

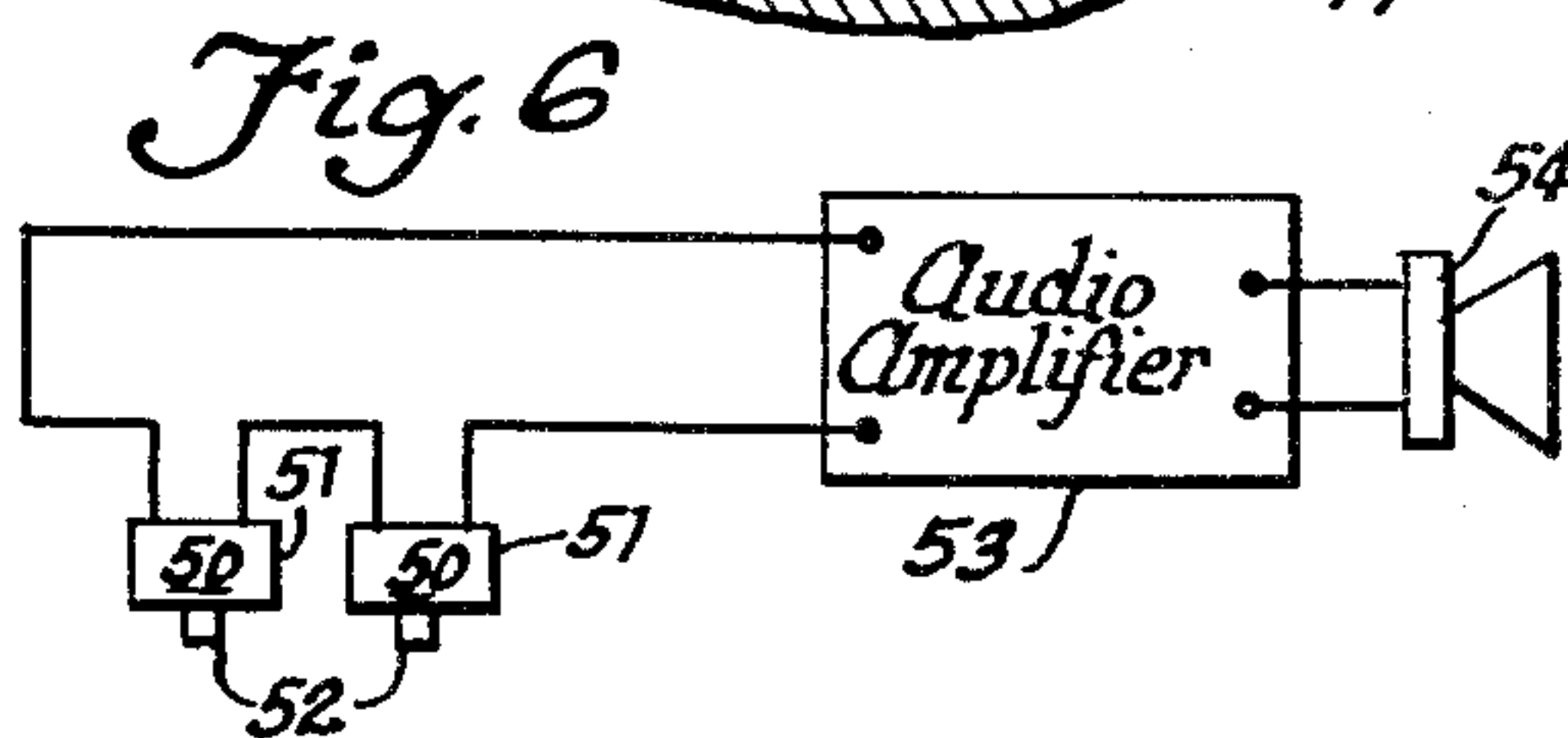
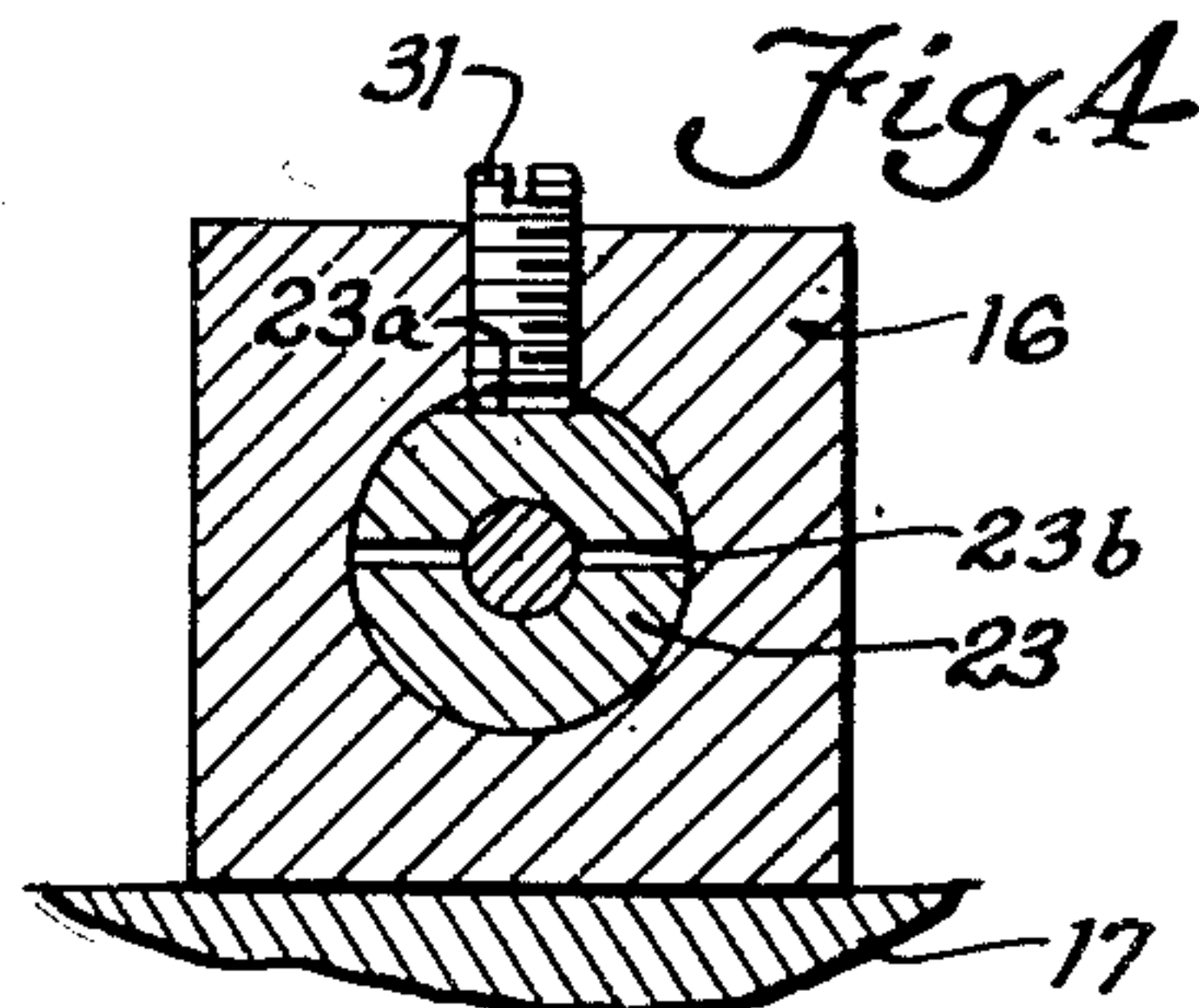
