

Oct. 11, 1949.

P. H. ROWE
DAMPER OPERATING MECHANISM FOR ELECTRIC
PERCUSSION INSTRUMENTS

2,484,745

Filed April 30, 1947

3 Sheets-Sheet 1

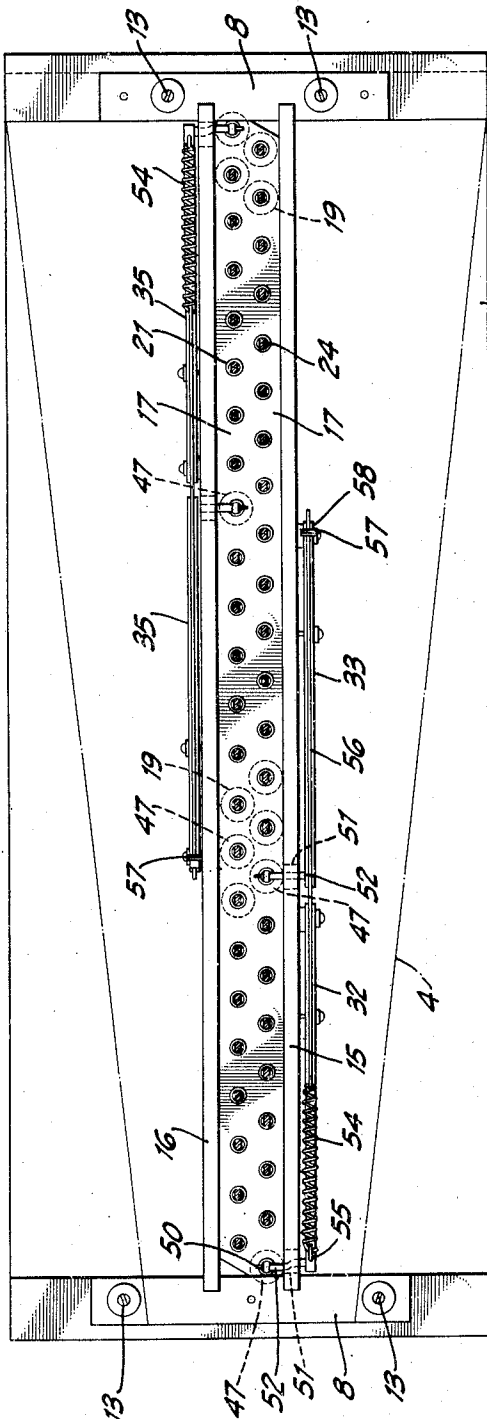


Fig. 2.

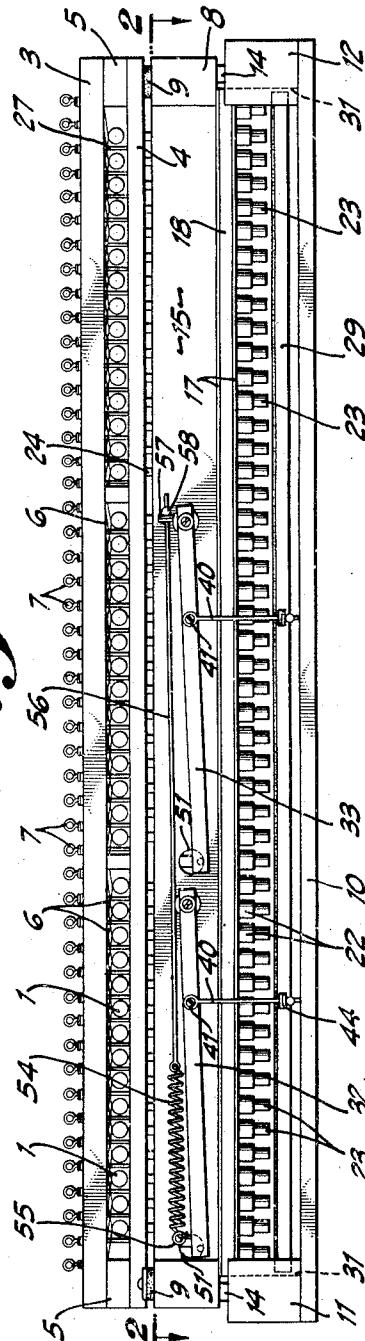


Fig. 1.

