

2 SHEETS—SHEET 1.

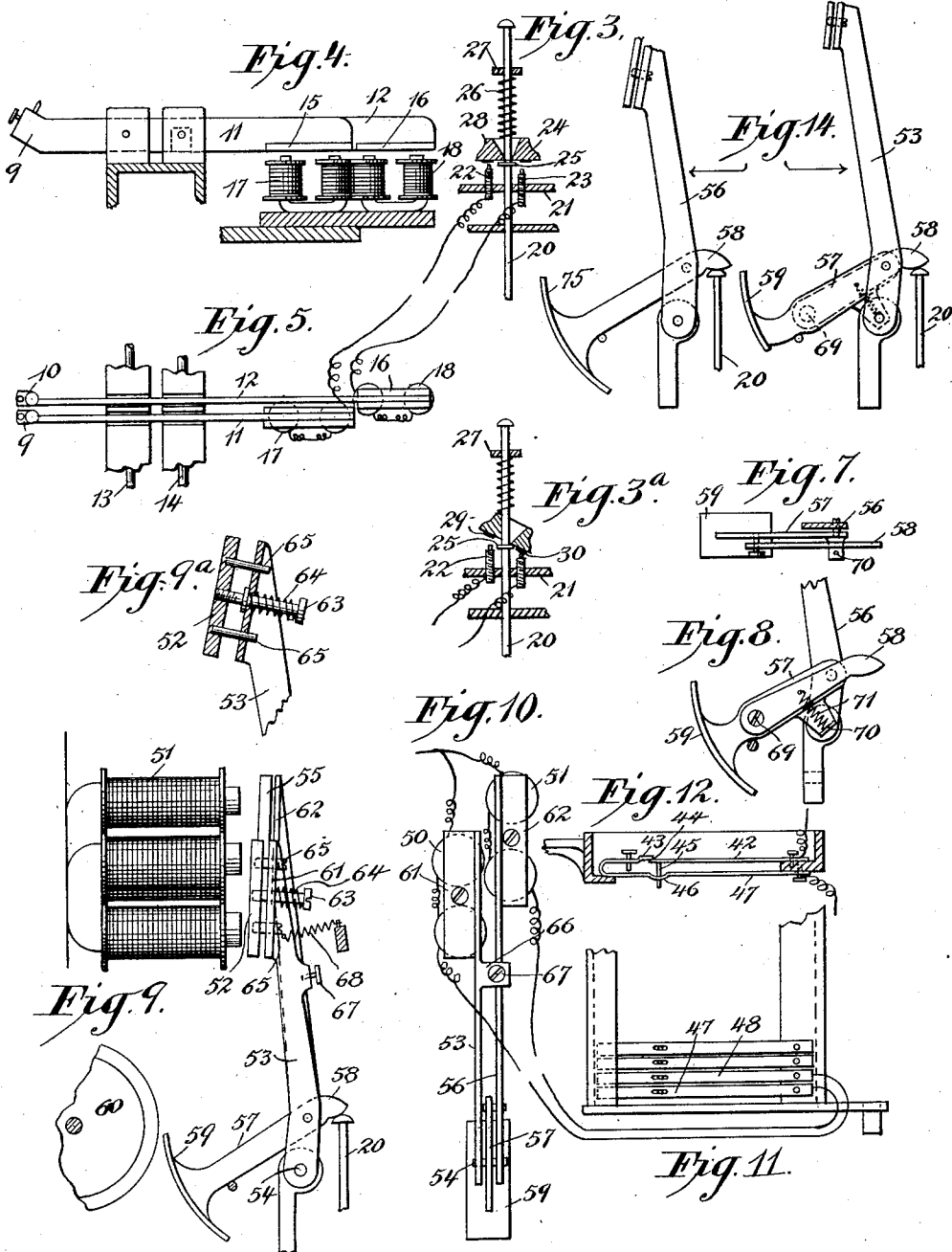
COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

C. W. NYSTRÖM.
 APPARATUS FOR RECORDING AND REPRODUCING MUSIC.
 APPLICATION FILED MAR. 25, 1909.

1,046,487.

Patented Dec. 10, 1912.

2 SHEETS-SHEET 2.



Witnesses:
 John C. Sanders
 Albert F. Newman

Fig. 13. Inventor:
 Carl Wilhelm Nyström
 BY *Wm. M. M. M.*
 Atty.

UNITED STATES PATENT OFFICE.

CARL WILHELM NYSTRÖM, OF KARLSTAD, SWEDEN.

APPARATUS FOR RECORDING AND REPRODUCING MUSIC.

1,046,487.

Specification of Letters Patent.

Patented Dec. 10, 1912.

