No. 778,908. PATENTED JAN. 3, 1905.

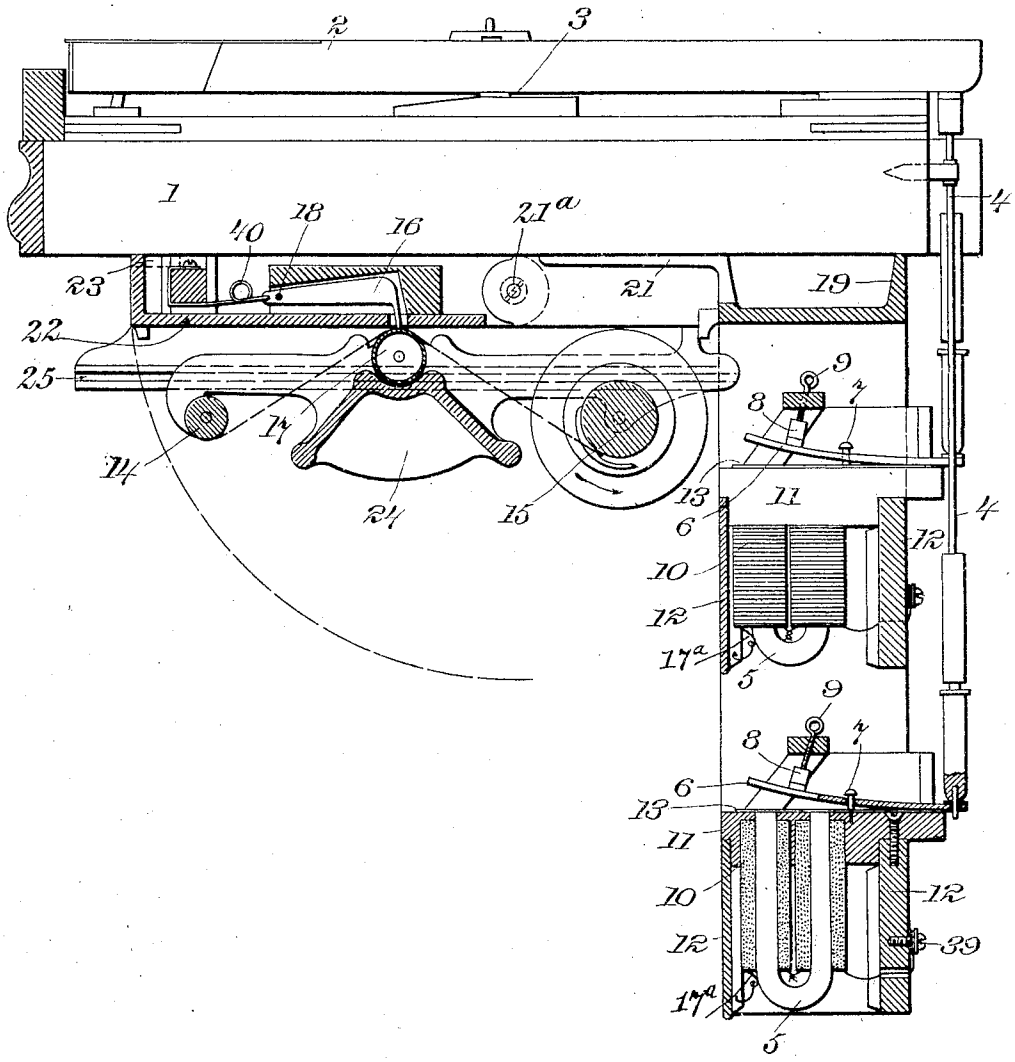
H. W. SHONNARD.

SELF PLAYING MUSICAL INSTRUMENT.

APPLICATION FILED JAN. 16, 1899.

4 SHEETS—SHEET 1.

Fig. 1.