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3 Sheets-Sheet 2

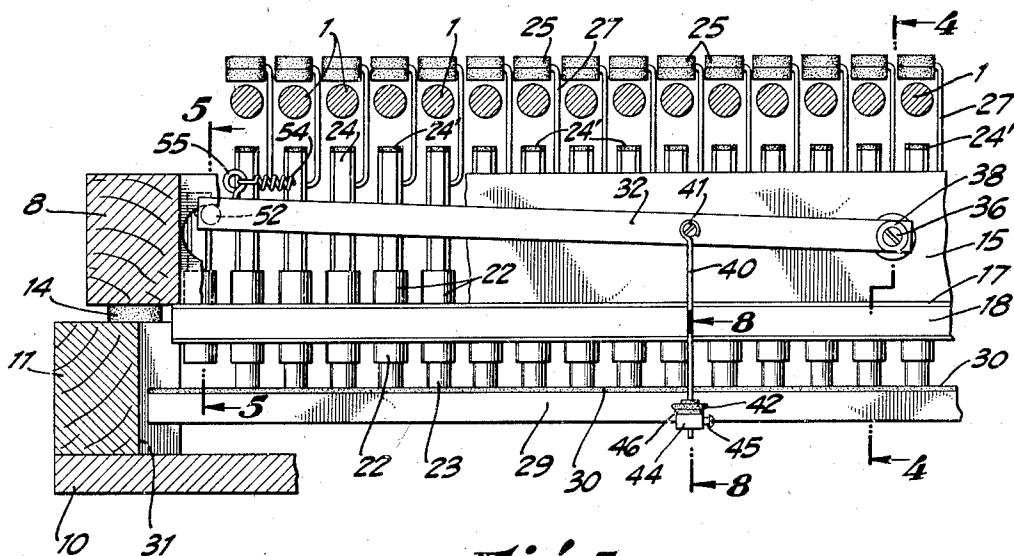


Fig. 3.

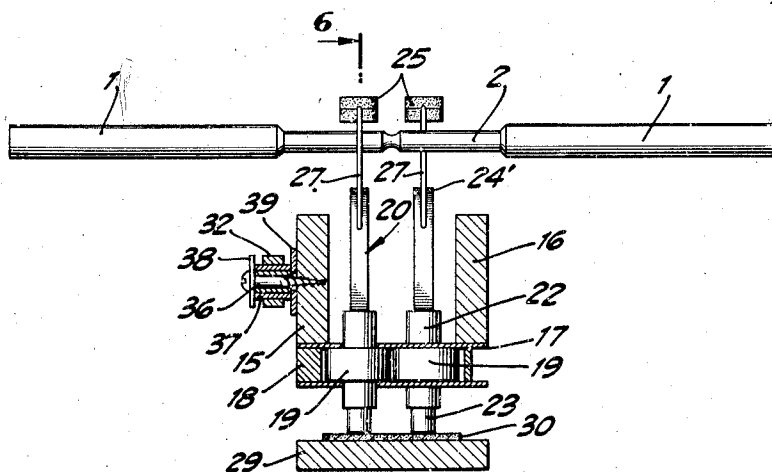


Fig. 4.