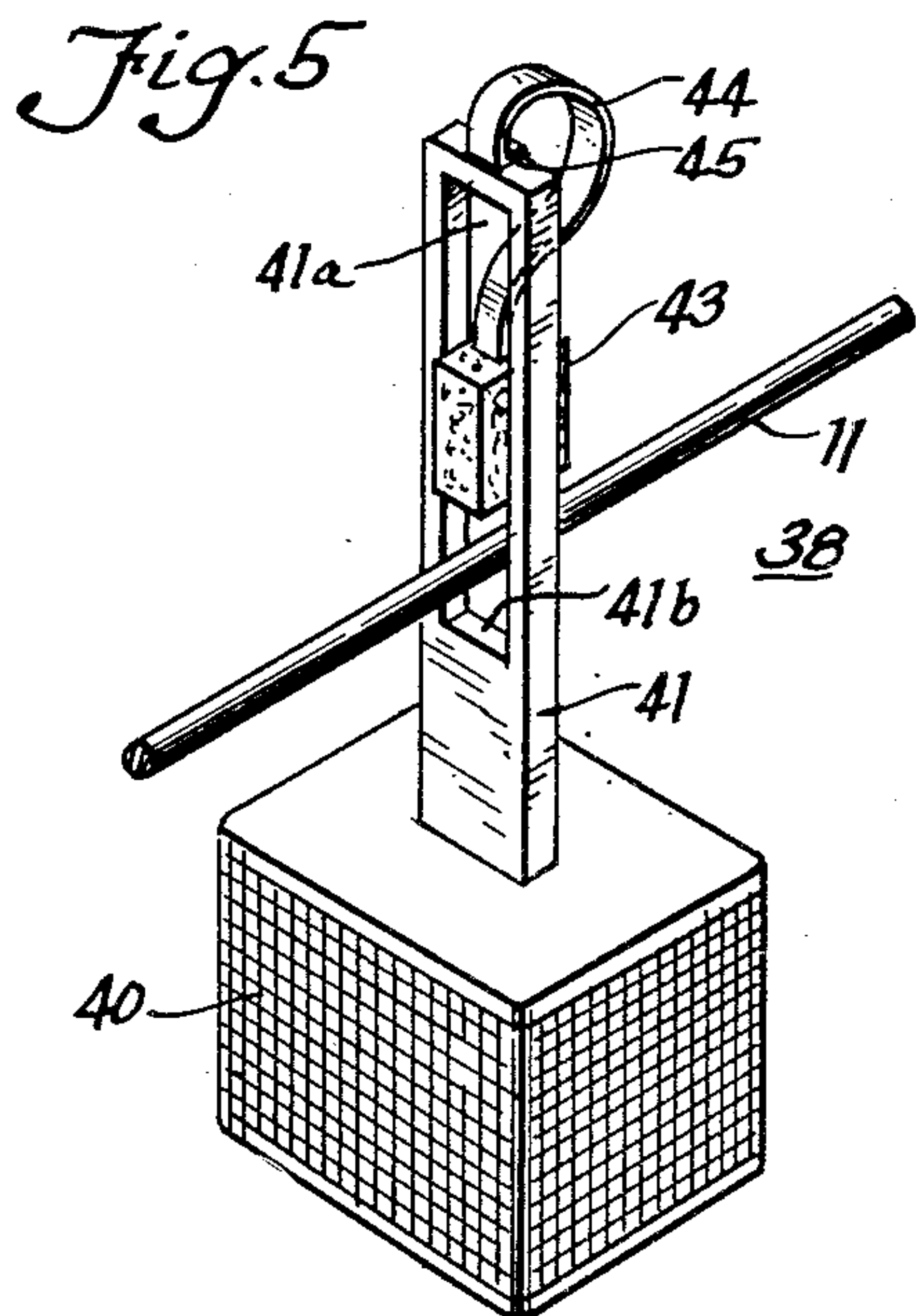
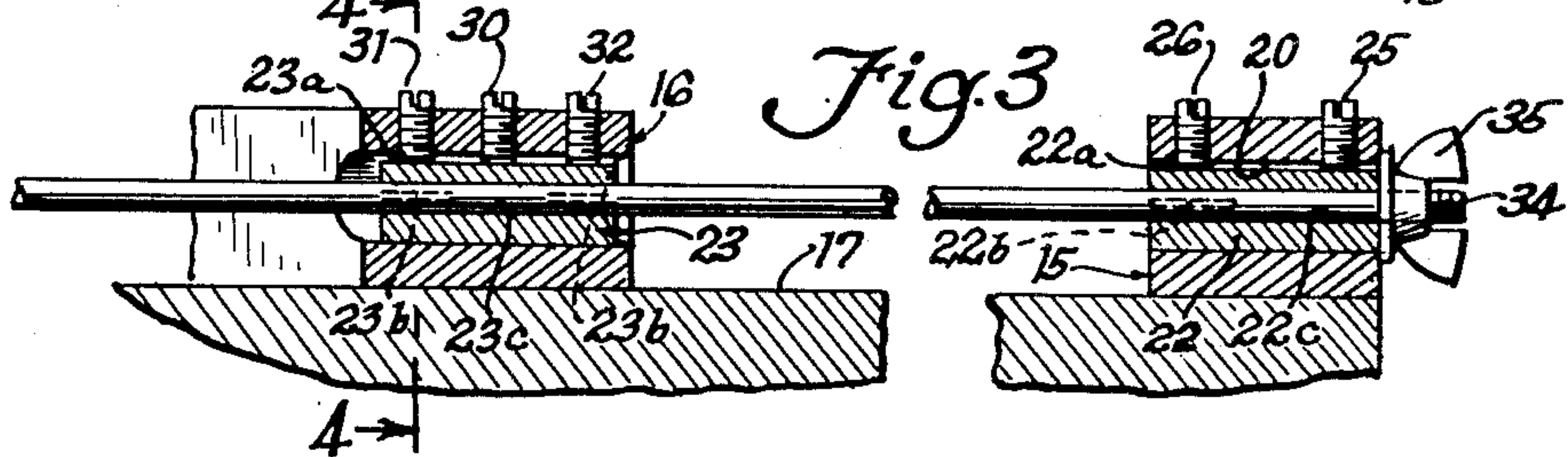