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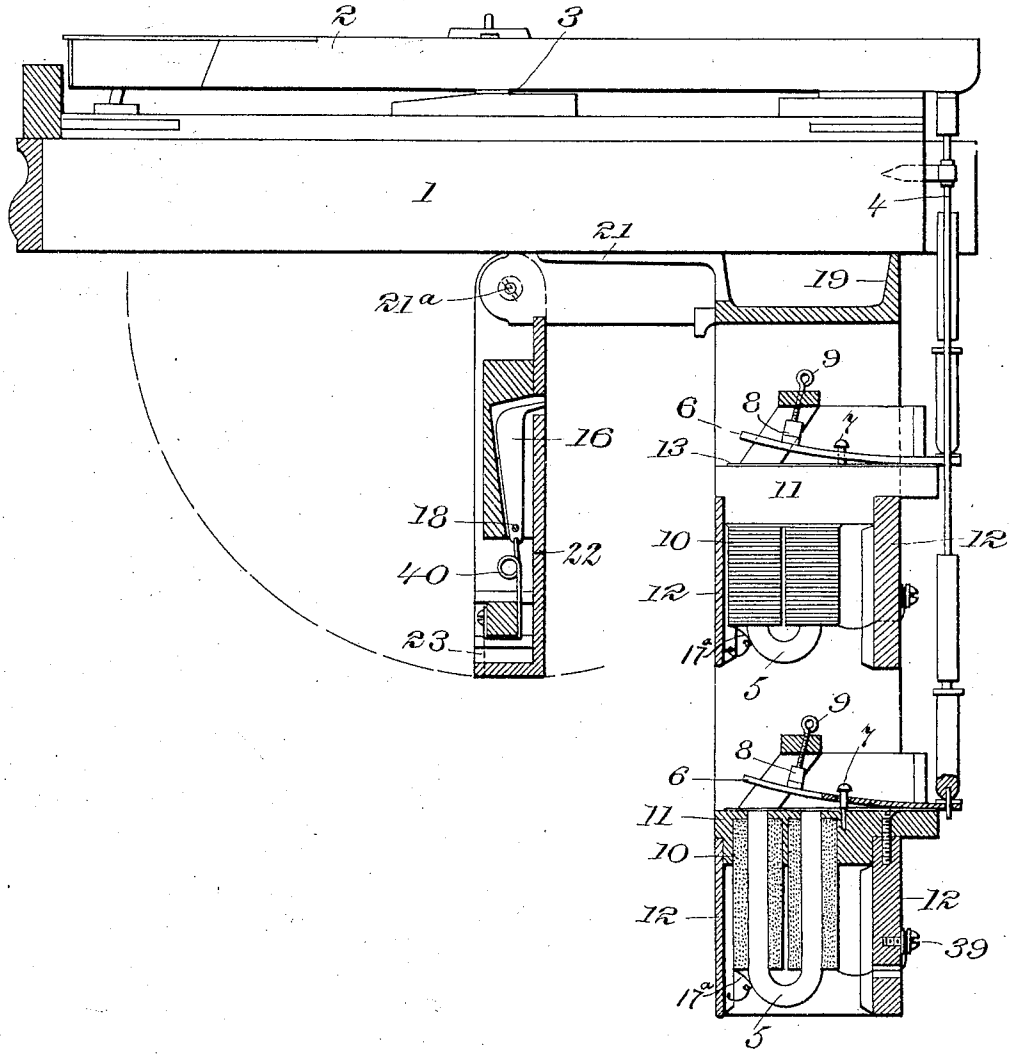
4 SHEETS—SHEET 2.

Fig. 2.



