

May 20 , 1924.

H. K. SANDELL

1,494,811

ART OF REPRODUCING PIANO PLAYING

Filed June 14, 1922

3 Sheets-Sheet 1

Fig. 1.

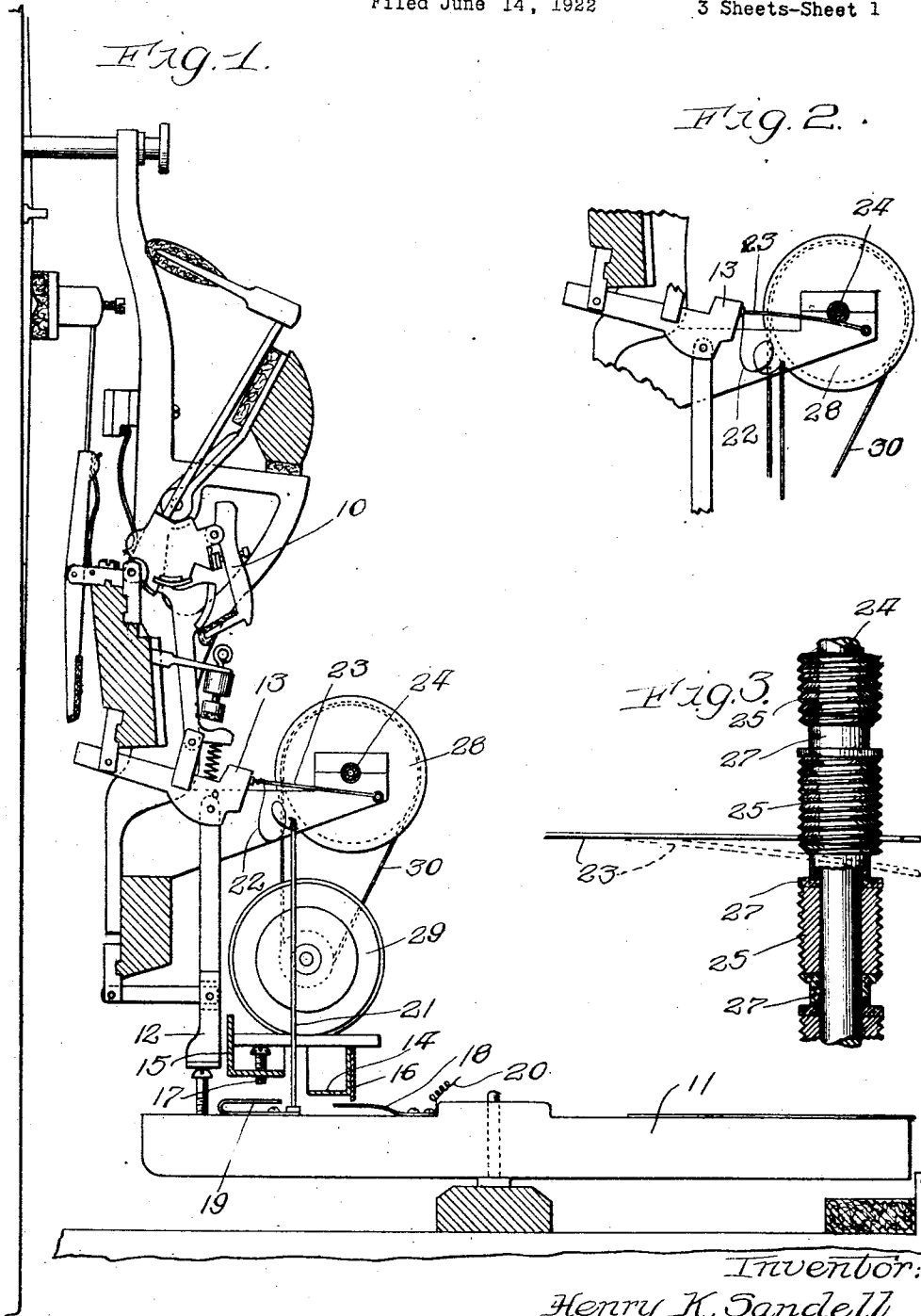
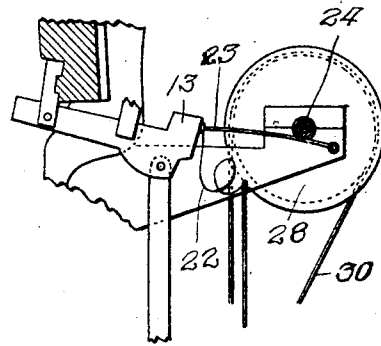
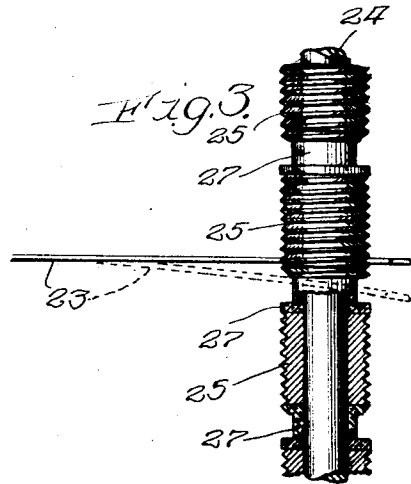