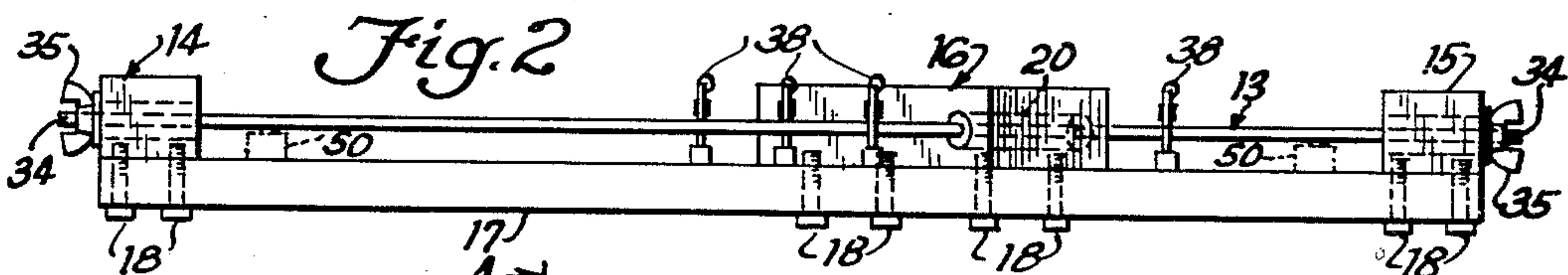
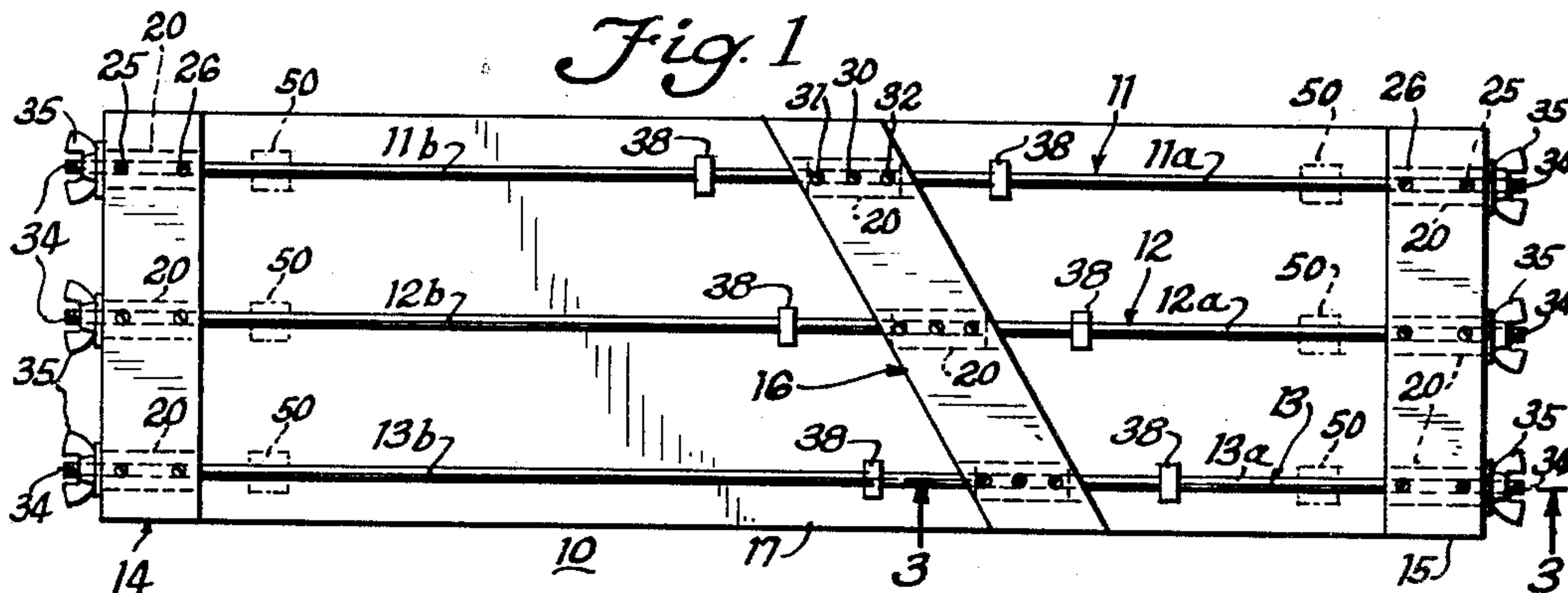
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2,707,414