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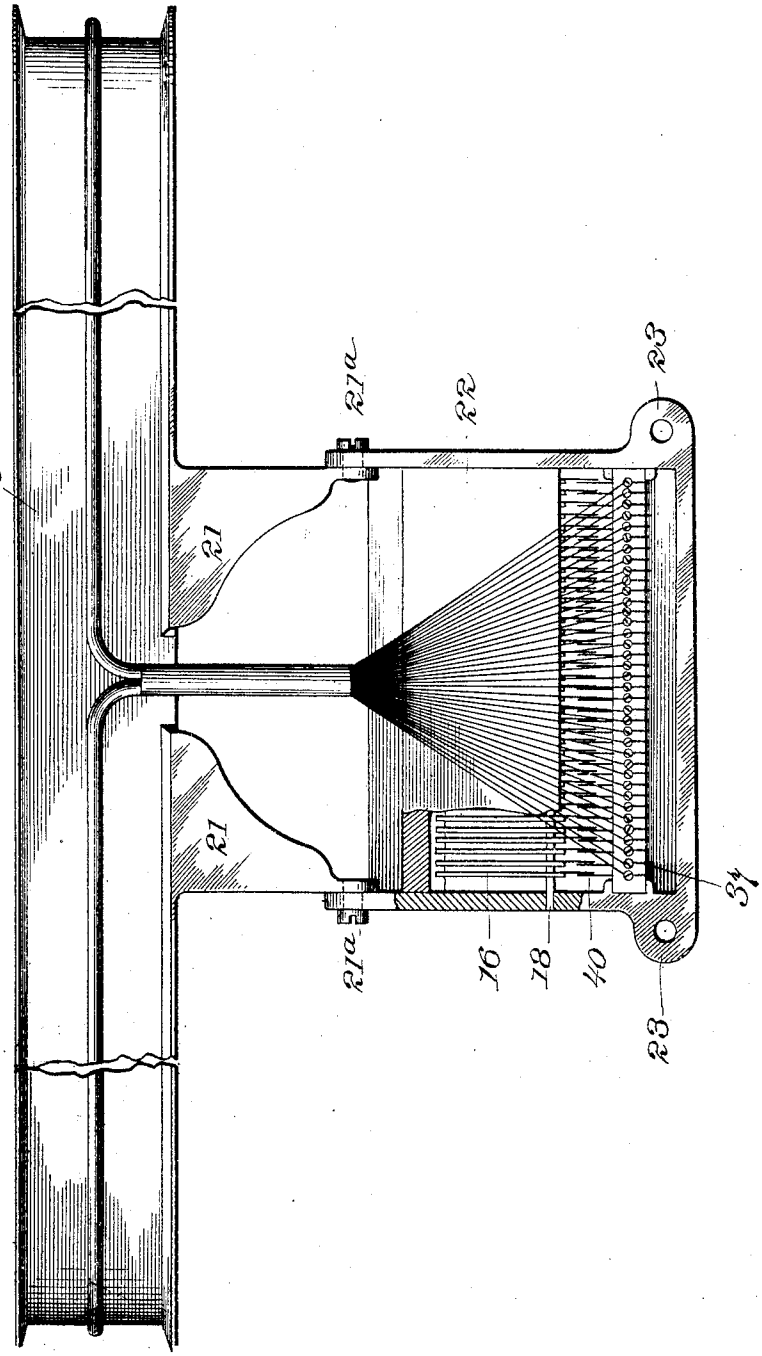
4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

Fig. 4.