Application filed March 25, 1909. Serial No. 485,797.

To all whom it may concern:

Be it known that I, CARL WILHELM NYSTRÖM, engineer, subject of Sweden, residing at Karlstad, Sweden, have invented new and useful Improvements in Apparatus for Recording and Reproducing Music, of which the following is a specification.

This invention consists in improvements in apparatus for recording and reproducing music produced on key-instruments. The improvements are especially adapted to be applied to apparatus of a previously known type, consisting of a rotary cylinder or an advancing note strip, on which impressions are made during the performance of a piece of music, by means of cutting tools, entering into action when the keys are depressed, said impressions consisting in lines, the lengths of which depend on how long the keys have been depressed. For reproducing said piece of music, which can be done on the same instrument or on another key instrument, reproducing tools are made to abut against a rotary cylinder or a note strip provided with such impressions, whereby, when the reproducing tools enter the said impressions, the corresponding keys are depressed by means of a lever transmission between the reproducing tools and the keys. In apparatus of this known type only one cutting tool and one reproducing tool have been used actuated from or actuating each key, and the impressions on the cylinder or the note strip have been independent of the variations of the tone intensity. It has been proposed to record and to reproduce said variations by means of special devices, but such devices are very complicated and have not worked satisfactorily.

According to the present invention two or more cutting tools are employed for each key, successively entering into action at different times according to the velocity with which the key is depressed, and thus two or more impressions are made on the rotating cylinder or the advancing note strip for each tone, said impressions representing the length as well as the intensity of the tone in question.

For reproducing the piece of music two or more reproducing tools are used for each key, successively entering into action at different times according to the impressions on the note strip or cylinder, whereby the key is depressed with more or less power.

On the drawings Figure 1 shows the ap-

paratus in vertical section; Fig. 2 is a view from behind from the left of Fig. 1; Fig. 3 is a vertical section of a spindle on an enlarged scale; Fig. 3^a is a view similar to Fig. 3 showing the boss in its lowest position; Fig. 4 is a plan view on an enlarged scale of a pair of cutting tools and their electromagnets; Fig. 5 is a side view of said pair of cutting tools; Fig. 6 shows part of the note strip with impressions thereon; Fig. 7 is a plan of a modified construction of part of the lever transmission for actuating the keys; Fig. 8 is a side view of the same; Fig. 9 is a side view of the electromagnets and the lever mechanism for actuating the keys; Fig. 9^a is a detail sectional view showing the means for adjusting the armature; Fig. 10 is a plan of the same; Fig. 11 is a plan of the reproducing tools; Fig. 12 is a vertical section of the same; Fig. 13 is a plan of the boss and the contacts shown in Fig. 3; Fig. 14 is an elevation of a modified construction of lever for actuating the keys; Fig. 15 is a modified form of the spindle which controls the movement of the key and the closing of the magnet circuits.

1, Fig. 1, indicates the frame work of the apparatus, which is adapted to be applied on a key instrument at 2. A frame 3 is adjustably jointed to the upper part of the frame work of the apparatus and carries brackets 4 with bearings for three cylinders 5, 6 and 7. A strip 8 of paper, cloth or the like, coated on the one side with a thin wax-like material, is led from the cylinder 5 to the cylinder 7 over the cylinder 6. The cylinder 7 is rotated by any suitable means, not shown on the drawing, such as for instance an electro-motor.

For each key two cutting tools 9, 10, Figs. 3, 4 and 5, are arranged, projecting below the cylinder 6 so as to come into contact with the strip 8. The tools 9, 10 are carried by levers 11, 12, rocking on shafts 13, 14 and carrying armatures 15, 16, below which electromagnets 17, 18 are placed. Said electromagnets successively are made active by means of a vertical spindle 20 resting on the key 19. In a strip 21, serving as guide for the spindles 20, two contacts 22, 23 are fixed at different heights. Above said contacts a boss 24 is placed on the spindle 20, resting on a fixed boss 25 on the spindle 20 and actuated by a spring 26, inserted between the boss 24 and a strip 27. The boss 24 has a conical boring 28, through which

the spindle 20 passes, so that it can occupy an oblique position on the spindle. It is moreover provided with two contacts 29, 30 placed opposite to the contacts 22, 23, and insulated one from the other, Fig. 13.