TUNED VIBRATING SYSTEM

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1

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TUNED VIBRATING SYSTEM

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11 Claims. (Cl. 84-405)

The present invention relates to tuned vibrating systems for musical instruments generally and more particularly to a tone bar assembly and associated mechanism for musical instruments such as carillons or the like.

The electronic or so called amplified carillon is fast replacing the traditional church bells in popularity because it does everything the traditional bells can do automatically, it is tons lighter and thousands of dollars more economical. Furthermore, it can be installed where traditional bells by virtue of their weight and cost are entirely out of the question. Such a carillon heretofore has comprised a plurality of tone bars of different lengths usually fastened at one end with striker means for striking individually or in groups various ones of said tone bars. Suitable pick-up devices pick up the vibrations created which are amplified and broadcast direct from church belfries or other places through the medium of loud speakers and the like.

It is an object of the present invention to provide a new and improved carillon of the electronic type.

It is another object of the present invention to provide an improved tone bar assembly and tuning means for a carillon or similar device in which standard length rods may be used for all the notes.

It is a further object of the present invention to provide a tone bar for a carillon in which the bar is placed under tension to determine the relative frequencies of the overtones.

Still another object of the present invention resides in the provision of an improved striker mechanism for the tone bar assembly of a carillon or similar device.

A still further object of the present invention comprises an improved tuning means including adjustable collets for the tone bars of a carillon which bars are rigidly supported at each end.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the present invention, reference may be had to the accompanying drawing in which:

Fig. 1 is a top view, somewhat schematic of a tone bar assembly embodying the present invention;

Fig. 2 is a side elevational view of the tone bar assembly of Fig. 1;

Fig. 3 is an enlarged sectional view taken on line 3-3 of Fig. 1;

Fig. 4 is a sectional view taken on line 4-4 of Fig. 3 assuming that Fig. 3 shows a complete structure;

Fig. 5 is an enlarged perspective view of the details of the striker element embodiment schematically indicated in Fig. 1; and

Fig. 6 is a schematic circuit diagram showing the vibration pick ups and associated amplifying and sound reproducing means which may be associated with the vibrating elements of the carillon of the present invention.

2

In accordance with the present invention, there is provided a carillon which has many basic advantages over that of the bell type carillons heretofore employed. It is a well known fact that conventional bells have harmonics or overtones which are not in tune with their fundamental and in order properly to tune such bells is a very expensive proposition requiring the removal of material from the bell. If too much material is removed, the bell must be scrapped or recast. The amplified carillon of the present invention is of low cost, may be housed in a small space, is of small mass and may be tuned so that the overtones are in tune with their fundamental. A tone bar assembly is provided in which tone bars of the same length and configuration are rigidly supported at each end and at an intermediate point, and the different fundamentals of the respective tone bars are obtained by properly positioning elements associated with each bar. The relative frequencies of the overtones are controlled by appropriately tensioning the bars. An improved striker element is provided including a snubber member mounted in an improved manner whereby sustained tones and damped tones may be obtained selectively.

Referring now to the drawing, there is illustrated in Figs. 1 and 2 in somewhat schematic form the improved tone bar assembly of the present invention generally designated at 10 comprising a plurality of tone bars or vibrating members 11, 12 and 13. It should be understood that the number of tone bars may be varied in dependence upon the number of notes the carillon is designed to have and the number of bars illustrated in Fig. 1 is of no significance, a plurality being illustrated more clearly to illustrate the present invention. In accordance with the present invention, the tone bars 11 to 13 for producing different bell tone fundamentals are all of the same length and cross section and in the particular instance illustrated are subdivided into six different lengths and independently vibrating rods designated as 11a, 11b, 12a, 12b, 13a and 13b, respectively.

For the purpose of supporting the tone bars 11 to 13 inclusive, there is provided, adjacent each end of the bars, mass or supporting elements 14 and 15. To subdivide each tone bar, there is additionally provided an intermediate or center mass element 16. These mass or supporting elements which are rigidly supported on a frame 17 preferably are relatively heavy elements so that relatively no vibrations thereof will occur in the event that one or more of the tone bars 11 to 13 or individual parts thereof are caused to vibrate, thereby preventing damping of the vibration of the bars by transmission of the vibration to other members of the tone bar assembly. Essentially, therefore, the mass elements 14, 15 and 16 are of sufficient weight so that they will not vibrate appreciably from the reaction of the tone bars thereagainst. Each of the mass elements 14 and 15 are of substantially identical construction, and are disposed in spaced parallel relationship at the ends of frame 17. The mass element 16 is skewed or disposed at an angle as clearly shown in Fig. 1 of the drawing in order to produce approximately the different length tone bar sections 11a, 12a, 13a, 11b, 12b and 13b for the desired portion of the musical scale. These mass elements 14, 15 and 16 are preferably fastened to the frame 17 by fastening means 18. Each mass element is provided with a plurality of spaced openings 20 therein which openings are so disposed that when the sound bars 11 to 13 are disposed therein, they are preferably supported in spaced parallel relationship.