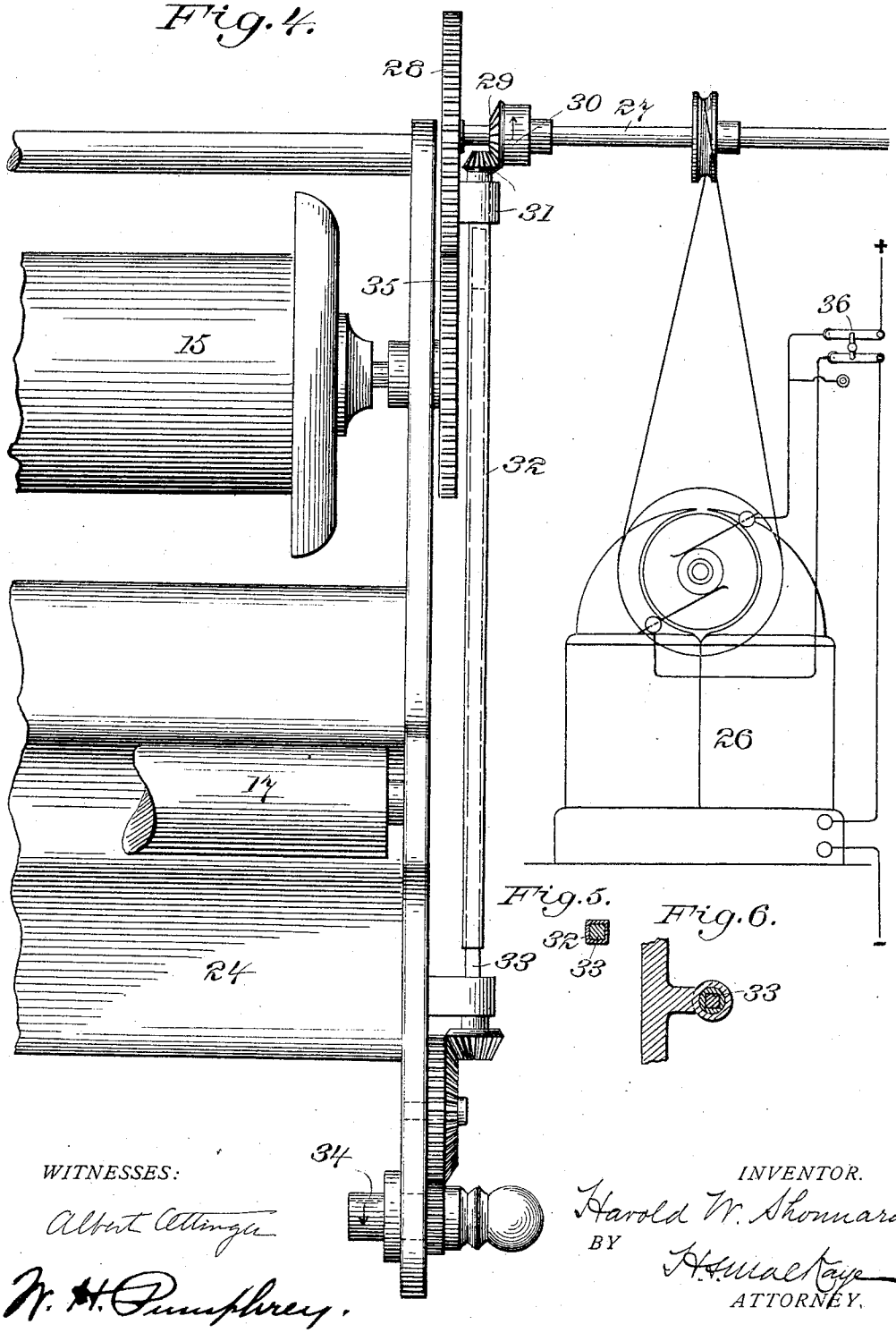

Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE.

HAROLD W. SHONNARD, OF NEWARK, NEW JERSEY.

SELF-PLAYING MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 778,908, dated January 3, 1905.

Application filed January 16, 1899. Serial No. 702,482.

To all whom it may concern:

Be it known that I, HAROLD W. SHONNARD, a citizen of the United States, residing in Newark, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Self-Playing Musical Instruments, of which the following is a specification.

My invention has relation to improvements in that class of self-playing musical instruments wherein the keys are operated by electric currents, whether direct or alternating, and particularly to such forms of apparatus as are adapted to be attached to standard forms of pianos and organs.

One principal object of my invention is the provision of simple means whereby magnets may be used to directly impel the sound-producing agent by use of relatively weak currents, avoiding foreign noises. When used for pianos, my invention enables me, further, to so graduate the effect of magnetism in producing percussive force as to obtain a natural touch effect and a pleasing tone. I am thus enabled to dispense with much expensive, cumbrous, and bulky mechanism hitherto introduced between the magnet and the keys in the effort to produce the requisite tone effect and at the same time to improve the tone itself. Where used for small cabinet-organs and the like, my invention is very advantageous in that it accomplishes the necessary functions economically and with certainty within a minimum of space.

My invention further contemplates the provision of means whereby the music-sheet may be rapidly and automatically rewound after being used, as also means for easily and conveniently getting access to all parts of the apparatus.

My invention also includes a variety of improvements in details, which are hereinafter described and more particularly set forth in my claims.

While I have shown and described my invention herein as directly attached to a keyed instrument, such as a piano, it will be obvious that the music-sheet may be separated by any desired distance from the instrument which is operated, the connections being purely electrical.

My invention is illustrated in its preferred form in the accompanying drawings, wherein—

Figure 1 is a vertical section of my preferred apparatus, showing its location in relation to the keyboard of a piano. Fig. 2 is a similar view with the sheet-supporting drawer removed and the finger-supporting frame depressed. Fig. 3 is a top view of my apparatus, showing the preferred form of frame and location of cable relative thereto. Fig. 4 is a detail plan view of one side of the sheet-supporting drawer, showing driving-gear and automatic rewind. Fig. 5 is a section of the rewinding drive-bar, and Fig. 6 is a sectional detail of a bearing for the same.