Fig. 2.



H' 29.5



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May 20 , 1924.

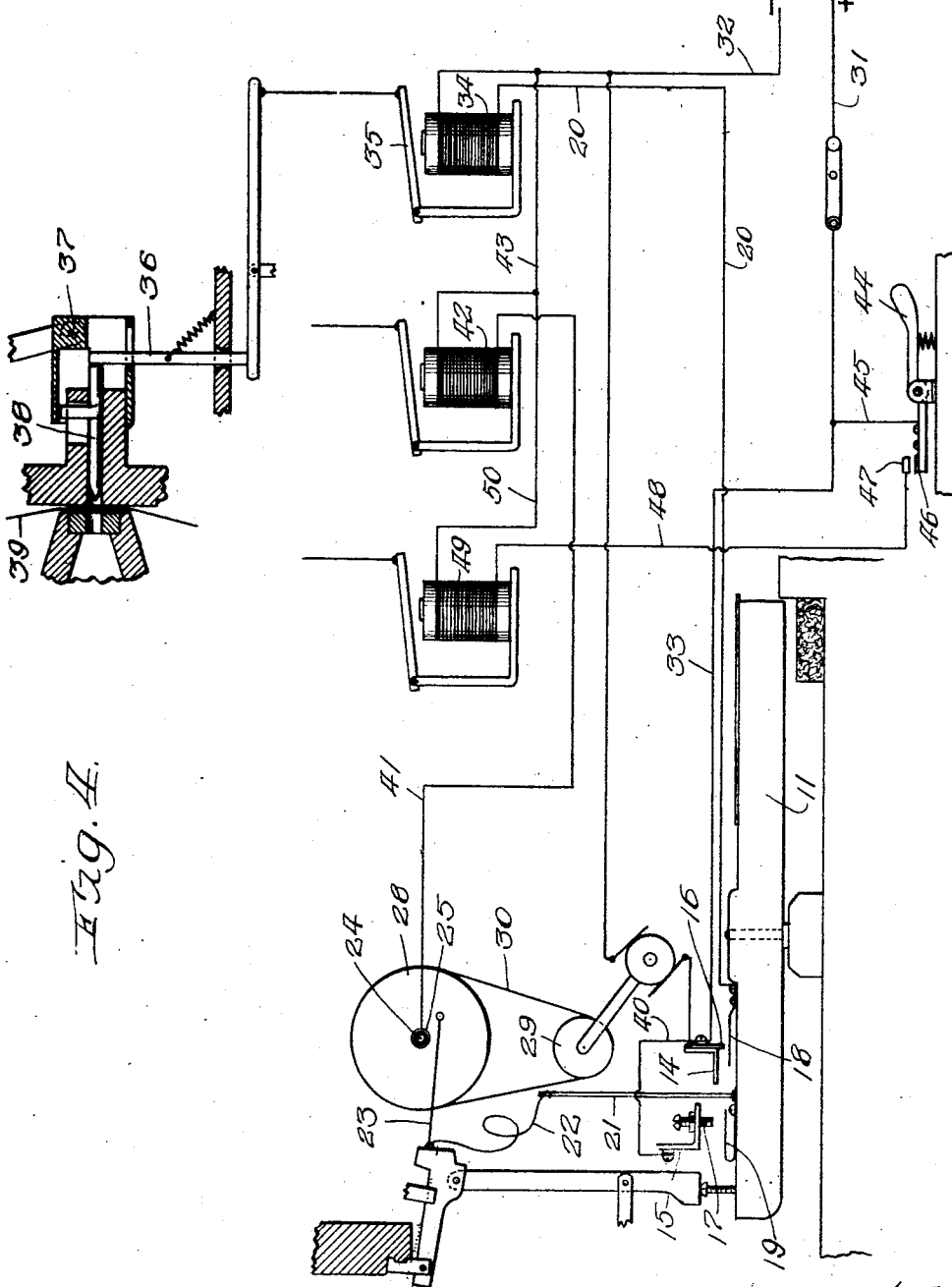
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ART OF REPRODUCING PIANO PLAYING.