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3 Sheets-Sheet 3

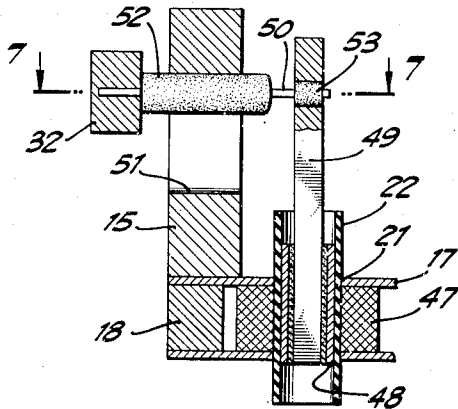


Fig. 5.

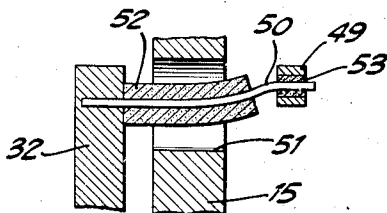


Fig. 7.

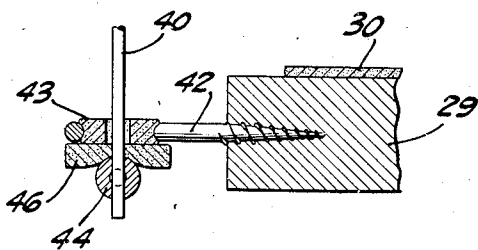


Fig. 8.

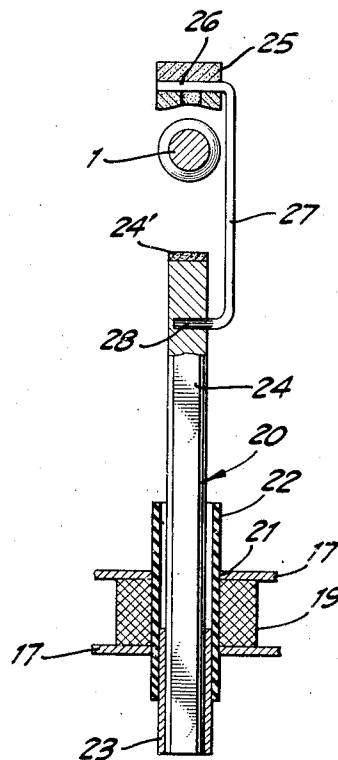


Fig. 6.

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DAMPER OPERATING MECHANISM FOR
ELECTRIC PERCUSSION INSTRUMENTS

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Application April 30, 1947, Serial No. 744,876

13 Claims. (Cl. 84-405)

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This invention relates to an electrical percussion instrument of the type in which metal bars are struck to produce musical tone by vibration of the rod.

Usually, the bars of varying lengths are suspended side by side in closely spaced relation. The suspension permits some freedom of motion, whereby they may freely vibrate. A striker is associated with each bar and operated by an electromagnet, or solenoid, and a plunger of magnetic material. A common arrangement is one in which the strikers are located below the bars, a keyboard being provided for controlling the electromagnet circuits.

A damper, usually of felt, may be arranged for each bar, to stop the vibrations of the bar except when the striker associated with the bar is operated. It is one of the objects of this invention to improve, in general, the manner in which the dampers are operated.

It is another object of this invention to make it possible to support the damper in a compact and simple manner on the corresponding striker. For this purpose, a special form of support for the damper is utilized, and which is compact and of such small cross section that it may readily pass between adjacent bars, so that the damper may rest on the top of the bar and thereby suspend the plunger carrying the striker.

At times it may be desirable to permit the bars to vibrate sympathetically when one of the bars is struck. This entails the necessity of raising all of the dampers from the bars. It is another object of this invention to provide a simple mechanism for raising the dampers, and especially by the aid of electromagnets that operate to lift the plungers slightly without bringing them into contact with the bars.

Preferably, this lifting action is controlled from the keyboard by the aid of one or more electromagnets. It is still another object of this invention to provide an arrangement of this character in which only a small electric power is needed to lift all of the dampers. This is accomplished by aid of force-multiplying devices, such as levers. It is still another object of this invention to make it possible still further to reduce the power for this purpose by aid of a specific lever arrangement.