As is best shown in Fig. 3 of the drawing, each of the openings 20 in the end masses 14 and 15 is adapted to receive therein a collet 22 provided with a flat surface 22a along one portion of the circumference, diametrically opposed longitudinally extending notches 22b at one end

of the collet in order effectively to provide a bifurcated end, and a central opening or passageway 22c so as to slidably receive therein one of the tone bars such as 11, 12 or 13. Similarly each of the openings 20 in the center or skewed mass portion 16 is adapted to receive a collet 23 which, like the collets 22, is provided with a flat surface 23a along one portion of the circumference, diametrically opposed longitudinally extending notches 23b at either end of the collet 23 so as to provide bifurcations at both ends of the collet, and a central passageway 23c adapted to receive therein the tone bars such as 11, 12 or 13. A plurality of pairs of set screws 25 and 26 are associated with the mass elements 14 and 15, one pair of the set screws 25 and 16 being associated with each opening 20 and spaced from each other along the longitudinal axis of the opening 20. The set screw 25 is adapted threadedly to engage the flat surface 22a at the nonbifurcated end of the collet 22, thereby rigidly securing the associated collet means to the mass element 14 or 15. The set screw 26, on the other hand, is adapted to engage the flattened surface 22a adjacent the bifurcated end of the collet 22 as is clearly shown in Fig. 3 of the drawing to clamp the collet 22 to the associated tone bar. Similarly, the skewed center mass element 16 is provided with a plurality of groups of set screws 30, 31 and 32, each group of three set screws being spaced from one another in a line extending along the longitudinal axis of the opening 20. Each set screw 30 is adapted to engage the flat surface 23a of the collet 23 at an intermediate point thereof so as firmly to fix the collet 23 to the skewed mass element 16. The set screws 31 and 32, on the other hand, are associated with the bifurcated ends of the collets 23 and function in the same manner as the set screws 26 to fasten the collets to the associated tone bars, two set screws being required, one for each section of the tone bars as mentioned above.

During the assembly operation of the tone bars with the mass elements, the collets 23 are first inserted into the respective openings 20 of the skewed center mass element 16 and the set screws 30 are adjusted to hold all these collets 23 in position. The tone bars of equal length 11, 12 and 13 are then inserted in the passageways 23c of the collets 23 with the ends thereof extending into the passageways 20 of the mass elements 14 and 15. It should be noted that the passageways 20 in the mass element 14, 15 and 16 for receiving any particular tone bar are coaxially disposed, or, in other words, are in alignment. The set screws 31 and 32 are now tightened so as to clamp the bifurcated ends of the collets 23 to the associated tone bars. The passageways 23c of each of the collets 23 are sufficiently long to prevent tilting or displacement of the tone bars and furthermore, the bifurcated ends of the collets 23 provide for a good grip on the tone bars.

In order to cause the tone bars 11, 12 and 13 to produce six different fundamental notes, the collets 22 are now inserted in the openings 20 of the mass elements 14 and 15 so as to surround the associated tone bars 11, 12 and 13. The end collets are fastened to the mass elements by the set screws 25 and to the tone bars by the set screws 26. Tuning of the sections 11a, 12a, 13a, 11b, 12b, and 13b of the tone bars 11, 12 and 13 is accomplished by moving the end collets 20 to the left or right as desired for proper tuning and refastening the collets to the tone bars and masses in the desired positions. It should be understood that although the tone bars illustrated are each capable of producing two separate fundamental notes, that at least one tone bar might be employed without any associated center mass element to produce very low frequency bell tones. Likewise, in certain cases more than three masses may be associated with each rod. When the mass elements 14, 15 and 16 are effectively clamped to the rods 11, 12 and 13, two tone bars are in effect provided for each length of a tone bar, one comprising the portion between the mass elements 14 and 16 and the other comprising the

portion between the mass elements 15 and 16. The frequency at which the rods vibrate is, of course, dependent upon the length of the end clamped rod sections between the masses 14 and 16 and 15 and 16. With this arrangement, the various tones desired can be obtained by using a number of tone bars such as 11, 12 and 13, all of the same length. As was mentioned above, tuning the tone bar assembly 10 shown in Fig. 1 is a relatively simple matter since initially the tone bars are assembled in the manner shown with the end collets 22 loose thereon in the end masses 14 and 15 and the tone bars clamped to the center mass 16. The ends of the tone bars or rods are subsequently clamped to the end masses by means of the collets 22 which can be moved in and out to the proper position to determine the dominant tone or fundamental note desired of each tone bar. By clamping the collets 22 securely to the mass elements 14 and 15 by the set screws 25 any twisting of the associated tone bar is prevented when the set screw 26 is tightened, thereby eliminating any possibility of change in the overtone structure.