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3 Sheets-Sheet 2



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May 20, 1924.

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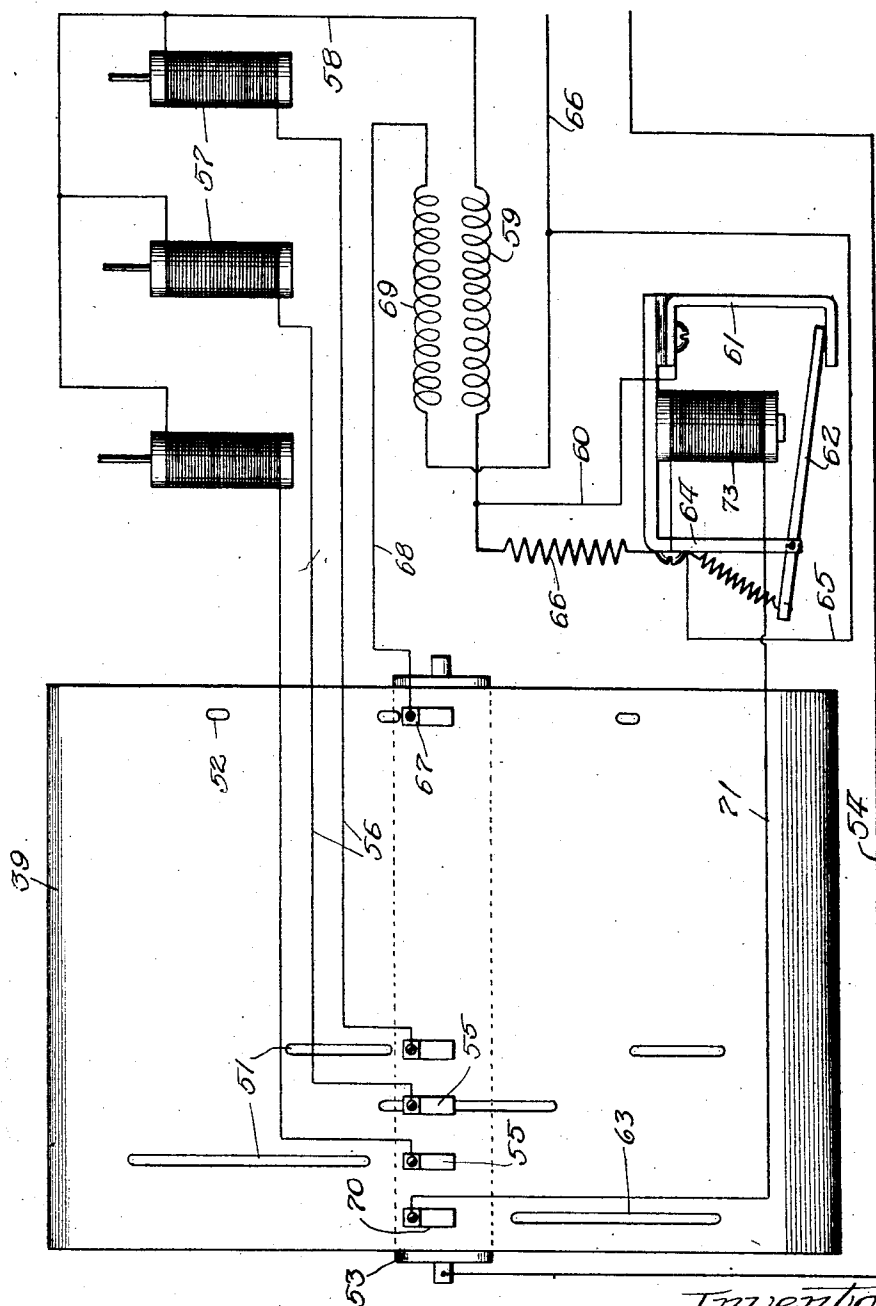
1,494,811

ART OF REPRODUCING PIANO PLAYING

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3 Sheets-Sheet 3

Fig. 5.



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UNITED STATES PATENT OFFICE.

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ART OF REPRODUCING PIANO PLAYING.