This invention possesses many others advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of the invention. For this purpose there is shown a form in the drawings accompanying and forming part of the present

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specification. This form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a side elevation of an electrical musical instrument incorporating the invention; Fig. 2 is a sectional view, taken along plane 2-2 of Fig. 1;

Fig. 3 is an enlarged fragmentary longitudinal, sectional view of the instrument, the elements being shown in an alternative position;

Figs. 4 and 5 are sectional views, taken along planes 4-4 and 5-5 respectively of Fig. 3;

Fig. 6 is a sectional view, taken along plane 6-6 of Fig. 4;

Fig. 7 is a sectional view, taken along plane 7-7 of Fig. 5; and

Fig. 8 is an enlarged sectional view, taken along plane 8-8 of Fig. 3.

The instrument includes a plurality of horizontally arranged resonant bars 1. One of these bars is shown in Fig. 4. However, they are of different lengths and may include reduced portions, such as at 2, in order to obtain the desired tone when the bar is struck by a striker in a manner to be hereinafter described.

These bars 1 are arranged in closely spaced relationship, as shown most clearly in Fig. 1.

The support for these bars is provided by the aid of a wood frame comprising spaced upper and lower portions 3 and 4 (Fig. 1). The two sections of the frame 3 and 4 are held apart by the end spacers 5, the bars 1 extending between these sections. Each of the frame sections, furthermore, has a central, rectangular opening extending substantially the entire length of the bar 1 from one side of the frame to the other. The bars 1, furthermore, are suspended by the aid of cords 6 from the top frame 3. These cords are anchored to a series of anchors 7 in the form of screw eyes threaded into the top of the frame 3. Since the specific manner of suspending the bars forms no part of the present invention, it is sufficient to state that these suspensions occur adjacent the ends of the bars, by the aid of the cords, in a manner described and claimed in a copending application, Ser. No. 744,875, filed April 30, 1947, in the name of Paul H. Rowe.

The frame structure 3-4-5 is mounted on a pair of wood cross-pieces 8 by the aid of the interposed felt washers 9. These cross-pieces, in turn, are supported on a main base structure

including a base plate 10 and the end pieces 11 and 12.

This mounting may be accomplished by the aid of a pair of screws 13 that pass through the support 8 and include the rubber mountings 14.

Beneath the frame structure there are provided electromagnetically operated striker devices which are shown most clearly in Figs. 4 and 6. In order to provide a support for these devices, a pair of longitudinally extending wood members or strips 15 and 16 are anchored at their ends in the supports 8, as shown most clearly in Fig. 2.

In turn, as shown most clearly in Fig. 4, these wood members support a hollow metal frame 17 beneath their lower edges. A wood strip 18 can be provided on one side of the frame to serve as a support for various electrical terminals not shown.

The frame 17 extends from one end to the other of the instrument. Within the frame are supported the electromagnet coils 19, having axes transverse to the bars 1. There are two rows of these coils in staggered relation. These coils provide electromagnetic power for operating the striker devices 20 (Figs. 4 and 6).

In order that these strikers may be guided in a vertical direction, the top and bottom of frame 17 have a plurality of apertures 21 respectively coaxial with the axes of the coils 19. In these apertures are located insulation sleeves 22 which serve as guides for the striker mechanisms. These sleeves extend completely through the frame.

When a specific coil 19 is energized, it will serve to draw in a hollow magnetic core 23 that is guided in the sleeve 22. Accordingly, when a corresponding coil 19 is energized, the core 23 is violently pulled upwardly and carries the striker mechanism upwardly to hit the bar 1.

Each striker mechanism includes a rectangular wood strip 24 (Fig. 6) that is anchored at its lower end in the core 23. At its upper end, it carries a felt cover 24' that comes into contact with the bar 1 when the corresponding electromagnet is energized.

In the unenergized position indicated in Fig. 1, the tops of strips 24' are spaced a considerable distance below the corresponding bar 1.