The device now described, in which the strip 8, the cutting tools 9 and 10, in combination with the electromagnets, entering into action when a key is depressed, are previously known, works in the following manner. When the key 19 is depressed, the spindle 20 descends by its own weight and under the influence of the spring 26, whereby at first the contact 22 is caused to abut against the contact 29. Hereby an electric circuit is closed through the electromagnet 17, which attracts the armature 15 on the lever 11, so that the cutting tool 9 makes an impression 31 on the note strip 8, Fig. 6. During the continued motion downward of the key 19 the boss 24 is placed in an oblique position, so that the contact 23 is caused to abut against the contact 30, whereby the electric circuit is closed through the electromagnet 18, which attracts its armature 16, causing the cutting tool 10 to make an impression 32 on the note strip 8. It will be obvious, that the more forcibly the key 19 is depressed, the shorter time will lapse between the moment when the cutting tool 9 enters into action to the moment when the cutting tool 10 enters into action, and the length of the impression made by the cutting tool 10 thus will come more and more near the length of the impression, made by the cutting tool 9, as indicated at 33, 34, 35, 36, 37, 38, and 39 40 in which latter case the key 19 is depressed so powerfully, that is so fortissimo, that the cutting tools 9 and 10 have entered into action almost simultaneously. By employing a device, such as that described, in connection with each key impressions 31, 32,—39, 40 are made on the note strip, during the performance of a piece of music. The impressions 31, 33, 35, 37 and 39 indicate by their length the length of the tones played while the strength of the tones is indicated by the difference between the lengths of the impressions 31, 33, 35, 37 and 39 and the impressions 32, 34, 36, 38 and 40 respectively.

In order to record the variations of the intensity of the tones more completely, more than two cutting tools, each combined with an electromagnet, which is made active by closing an electric contact, may be provided, each electric contact being closed successively during the depression of the key. By these means, for each tone played a number of impressions of different lengths are made on the note strip, whereby the difference of length between the impressions is the smaller, the more powerful the key is depressed.

For reproducing the piece of music re-

corded in the manner just described, on the same key instrument or on another key instrument, a number of reproducing tools corresponding to the number of cutting tools is employed for each key, said reproducing tools being caused to enter into the impressions on the note strip 8 made by the cutting tools, after that said strip has been wound back again upon the cylinder 5, whereby the reproducing tools in a previously known manner close electric circuits through electromagnets, which depress the key through a suitable lever connection.

Each reproducing tool comprises two parallel springs 41, 42, Figs. 11 and 12, the upper one 41 of which is bent in U-form. The springs 41, 42 form electric contacts 43, 44 at their ends. The spring 42 carries a pin 45, passing through a hole in an arc-shaped part 46 of the upper spring 41. Two such reproducing tools 47, 48 are provided, actuating one and the same key, and they are all arranged in an adjustable frame 49, which is placed in such a position to the cylinder 6, which during the reproduction is moved over to the position shown with dotted lines in Fig. 1, that the pins 45 abut against the note band 8.

Each pair 47, 48 of reproducing tools is electrically connected with a pair of electromagnets 50, 51, Figs. 9 and 10. The armature 52 of the electromagnet 50 is carried by a lever 53, rocking on the shaft 54. The armature 55 of the second electromagnet 51 is carried by a lever 56, also rocking on said shaft 54. To the lever 56 is jointed a lever 57, the shorter arm 58 of which rests against the upper end of the spindle 20. The lever 57 carries at its end an arc-shaped piece 59 placed in front of a rotating cylinder 60. The armatures 52 and 55 are adjustably arranged on the upper parts 61, 62 of the levers 53, 56. For the sake of clearness the adjusting means are shown only for the armature 52. It comprises a screw 63 passing through a threaded hole in the center of the armature 52 and penetrating a hole in the part 61 and actuated by a spring 64. Two pins 65 prevent swinging movement of the armature. The lever 53 is provided with a projection 66, through which extends a screw 67 resting on the lever 56.

The reproducing device now described acts in the following manner. The frame 49 is adjusted so that the pins 45 are resting on the note strip 8 and so that they are put in line with the impressions 31, 32, 33—on said note strip. For each pair of impressions 31, 32, 33, 34— one pair of reproducing tools 47, 48 and pins 45 are provided. When during the motion of the note strip 8 the pin 45 belonging to a reproducing tool, say the reproducing tool 48, enters an impression, say the impression 31, the contacts

43, 44 are closed, whereby the electric circuit is closed through the electromagnet 50, which attracts its armature 52 against the action of the spring 68. Thus the lever 53 is turned taking with it by means of the screw 67 the lever 56, which brings the arc-shaped piece 59 in contact with the rotating cylinder 60. The lever 57 is thereby turned upward, whereby the spindle 20 is depressed and the key, on which the spindle 20 rests, is depressed. The armature 52 is adjusted in such a way that the piece 59 is pressed with a very light pressure against the cylinder 60. During the continued motion of the note strip 8 the pin 45 belonging to the second reproducing tool 47 of the pair in question will enter the second impression 32 belonging to the same tone, whereby in an analogous manner the electromagnet 51, which is electrically connected with said tool, is made active. It thus attracts its armature 55 and presses the piece 59 more energetically against the rotating cylinder 60, whereby the spindle 20 is depressed more energetically and the tone is struck more intensely. The tone thus will be struck with the same touch, that is indicated by the impressions on the note strip for that tone, and as said impressions represent the length and touch of the tone played during the performance of the piece of music, the said tone will be reproduced with the same length and touch.