Application filed June 14, 1922. Serial No. 568,227.

To all whom it may concern:

Be it known that I, HENRY K. SANDELL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in the Art of Reproducing Piano Playing, of which the following is a specification.

The present invention relates to improvements in the playing of electrically operated piano instruments, and more particularly in means for selectively reproducing emphasized or melody notes in louder tone in connection therewith. It will be fully understood from the following description, illustrated by the accompanying drawings, in which:

Figure 1 is a partial sectional view through a piano instrument for producing master records embodying the present invention;

Fig. 2 is a detail sectional view on enlarged scale of a part shown in Figure 1;

Fig. 3 is a detail view, partly in section, of an element of the device shown in Figures 1 and 2;

Fig. 4 is a diagrammatic view showing electrical circuits operated by the keys of the piano shown in Figure 1 and means for producing a master sheet in connection therewith; and

Fig. 5 shows diagrammatically the circuits employed in reproducing playing from a roll such as that formed in the operation of the device of the preceding figures.

In accordance with the present invention, means are provided for selectively emphasizing or increasing the loudness of tone of the individual notes in reproducing the playing of a piano from a perforated note sheet, and means are likewise provided for producing note sheets for use in connection therewith.

Figures 1, 2 and 3 illustrate the mechanical devices which may be employed in connection with the present invention in the piano which is played to produce the master record or note sheet to be subsequently used for reproduction of the playing. Referring more particularly to Figure 1, the numeral 10 indicates a note action operated in the usual manner from key 11 through riser 12 and jack-butt 13. Above the keys are mounted two angle bars 14 and 15 transversely of the piano, these angle bars serving as electrical connectors in the manner more particularly hereinafter set forth in

connection with the diagram of Fig. 4. Secured to angle bar 14 are depending contact members 16 corresponding to the several keys. From angle bar 15 depend the adjustable contact members 17, which may suitably be screws, one corresponding to each key. On the rear end of each key 11 are mounted spring contact members 18 and 19, so arranged that contact member 18 engages contact member 16 when key 11 is lightly depressed, and contact member 19 engages contact member 17 only when the key is forcibly and fully depressed. To the contact member 18 on each key is secured a lead line 20 leading to the electromagnet corresponding to the note played by the key, as more fully hereinafter described.

To each of the contacts 19 is secured a vertical metallic rod 21, the end of which is connected by a flexible connector 22 with the end of a resilient rod or wire projecting forwardly from the jack-butt 13. A special contact device cooperates with the flexible wire contact members 23 when the latter are raised by the movement of the jack-butts 13 corresponding to the keys 11 which may be operated. This contact device will be clear from a consideration of Figures 1, 2 and 3. A horizontal shaft 24 extends transversely across the piano in front of the action. Upon this shaft are mounted spaced metallic collars 25, one of which corresponds to each key of the piano. These collars are formed with an external threaded surface of fairly steep pitch, as shown most clearly in Figure 3. Between the metallic collars 25 are inserted the grooved collars 27, formed of insulating material. The shaft 24 serves as a common electrical connector, the metallic collars 25 serving as contact members. The shaft 24 may suitably be rotated by means of pulley 28, driven by motor 29 through belt 30.

The operation of the resilient contact rods 23 is as follows:

When a key 11 is struck, the jack-butt 13 corresponding thereto is raised, carrying with it the resilient contact rod 23. The contact rod engages the corresponding collar 25 on shaft 24, making electrical contact therewith. The screw threads on the surface of the contact 25, which rotates constantly with shaft 24, causes the flexible rod 23 to ride off the metallic collar 25 and to enter the groove in the insulating collar 27,

as shown in dotted lines in Fig. 3. The contact is thereby broken and it will be readily apparent that by means of this device a prolonged contact between the rod member 23 and the metallic sleeve 25 is positively prevented.

In Fig. 4 the circuits are illustrated showing diagrammatically the connections between the keys of the piano and the devices for cutting notes in the master roll or note key. The various parts of the piano action are designated by the same numerals as in Figures 1, 2 and 3. The circuits shown are intended for operation with direct current, the two current supply lines being indicated by numerals 31 and 32. From one of these lines a connector 32 leads to the angle iron 14, which serves as a common connector or buss for the circuits for the note perforating magnets. When any key 11 is depressed, contact is made between the depending contact member 16 on angle iron 14 and contact 18 on the key, closing the circuit through line 20 and the note perforating magnet 34 to the negative supply line 32. The energization of the note perforating magnet 34 causes its armature 35 to be pulled down, thereby throwing the bar 36 of the corresponding note perforating punch into such position that the constantly reciprocating head 37 will actuate the punch 38 to perforate the traveling note sheet 39, the bar 36 remaining in this position as long as the electromagnet 34 remains energized.