Each of the striker mechanisms is suspended freely within the sleeve 22 by the aid of a damper 25 which engages the upper side of the bar 1. The damper 25 (Figs. 3, 4, and 6) may be formed by a pair of felt members between which is accommodated one leg 26 of a damper supporting rod 27. This damper supporting rod is made from relatively thin wire, and can readily pass between adjacent bars 1. Its lower end 28 extends horizontally and enters transversely into the striker 20. Preferably, this end 28 may be knurled to form a tight fit.

The core 23 of each of the mechanisms forms a plunger for the corresponding solenoid coil 19. In playing the instrument, the core is ultimately centralized within the coil 19. Each energization carries the striker mechanism upwardly, and a single blow is imparted to the bar 1, after which the plunger falls back to central position; and when the coil is deenergized, the striker mechanism falls to the lowered position illustrated in Fig. 1. The damper pad 25, while the corresponding coil 19 is energized, is free of bar 1, and permits the bar 1 to have a free vibration until the plunger returns to its lowermost position.

At times it is required that all of the dampers 25 for all of the bars 1 be released from the bars

in order to cause the bars to sustain a sympathetic vibration. This is accomplished in the present instance by the aid of a wood platform 29 (Figs. 1, 3, and 4) which extends underneath all the cores 23 and lengthwise of the instrument. Preferably, a felt pad 30 is disposed above the platform. This platform 29 is shown in the inactive position of Fig. 1. It is, however, shown in raised position in Figs. 3 and 4. The raised position of the plunger is illustrated in Fig. 6. In this position all of the damper pads 25 have been lifted away from the bars 1.

The ends of the platform 29, as shown most clearly in Fig. 3, are received in slots 31 formed vertically in the central portion of the supports 11 and 12.

The mechanism for optionally raising the platform to a sufficient distance to release all of the pads without striking the bars 1 will now be described.

On one side of the instrument, and supported on the supporting member 15, are a pair of levers 32 and 33. Corresponding levers 34 and 35 are similarly supported on the supporting member 16.

These levers are each mounted for pivotal movement on the supports 15 and 16, as indicated most clearly in Fig. 4. Thus, passing through and forming a pivot for the right-hand end of lever 32, there is a wood screw 36. This wood screw passes through a bushing 37 accommodated between the washers 38 and 39. On the bushing 37 is pivoted the lever 32.

Each of the levers 32, 33, 34, and 35 is connected, as by a link 40, to the platform 29. Accordingly, when levers 32 and 33 are raised, the links 40 serve to raise the platform 29. Since there are four such links arranged symmetrically, the platform is lifted evenly to contact all of the cores 23 substantially simultaneously.

The link 40 is hooked at its upper end over a screw 41 (Fig. 3) carried by the lever. As its lower end, as shown in Fig. 8, it passes through a screw-eye 42 that is attached to the platform 29. This screw-eye may be lined with a felt washer 43. Furthermore, the link 40 has an adjustable stop 44 beneath the eye 42. This stop is held in any adjusted position by the aid of the set screw 45 which extends transversely of the link 40, and which passes into the member 44. A felt pad or washer 46 is interposed between the stop 44 and the eye 42.

Accordingly, by proper adjustment of the position of all of the stops 44, movement of the four levers 32-35 can be made such as to elevate the platform to the position of Fig. 3.

Operation of all of the levers is accomplished by the aid of solenoids, one for each lever. The solenoid structure for lever 32 will be described, and it will be understood that similar solenoid structures are employed for the remaining levers.

Thus, as shown most clearly in Figs. 3 and 5, a coil 47 is supported in the frame 17, and carries a core 48 of the same general character as cores 23. In Fig. 5, the core 48 is shown in the position that it assumes when the coil 47 is energized.