In the drawings the keyboard of a piano is indicated at 1, and one of the keys is shown at 2, pivoted in the usual manner at 3. The impact-rods 4 abut upon the inner ends of the keys in a manner well known in this art and act by movement upward to produce the necessary percussion on the wires.

The operating-magnets are shown at 5 arranged in two rows, so as to break joints vertically in order to afford room for as many magnets as there are keys. This arrangement is indicated in the drawings by the lower magnet being shown in section and the upper magnet in elevation.

In the earliest forms of self-playing pianos operated electrically it was proposed to use direct-acting magnets acting upon pivoted armatures which were connected directly to the keys or to the inner mechanism of the piano. This arrangement proved impracticable, however, for two main reasons. In the first place the current requisite to so energize the magnets as to make them effective when the armature was farthest away from the poles was found to cause too great expense; secondly, if the magnet was strong enough to properly operate its armature at its greatest distance from the poles the force became so great when the armature reached its nearest approach to the poles that the blow was excessive in force and the tones produced were harsh and overloud.

A further objection to the old-fashioned armatures as used for direct action was the noise necessarily produced at the pivots under the sudden action of the magnets. This objection obtains in the case of organs as well as pianos, and, furthermore, in organs the long levers necessary with weak magnets in opening the valves against air-pressure are found to take up much room. The law of magnetic attraction involving very rapid increase of force as the armature approaches the poles and the piano mechanism, on the other hand, affording an approximately constant resistance to the impelling force, direct-acting magnets were deemed totally unfit in principle for application to self-playing pianos, and inventors turned their minds to perfecting purely mechanical operators for the keys, the magnets becoming in these devices merely auxiliary elements employed to bring the appropriate portions of the main mechanism into operative position in their right order. The introduction of these mechanical operators caused a great increase in the first cost of the apparatus and increased danger of disarrangement, and the necessity of means whereby the magnets might be made to act directly while still obtaining the desired beauty of tone has been long apparent.

I have discovered that by substituting for a pivoted armature a rocker and connecting the inner end or rear of said rocker with the piano or organ mechanism, while allowing the magnet-poles to act upon the outer end of said rocker, the desired restriction of space and absence of foreign noises can be attained with use of comparatively weak magnets. Furthermore, this arrangement when used in pianos produces a touch effect that is more natural and a tone that is more beautiful than by use of the expensive and bulky mechanical operators now in use. In the drawings these rockers are shown at 6 located as above described in relation to the magnets and piano mechanism. The pins 7 are placed within appropriate slots in said rockers to keep the latter in place, and the stops 8 are preferably used to limit the return movement of the rockers. By means of the screws 9 the positions of these stops may be modified for adjustment. The coils 10 of the magnets are firmly embedded in wooden blocks 11, which are in turn screwed or otherwise secured to the bars 12, hereinafter described. The rockers preferably rest upon strips of blotting-paper, felt, or other sound-deadening and non-magnetic material, whereby actual metallic contact between the magnet-poles and the rockers is prevented. These strips are shown at 13. Where rockers are used as shown, the points of contact, with their support, approach the magnet-poles as their outer ends are depressed. Consequently the ratio of outer to inner lever-arm, which affects the ratio of attractive effort to percussive effort, decreases as the magnet-poles are approached. Thus the increase of magnetic attraction is compensated for by continually-increased opposing leverage, and a substantially constant percussive effort is produced. My invention covers any arrangement of a lever or levers whereby this end is attained in a self-playing instrument.

While the form of curve of rocker which I have shown in the drawings has been found appropriate with magnets of the type shown in the drawings, I do not confine myself to this form of rocker, as variations in the form of curve may be made for producing different kinds of touch and for use with different types and strengths of magnet. Indeed, by changing the rockers in any given apparatus the exigencies of different tastes may be consulted, as well as adaptation to different pianos attained.

The control of the circuits whereby magnets 5 are energized in their proper order is of course immaterial so far as the details thereof are concerned in connection with the operation of my improved rockers; but I prefer the construction shown, wherein the circuits are controlled by means of the well-known perforated music-sheet, adapted to be unrolled automatically from the roller 14 onto the driving-roller 15 in the direction of the arrows in Fig. 1.