If any key 11 is struck with sufficient force, the contact 19 engages the contact 17 on the angle bar 15. The force required may be varied by adjustment of contact screws 17. The angle bar 15 is connected by connector 40 with the connector 43 leading to the main line 31. As has been previously described, the striking of a key causes contact between the flexible contact rod 23 and a metallic collar on shaft 24, this contact being broken very shortly after in the manner already described. Assuming that key 11 has been struck with sufficient force to cause engagement of contacts 17 and 19, the circuit is then closed through the rod 21, connector 22, contact rod 23, shaft 24, connector 41 and electromagnet 42 to line 43 connecting with the other main line 32. The electromagnet 42 operates a punch on the perforating machine, preferably near the margin of the note sheet. As this circuit is broken very shortly after the key is struck by the co-operation between the rod 23 and the collar 25 on shaft 24, the magnet 42 is energized for only a short period and consequently only short perforations can be produced by this magnet. The same magnet is actuated by all of the keys of the piano.

The soft pedal 44 of the piano, when depressed, closes a circuit from main line 31 through connector 45, contacts 46 and 47,

connector 48 and electromagnet 49 to connector 50 leading to the other main line 32. The resulting energizing of the magnet 49 causes a perforation in the note sheet, the length of which corresponds to the length of time the pedal remains depressed.

It will be apparent from the above description of circuits that at the moment any note is emphasized in playing the piano, the additional force used in striking the key causes the circuit through the electromagnet 42 to be closed as well as the circuit through the magnet corresponding to the particular note.

Fig. 5 shows in a simple diagrammatic form circuits which may be used for reproducing from a note sheet produced in the manner just described. In this figure the numeral 39 indicates the note sheet, upon which are note perforations 51, perforations 52 for producing additional volume of tone, (corresponding to those produced by the magnet 42 of Fig. 4), and perforations 63 for producing a lesser volume of tone (corresponding to those produced by the electromagnet 49 of Fig. 4). The note sheet 39 travels over a contact roll 53, which serves as a terminal for the main lead line 54. Contacts 55 are provided, corresponding to the various notes. When a perforation 51 corresponding to a given note passes between the contact roll 53 and a contact 55 corresponding to the same note, a circuit is closed through a connector 56, an electromagnet 57 for actuating the corresponding note of a piano action, connector 58, resistance 59, connector 60, contact member 61, armature 62 of electromagnet 73, and from this armature through the frame 64 supporting the electromagnet and connector 65 to the other main current line 66. The armature 62 of electromagnet 73 is in contact with the contact member 61 during such period as the magnets 63 are not energized. A resistance 66 is in shunt between resistance 59 and line 65. Normally a free path for the current is provided around this resistance, so that relatively little current passes therethrough.

When one of the perforations 52 for loud tone passes over the contact roll 53, a corresponding contact member 67 makes contact, closing a circuit across from the roller 53 through the connector 68, and the resistance 69 to the line 66. Resistances 69 and 59 are in the form of coils inductively coupled and the coil 69 is wound in the reverse direction to the coil 59. Consequently, the momentary rush of current through the coil 69 when contact is made through the opening 52 causes a corresponding increase in current in the coil 59, resulting in a stronger current through the note magnets 57 energized at the same time.

For softening the volume of notes, certain

perforations 63 permit contact between the roller 53 and a contact member 70, thereby closing a circuit through line 71, magnet 73, and line 65 to the main current line 66. The energizing of magnet 73 causes the armature 62 to be attracted, thereby breaking the circuit between the contact member 61 and the armature 62 and making it necessary for the current in the note playing magnet circuit to pass through resistance 66 as well as resistance 59. The strength of the current is consequently decreased and a softer tone is produced by the action of the note magnets during the period of passage of perforation 63 over the contact roller 53.

Although the present invention has been described in connection with specific details of devices for carrying it into operation, it is not intended that these shall be regarded as limitations upon the scope of the invention, except in so far as included in the accompanying claims.

I claim:

1. In combination with hammer-operating mechanism of a piano action, a contact member carried by a part of said mechanism, a co-operating contact member in position to be engaged by the first contact member when the hammer is operated and means for breaking contact between said contact members after a predetermined period.