The hollow core 48 carries a wood strip 49 (Figs. 5 and 7). This wood strip is connected to the lever 32 by the aid of a stiff wire 50, which passes through a large clearance aperture 51 in the supporting strip 15. In order to render the operation on the lever noiseless, felt sleeves 52 and 53 are disposed on the wire 50. The upper edge of the aperture 51 serves as a limit for the upward movement of the lever 32.

In order that small solenoid coils 47, using only limited power, may be provided to lift the platform 29 and all of the cores 23, use is made of an auxiliary spring force associated with lever 32 and lever 34. Thus, a tension spring 54 is anchored at its left-hand end to a screw-eye 55 attached adjacent the free end of the lever 32. Its other end is anchored to a wire 56 that passes through stationary guides 57 mounted on the support 15, and that has an adjustable stop 58.

In the position of Fig. 1, in which the platform 29 is in the inactive position, the direction of the force exerted by the spring is such that this force passes quite close to the pivot of the lever 32. Accordingly, in this position the torque tending to turn the lever 32 in a clockwise direction, due to the spring tension, is very small and not sufficient to raise the platform and its associated parts. The weight of these parts is sufficient, when the coils 47 are de-energized, to carry the platform 29 to its lowermost position.

However, just as soon as the plungers 48 are elevated slightly, the torque arm of the spring force increases rapidly. Accordingly, the spring tension helps materially to raise the platform.

The inventor claims:

1. In an electric percussion instrument: a suspended horizontal resonant bar; a striker below the bar; a damper resting on the bar and above it; a connection between the damper and the striker; and electromagnetic means for operating said striker, including a core suspended by the damper.

2. In an electric percussion instrument: a plurality of spaced parallel resonant bars; a plurality of strikers respectively for the bars and movable transverse to the axis of the bars; a damper for each bar located on the opposite side of the bar from the striker; a connection between each striker and the corresponding damper and passing between adjacent bars; and electromagnetic means for operating each striker including a core for each striker suspended by the respective damper.

3. In an electric percussion instrument: a plurality of horizontally arranged, parallel spaced resonant bars; a plurality of strikers respectively for the bars and disposed to move upwardly against the bars; electromagnets having plungers connected to the strikers; a damper for each bar and disposed above the bars; and a connection between the damper and striker of each bar, and passing between adjacent bars; the damper thereby serving to suspend the associated striker and plunger from the bar.

4. In an electric percussion instrument: a plurality of spaced parallel resonant bars; a plurality of strikers respectively for the bars and movable transverse to the axis of the bars; a damper for each bar located on the opposite side of the bar from the striker; a connection between each striker and the corresponding damper and passing between adjacent bars; and means for simultaneously moving a plurality of the strikers but not into contact with the bars, for moving the corresponding dampers off the bars.

5. In an electric percussion instrument: a plurality of horizontally arranged, parallel spaced resonant bars; a plurality of strikers respectively for the bars and disposed to move upwardly against the bars; electromagnets having plungers connected to the strikers; a damper for each bar and disposed above the bars; a connection between the damper and striker of each bar,

and passing between adjacent bars; the damper thereby serving to suspend the associated striker and plunger from the bar; and means for simultaneously lifting a plurality of the plungers to release the dampers, said movement being insufficient to move the strikers into contact with the bars.

6. In an electric percussion instrument: a plurality of horizontally arranged, parallel spaced resonant bars; a plurality of strikers respectively for the bars and disposed to move upwardly against the bars; electromagnets having plungers connected to the strikers; a damper for each bar and disposed above the bars; a connection between the damper and striker of each bar, and passing between adjacent bars; the damper thereby serving to suspend the associated striker and plunger from the bar; a vertically movable member beneath the plungers; and means for moving said member to lift a plurality of plungers for releasing the dampers, said movement being insufficient to move the strikers into contact with the bars.

