to said first portion and adapted to form a contactor; an output terminal disposed for engagement with said second portion; and mechanism for causing engagement of said second portion with said output terminal.

4. A switch as set forth in claim 3, wherein a mounting supports said output terminal and said continuous coil and includes a member of elec-

5

trical insulating material to which one end of the first portion of said coil is fixed.

5. An electric switch as set forth in claim 3, wherein a mounting supports said continuous coil and includes a member of insulating material to which one end of the first portion of said coil is fixed, and wherein a pin is slidable in said mounting and is connected with said first portion of said coil for urging the pin in a direction to cause electrical engagement of the second portion of the coil with said output terminal.

6. An electric switch as set forth in claim 3, wherein a mounting supports said continuous coil and includes a member of electrical insulating material to which one end of the first portion of said coil is fixed; and wherein a pin is slidable in said mounting and is connected with said coil by a longitudinally adjustable follower to which the opposite end of the coil is attached in a manner to angularly relate the second portion of said coil to said first portion thereof as aforementioned.

7. An electric switch comprising an electrical conductor consisting of coiled wire providing a first coil adapted to function as a retractile spring and a second coil adapted to form a movable con-

6

tactor; a fixed contactor with which the second coil is adapted to be engaged; and means for causing engagement of said second coil with and disengagement thereof from said fixed contactor.

8. An electric switch as set forth in claim 7, wherein a mounting supports said conductor and includes a member of insulating material to which one end of the first coil is secured, and a vertically adjustable pin having a threaded portion provided with a follower of electrical insulating material to which the opposite end of the first coil is attached and by means of which the second coil is disposed for coaction with said fixed contactor as aforementioned.

MERWIN J. LARSEN.

NORMAN B. ERICKSON.

WALTER J. ANDERSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,722,703	Louis	July 30, 1929

Certificate of Correction

Patent No. 2,487,977

November 15, 1949

MERWIN J. LARSEN ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 4, line 69, for the word "contractor" read *contactor*;
and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.
Signed and sealed this 21st day of March, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

Certificate of Correction

Patent No. 2,487,977

November 15, 1949

MERWIN J. LARSEN ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 4, line 69, for the word "contractor" read *contactor*;
and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 21st day of March, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.