2. In combination with hammer operating mechanism of a piano action, a contact member carried by a part of said mechanism, a co-operating contact member in position to be engaged by the first contact member when the hammer is operated and means associated with the co-operating contact member for breaking the contacts between said contact members after a predetermined period.

3. In combination with hammer operating mechanism of a piano action, a resilient connector rod, carried by a part of said mechanism, a screw threaded cylindrical contact member in position to be engaged by said rod when the hammer is operated and means for rotating the cylindrical contact member whereby the threads upon the latter carry off said rod and break the contact therewith.

4. In combination with hammer operating mechanism of a piano action, resilient contact rods carried by corresponding parts of the operating mechanism of each hammer, a series of contact members in position to be engaged by said rods when the corresponding hammers are operated and means for breaking contact between said rods and contact members after a predetermined period.

5. In combination with hammer operating mechanism of a piano action, resilient contact rods secured to corresponding parts of the operating mechanism for each hammer, a horizontal shaft, a series of threaded metal collars mounted on said shaft, one of said collars being in position to be engaged by

each of said rods when the corresponding hammer is operated, said collars serving as contact members, and means for rotating said shaft whereby the threads upon said collars move the rods off the latter, thereby breaking contact therebetween.

6. In combination with hammer operating mechanism of a piano action, resilient contact rods secured to corresponding parts of the operating mechanism for each hammer, a horizontal shaft, metallic collars mounted on said shaft, one of said collars being in position to be engaged by each of said rods when the corresponding hammer is operated, said collars serving as contact members co-operating with said resilient rods.

7. In combination with hammer operating mechanism of a piano action, resilient contact rods secured to corresponding parts of the operating mechanism for each hammer, a horizontal shaft, a series of spaced metal collars mounted on said shaft, one of said collars being in position to be engaged by each of said rods when the corresponding hammer is operated, said collars serving as contact members, grooved insulating collars on said shaft between said metal collars, and means for rotating said shaft whereby the threads upon said collars move the rods off the latter into the grooves in said insulated collars, thereby breaking contact between said rods and metal collars.

8. In combination with a piano keyboard, means controlled by each key for operating a corresponding perforating device, a contact device closed after partial depression of each key, a common electric circuit controlled by said contact devices and a perforating device controlled by said circuit.

9. In combination with a piano keyboard, means controlled by each key for operating a corresponding perforating device, a contact device closed after partial depression of each key, a common electric circuit controlled by said contact devices, a perforating device controlled by said circuit and means for breaking said circuit after a predetermined period.

10. In combination with a piano keyboard, a contact member on each key thereof, a corresponding stationary contact member engaged by said contact member on movement of the key, an electric circuit for each key closed by the engagement of said contact members, a perforating device controlled by each said circuit, a second contact member on each key, a stationary contact member co-operating therewith and engaged after partial depression of the key, a common electric circuit closed by the engagement of said second contact members and a perforating device controlled by said circuit.

11. In combination with a piano keyboard, a contact member on each key there-

of a corresponding stationary contact member engaged by said contact member on movement of the key, an electric circuit for each key closed by the engagement of said
5 contact members, a perforating device controlled by each said circuit, a second contact member on each key, a contact member co-operating therewith and engaged after partial depression of the key, a common electric
10 circuit closed by the engagement of said second contact members, a perforating device controlled by said circuit and means for breaking said circuit after a predetermined period.

15 12. In combination with a piano keyboard, a contact member on each key, a contact member co-operating therewith and engaged after partial depression of the key, a common electric circuit closed by the engagement
20 of all said contact members, a perforating device controlled by said circuit and means for breaking said circuit after a predetermined period.

25 13. In combination with a piano keyboard and a piano action, contact means in part carried by corresponding parts of the oper-

ating mechanism for each hammer of the piano, said contact means being closed by depression of the corresponding key, contact
30 means in part carried by each key of the piano, and closed after partial depression of the key, both said contact means corresponding to each key of the piano being in series
35 in an electric circuit, and a perforating device controlled by said circuit.

14. In combination with a piano keyboard and a piano action, contact means in part
40 carried by corresponding parts of the operating mechanism for each hammer of the piano, said contact means being closed by depression of the corresponding key, contact
45 means in part carried by each key of the piano, and closed after partial depression of the key, both said contact means corresponding to each key of the piano being in series
in an electric circuit, a perforating device controlled by said circuit and means for opening one of said circuits after a predetermined period, thereby breaking said circuit.

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