7. In an electric percussion instrument: a plurality of horizontally arranged, parallel spaced resonant bars; a plurality of strikers respectively for the bars and disposed to move upwardly against the bars; electromagnets having plungers connected to the strikers; a damper for each bar and disposed above the bars; a connection between the damper and striker of each bar, and passing between adjacent bars; the damper thereby serving to suspend the associated striker and plunger from the bar; a platform normally spaced below the plungers; and means for moving the platform to engage the lower ends of the plungers and to release the dampers from the bars.

8. In an electric percussion instrument: a plurality of horizontally arranged, parallel spaced resonant bars; a plurality of strikers respectively for the bars and disposed to move upwardly against the bars; electromagnets having plungers connected to the strikers; a damper for each bar and disposed above the bars; a connection between the damper and striker of each bar, and passing between adjacent bars; the damper thereby serving to suspend the associated striker and plunger from the bar; a common means for engaging the lower ends of the plungers; and means for raising said common means, comprising a lever; a link between the lever and said common means; and an electromagnet having a plunger connected to the lever.

9. In an electric percussion instrument: a plurality of horizontally arranged, parallel spaced resonant bars; a plurality of strikers respectively for the bars and disposed to move upwardly against the bars; electromagnets having plungers connected to the strikers; a damper for each bar and disposed above the bars; a connection between the damper and striker of each bar, and passing between adjacent bars; the damper thereby serving to suspend the associated striker and plunger from the bar; a common means for engaging the lower ends of the plungers; and means for raising said common means, comprising a lever; a link between the lever and said common means; an electromagnet having a plunger connected to the lever; and a spring connection urging the lever in a lifting direction, the direction of the force of the spring being quite close to the axis of the lever when the lever is in inactive position, whereby the weight imposed on the lever when the electromagnet

operating the lever is deenergized, is sufficient to cause reengagement of the dampers with the bars.

10. In an electric percussion instrument: a plurality of horizontally arranged, parallel spaced resonant bars; a plurality of strikers respectively for the bars and disposed to move upwardly against the bars; electromagnets having plungers connected to the strikers; a damper for each bar and disposed above the bars; a connection between the damper and striker of each bar, and passing between adjacent bars; the damper thereby serving to suspend the associated striker and plunger from the bar; a member beneath the plungers and normally out of contact therewith; a plurality of levers connected to the member to raise it and thereby release the dampers; and electromagnets respectively connected to the levers for operating them.

11. In an electric percussion instrument: a plurality of horizontally arranged, parallel spaced resonant bars; a plurality of strikers respectively for the bars and disposed to move upwardly against the bars; electromagnets having plungers connected to the strikers; a damper for each bar and disposed above the bars; a connection between the damper and striker of each bar, and passing between adjacent bars; the damper thereby serving to suspend the associated striker and plunger from the bar; a member beneath the plungers and normally out of contact therewith; a plurality of levers connected to the member to raise it and thereby release the dampers; said levers being angularly movable on spaced parallel axes; electromagnets respectively connected to the levers for operating them; and a spring connection between one lever and a stationary point for assisting the electromagnet, the direction of the spring force being close to the axis of the respective lever, and increasing as the lever operates; the weight of the member and its as-

sociated parts being sufficient when the lever operating electromagnets are deenergized, to return the member to inactive position.

12. In an electric percussion instrument: a plurality of spaced resonant elements; a plurality of strikers respectively for each element; a damper for each element; a connection between the damper and the striker of each element; independently operable means for operating the strikers so as to strike the elements; and means for simultaneously moving the strikers toward the elements but short of contact of the strikers with the elements, and thereby moving the dampers out of contact with their respective elements.

13. In an electric percussion instrument: a plurality of spaced resonant elements; a plurality of strikers respectively for each element; a damper for each element; electromagnetic means for operating each of said strikers, and including a core to which the respective striker is attached; a damper for each element carried by the striker for the element, said damper serving to suspend the core; and means for simultaneously moving said cores for releasing the dampers, the movement of the cores being insufficient to cause contact between the strikers and the elements.

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