In accordance with the present invention, it has been found that the tone produced by each of the tone bars may be improved if the rods are placed under tension, since by appropriately tensioning the rods it is possible to modify the relative frequencies of the overtones or harmonics. Accordingly, each end of the tone bars 11, 12 and 13 is threaded as indicated at 34 whereby a suitable winged nut 35 may be applied thereto appropriately to tension the tone bars against mass 14 and 15. Under these conditions, it will be understood that the tension will be applied to the tone bars or rods before the set screws 26 associated with the end supports 14 and 15 are finally tightened, but after the middle collets 23 are firmly clamped to the rods and skewed center mass.

It will be understood that the collets 22 and 23 are preferably formed of a hardened steel so as to perform satisfactory clamping operation. Similarly the tone bars 11, 12 and 13 inclusive are made of suitable material for producing satisfactory tones.

For the purpose of causing vibration of one or more of the tone bars 11, 12 and 13, inclusive, there is associated with each tone bar section a suitable striker mechanism schematically designated by the reference numerals 38 in Fig. 1 of the drawing. The details of the striker mechanisms 38, identical for all of the tone bars, is clearly shown in Fig. 5 of the drawing. As illustrated, the striker mechanism comprises an electromagnet generally designated at 40 having a movable armature of striker 41 which is provided with a suitable elongated opening 41a through which the tone bar such as 11 extends. Upon energization, the armature or striker 41 moves upwardly as indicated in Fig. 5 of the drawing whereby the striking surface 41b thereof engages the associated tone bar indicated as 11 in Fig. 5. It will be understood that electro-magnet 40 will be energized in response to closing a suitable control switch preferably in response to manipulating a key of the manual of the carillon whereupon the striking surface 41b will strike the associated tone bar. As long as the key is actuated, the striker 41 will be maintained somewhat in the position shown in Fig. 5 whereby the tone bar may produce a sustained tone. In accordance with the present invention, the striker mechanism 38 comprises suitable damping means comprising the snubber or damping member 43 formed of suitable material such as leather or the like. The snubber 43 is mounted at the end of a suitable spring member 44 which in turn is supported from the striker 41 as indicated at 45. The characteristics of the spring 44 and snubber member 43 are chosen to give suitable compliance. When the key which controls the energization of the solenoid or electromagnet 40 is released, the striker 41 drops down whereby the snubber member 43 engages the associated tone bar. If the compliance of the snubber 43 and spring 44 are correct, there will be no thump or

5

too-rapid snubbing action whereby any undesired too-sudden muffling of the tone will be eliminated.

It will be understood that a carillon of the type described will not produce an audible tone without amplification means or the like. Accordingly, there is appropriately associated with each bar section a suitable pick-up unit schematically indicated in Fig. 1 by the reference numerals 50, one pick-up unit being associated with each tone bar section. These pick-up units 50 preferably each comprise a winding 51 and a magnetizable core 52. As illustrated in Fig. 6 of the drawings, the windings 51 of a whole series of these pick-up units 50 may be connected together and to the input of a suitable amplifier 53 adapted to operate one or more signal reproducers or loud speakers 54. It will be understood that other appropriate types of pick-ups such, for example, as electrostatic pick-ups may be employed, and the pick-up units and amplification circuit of Fig. 6 form no part of the present invention but are merely illustrated for the purpose of making a complete disclosure.

In view of the detailed description included above, the operation of the carillon of the present invention will readily be understood by those skilled in the art. The tone bars may all be chosen of substantially the same length and the different fundamental notes obtained by adjusting the end collets 22. The relative frequencies of the overtones may also be adjusted by properly tensioning the tone bars through use of the nuts 35. In addition, the striker mechanism 38 includes a striker element having improved snubbing means associated therewith.