As is well understood in this art, the magnets 5 have a common electric return, and the individual ends of the respective coils are brought into electric connection by means of appropriate wires, with their respective representative contact-fingers 16 over the common electric circuit-closing abutment 17, over which the music-sheet is drawn, as indicated in Fig. 1. In the form shown in the accompanying drawings this abutment 17 is in electric connection with the main framework, being directly pivoted in metal bearings in the sliding drawer, and one end of each magnet-coil is brought also into permanent electric connection with this framework, as by means of terminals 17^a, shown in Fig. 1 as connecting the magnet-coils with the metallic framework.

I prefer to form the fingers 16 of thin metal sheets, pivoted, as at 18, and provided with contact-tips, adapted to project through the apertures in the music-sheet and to rest upon the abutment 17, as shown in Fig. 1. The arrangement of these fingers side by side over the abutment is illustrated in top view in Fig. 3. Fig. 3 also illustrates my preferred form of frame for support of the adjustable self-playing attachment and the relative arrangement of the cable, whereby the fingers are electrically connected to their proper magnets 5.

Projecting forward from the channel-bar 19 are two symmetrically-disposed lugs 21, to which is pivoted at 21^a the contact-finger support 22, which latter carries lugs 23 at its

outer corners, whereby the outer edge thereof may be screwed to the under side of the keyboard.

The music-drawer 24 is adapted to slide as a whole in the tracks or grooves 25. (See Fig. 1.)

The driving-gear preferably employed by me in actuating the music-sheet is shown in Fig. 4, wherein an electric motor is shown at 26, driving a counter-shaft 27, carrying two gears 28 and 29. The crown-gear 28 is fast on the counter-shaft, and the bevel-gear 29 is attached to a clutch 30, which may be of any well-known form, whereby motion is transmitted in the direction of the arrow shown thereon, but not in the opposite direction. The bevel-gear 29 meshes with another bevel-gear 31, attached to the end of a square tube 32, within which slides a square rod 33. (See Figs. 4 and 5.) This square tubing has a round bearing turning within an appropriate journal, attached to one of the lugs 21, while the square rod 33 has a similar bearing borne by a similar journal at the outer end of the side of the music-drawer, as shown in detail in Figs. 4 and 6. At the outer extremity of the square rod 33 appropriate gearing transmits motion to the stud 34, (see Fig. 4,) within which the end of the music-roll fits in a well-known manner. This stud 34 is adapted to turn in the direction of the arrow thereon during playing of the piano, and consequently in the opposite direction during rewinding.

It is of course evident that any form of motor, and not necessarily an electric motor, may be used for driving my apparatus. It is also obvious that the precise form of the tube and rod 32 33 is immaterial, so long as the two are adapted to slide the one within the other and the rotation of the one within the other is prevented. It is immaterial, too, whether the outer member of the telescoping elements 32 33 is attached to the driving or to the driven gear.

The driving crown-gear 28 is used for actuating the music-sheet when the piano is being played and is adapted to mesh with the gear 35, when the music-drawer is pushed back to its operative position. When pulled a little forward, however, this gearing is interrupted, and on reversing the motor 26, as by operating the switch 36 or otherwise, the clutch 30 comes into action to rewind the music-sheet on the roller driven by the stud 34. The telescoping of the rods 32 33 permits of the drawer being pulled forward, as described, without interrupting the engagement between the gears 29 and 30.

The pivotal hanging of the contact-finger support is provided in order to facilitate access to the conducting-cable and contact-fingers. This is accomplished by removing the music-supporting drawer 24 and unscrewing the lugs 23 from beneath the keyboard. The support can then be swung down into the position shown in Fig. 2, and repairs or adjustment of the wires and fingers become a very simple matter.

By use of my improved pivoted supporting-frame I am enabled to secure the greatest possible convenience in the location and connection of the conducting-cable. As shown in Fig. 3, the individual wires from the terminals 37, connected to the individual fingers 16, are carried over the top of the pivoted contact-finger support and united into a convenient bundle or cable 38, which is preferably made to divide after passing between the lugs 21. The two parts of the cable are then led over the channel-bar 19 and down the two sides of the frame, being separated into individual circuit-wires opposite the two rows of magnets 5, the wires being led to the individual terminals of said magnets, as at 39 in Fig. 2. By use of this arrangement of wires I provide the greatest possible accessibility for all parts of the electrical circuits. At the same time adjustment of my apparatus to any piano or organ is greatly simplified.