Figs. 7 and 8 show a modified arrangement of the arc-shaped piece 59 with the object to make the depression of the key softer. The lever 57 carrying the arc-shaped piece 59 is jointed to the lever 56 as before, but the arm 58 resting upon the spindle 20 constitutes a separate lever, which is jointed to the lever 57 at 69. The lever 57 is provided with a projecting arm 70, to which is fixed a spring 71, the other end of which is fixed to the arm 58. When the arc 59 is lifted by the rotating cylinder 60 the strength of the spring 71 must be overcome before the arm 58 can depress the spindle 20.

As shown on the drawing the recording device as well as the reproducing device is undetachably fixed in the apparatus, which thus serves for recording as well as for reproducing a piece of music. Obviously the reproducing device may be attached to a special frame, which can be applied to a key instrument, whereas the recording device may be attached to another frame and applied to another key instrument. The advance of the arrangement as shown is that the adjustment of the different parts is unnecessary each time a piece of music is to be reproduced.

To enable an adjustment of the spindles 20 according to the unevenness of the key board, the spindles are made in two parts, as shown in Figs. 1 and 2, which are con-

nected by means of sleeve 72, which can be clamped together at its upper part. When the sleeve 72 is loosened so that the upper part of the spindle is free, a spring 74, inserted between a boss 73 and the sleeve 72, presses the parts of the spindle from one another, so that the lower part of the spindle is caused to rest firmly on the key 19. In the same manner as described such variations, which are performed by means of the pedals, can be recorded and reproduced. For this purpose spindles, such as described, are connected with the pedals, acting upon cutting tools and acted upon by reproducing tools of the construction described.

Fig. 14 shows an arrangement in which the lever 53 carries a spring-actuated arc-shaped piece 59 constructed as shown in Figs. 7 and 8, whereas the lever 56 carries another arc-shaped piece 75 constructed in the manner shown in Fig. 9, both said pieces actuating one and the same spindle 20. In this case the projection 66 and the screw 67 are omitted. The function is that the piece 59 is first brought in contact with the rotating cylinder 60, whereby the key is depressed softly, and then the piece 75 enters into action, causing the key to be depressed forcibly. The two pieces thus enter into action in succession, and the interval of time depends upon the impressions recorded for the key in question.

Fig. 15 shows a device for enlarging the movements of the key in order to get the proper movement of the spindle 20. The spindle 20 is shown resting on the outer end of a lever 76 rocking on 77, and between said lever and the key 19 at a point near to the rocking point 77 a spindle 78 is inserted.

What I claim is:—

1. In a sound recording and reproducing attachment for key instruments, the combination with means for supporting the recording strip, of recording means operated by the depression of a key to contact with said strip, reproducing means adapted to contact with the record strip to operate the keys, and means for moving the record-strip supporting means to bring the same in contact with either the recording means or the reproducing means.

2. In a sound recording and reproducing attachment for key instruments, the combination with a roller supporting the recording strip, adjustable recording means operated by the depression of the key to contact with said strip, adjustable reproducing means adapted to contact with the recording strip to operate the keys, and means for moving the roller to bring the recording strip in contact with either the recording means or the reproducing means.

3. In a device for recording a piece of music performed on a key instrument, in combination, a plurality of cutting tools for

each key, electromagnets associated with
said cutting tools and adapted when ener-
gized to move said cutting tools into oper-
ative position, there being one electromag-
5 net for each tool, a plurality of spindles
resting upon the keys and adapted to move
up and down in accordance with the move-
ment of the keys, there being one spindle for
each key, a plurality of fixed contacts as-
10 sociated with each spindle, said contacts be-
ing arranged at different heights, a tilting
member carried by said spindle, a plurality
of contacts mounted upon said tilting mem-

ber and arranged to successively engage said
fixed contacts, and circuit connections be- 15
tween said contacts and said magnets where-
by said magnets associated with any one
key will be successively energized upon
the actuation of said key.

In testimony whereof I have signed my 20
name to this specification in the presence of
two subscribing witnesses.

CARL WILHELM NYSTRÖM.

Witnesses:

WALDEMAR BOMAN,
T. EKIBOHM.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."