My preferred arrangement of contact-making devices involves the use of fingers 16, held down by gravity, dispensing with springs. The coil 40 (seen in the drawings) represents merely a turn of pliable conductor provided to give free play without danger of tension on the pivoted fingers.

It is to be understood that the use of rockers in place of the old pivoted armatures and the use of magnets acting directly through such rockers or their leverage-changing equivalents is believed to be novel with myself in self-playing instruments, whether the magnets are located beneath the keyboard, as shown, or elsewhere in relation to the instrument. One great advantage which I have found to arise through the use of these rockers in place of pivoted armatures is that where the former are used with alternating electric currents they accommodate themselves to the molecular changes of condition without the rattling inseparable from the use of pivots, and much disagreeable foreign noise is obviated.

Many features of the apparatus herein described may be modified in a variety of ways, and I do not wish to be understood as limiting myself to the details of the illustrative device which I have herein shown.

What I claim is—

1. In a self-playing musical instrument, direct-acting electromagnets for impelling the sound-producing agent, and armature connections between the magnets and the sound-producing agent affording a gradually-lessening leverage in favor of the magnetic effort as the magnetic pole is approached.

2. In a self-playing musical instrument, a direct-acting electromagnet for inpelling the sound-producing agent, and a rocker adapted to be attracted at one end by the magnet and

to propel the sound-producing agent at its other end.

3. In a self-playing musical instrument, a direct-acting electromagnet for impelling the sound-producing agent, a rocker adapted to be attracted by said magnet at one end and to propel the sound-producing agent at its other end, and a non-magnetic layer upon which said rocker is adapted to rest.

4. In an electric self-playing attachment for musical instruments, a pivoted contact-finger support adapted to be fastened under the keyboard, and means for fastening up said pivoted support at its free edge.

5. In an electric self-playing attachment for musical instruments, a contact-finger support adapted to be fastened beneath the keyboard, a track on said support, a music-sheet drawer adapted to slide in said track, said contact-finger support being pivoted, and means for fastening it up at its front edge.

6. In an electric self-playing attachment for musical instruments, a frame comprising a top channel-bar, a contact-finger support fastened in front of the top channel-bar, wires from the fingers going over said channel-bar and carried in two groups down the two sides, and magnets carried by said frame and connected to said wires.

7. In an electric self-playing attachment for musical instruments, a frame comprising a top bar, symmetrically-placed lugs attached in front of said top bar, and a contact-finger support pivoted to said lugs.

8. In an electric self-playing attachment for musical instruments, a frame comprising a top channel-bar, symmetrically-placed lugs attached in front of said channel-bar, and a contact-finger support pivoted to said lugs and adapted to be fastened beneath the keyboard.

9. In an electric self-playing attachment for musical instruments, a frame comprising a top channel-bar, symmetrically-placed lugs attached in front of said channel-bar a contact-finger support pivoted to said lugs and adapted to be fastened beneath the keyboard, and a wooden block or blocks fastened to said frame having magnets fitting tightly within perforations in said block or blocks.

10. In an electric self-playing attachment for musical instruments, a music-sheet drawer, means for supporting the same adapted to be attached beneath the keyboard, and upon which said drawer is adapted to slide, a main driving-shaft, gearing for operating said music-sheet when playing the instrument, adapted to be engaged or disengaged from said main driving-shaft according to the position of said drawer on its support, gearing for rewinding the sheet and means on said main shaft for maintaining constant reverse driving engagement for rewinding in all positions of the music-sheet drawer.

11. In an electrically-operated musical instrument, the combination with a sound-producing device, of an electromagnet, a note-sheet controlling the magnet, a rocker-armature actuated by said magnet, and a connection between said armature and the sound-producing device.

12. In an electrically-actuated key-operating mechanism for musical instruments, the combination with a key-selecting medium of an electromagnet governed by said medium and having a rocker-armature to actuate the key.

13. In an electrically-actuated key-operating mechanism for musical instruments, the combination of an electromagnet having a rocker-armature to operate the key, with means for moving a key-selecting medium to govern said electromagnet.

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