While there has been illustrated and described what is at present considered the preferred embodiment of the present invention, it will be understood by those skilled in the art that numerous changes and modifications can be made without departing from the invention in its broader aspects, and it is aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a sound bar assembly for a carillon or similar device, a plurality of tone bars of approximately the same configuration and length, means for supporting said bars in spaced relationship comprising end supports of relatively great mass, means including a plurality of collets one for each juncture of support and tone bar for clamping said bars to said end supports, at least one striker for each of said bars, an intermediate mass element for supporting each of said tone bars between said end supports, means for clamping each of said tone bars to said intermediate mass element, and means for positioning the collets associated with said end supports to control the fundamental frequency produced by each tone bar when struck by its associated striker.

2. A sound bar assembly for a carillon or similar device comprising, a plurality of tone bars of approximately the same configuration and length, means for rigidly supporting said bars in spaced parallel relationship comprising end and center supports of relatively great mass, at least one striker for each of said bars, a plurality of collets slidable on said tone bars and means for clamping said supports to said collets and said collets to said tone bars to control the fundamental note produced by the associated tone bar when struck by its associated striker.

3. In a sound bar assembly for a carillon or similar device, a plurality of tone bars of approximately the same configuration and length, a pair of spaced supports, means defining a plurality of spaced openings in each of said supports for receiving the ends of said tone bars, said openings being so arranged that said tone bars are disposed in spaced parallel relationship and perpendicular to said spaced supports, means associated with each of said openings for clamping the portions of the tone bars disposed therein to said supports, an intermediate support disposed between said end supports comprising a

6

plurality of passageways one for each of said tone bars, means for clamping each of said tone bars to said intermediate support, said intermediate support being disposed at an angle other than a right angle with respect to each of said tone bars to divide each of said tone bars into two sections, and a striker for each section for causing each section to vibrate.

4. In a sound bar assembly for a carillon or similar device, a plurality of tone bars of approximately the same configuration and length, means for supporting said bars in spaced relationship comprising end and intermediate supports of relatively great mass, means comprising collets having a bifurcated end for clamping said bars to said end supports, means comprising a plurality of collets for clamping each of said tone bars to said intermediate support, said intermediate support being disposed in a different relative position with respect to each of said tone bars whereby each tone bar is divided into two sections each capable of vibrating at a different fundamental frequency, and a striker for each of said sections.

5. A sound bar assembly for a carillon or similar device comprising, a plurality of approximately identical tone bars, a plurality of spaced supports including a pair of end supports and a skewed center support whereby each tone bar is divided into two sections of different lengths by said center support and the sections of all the tone bars differ in length, means defining a plurality of spaced openings in each of said end supports and a plurality of passageways in said center support for receiving said tone bars, said openings and passageways being so arranged that said tone bars are disposed in spaced parallel relationship, a first collet disposed in each of said openings and surrounding the end of its associated tone bar for clamping the portions of the tone bars disposed therein to said supports, a striker for each of said bars, a second collet for each tone bar one disposed in each of said passageways for clamping each of said tone bars to said center support whereby said tone bar sections vibrate at different fundamental frequencies when struck by its associated striker.

6. A sound bar assembly for a carillon or similar device comprising, a plurality of approximately identical tone bars, a plurality of spaced supports including parallel end supports and an intermediate support disposed at an angle with respect to said end supports, means defining a plurality of spaced openings in each of said supports for receiving said tone bars, said openings being so arranged that said tone bars are disposed in spaced parallel relationship with each tone bar divided into two sections of different length by said intermediate support, a first collet disposed in each of said openings in said end supports surrounding the ends of its associated tone bar for clamping the portions of the tone bars disposed therein to said supports, a striker for each section of said bars, a second collet for each tone bar one disposed in each opening of said intermediate support, means for causing each of the sections of said tone bars to vibrate at different fundamental frequencies when struck by said striker, and means for placing each of said tone bar sections under tension to improve the tone produced thereby.

7. In a sound bar assembly for a carillon or similar device, a plurality of tone bars of approximately the same configuration and length each being threaded on at least one end, a pair of spaced end supports and an intermediate support, means defining a plurality of spaced openings in each of said supports for receiving said tone bars, the ends of said tone bars being disposed in the openings in said end supports, the threaded end of each tone bar extending beyond the associated end support, said openings being so arranged that said tone bars are disposed in spaced parallel relationship, means associated with each of the openings in said intermediate support for clamping the portions of the tone bars disposed therein to said supports, at least one striker for each of said bars, means for clamping the tone bars in different predetermined manners to said end supports whereby the

7

sections of said tone bars between adjacent supports vibrate at different fundamental frequencies when struck by said striker, and a clamping nut for each tone bar engaging said threaded end for applying predetermined tensile forces to said tone bars to improve the tones produced thereby.

8. In a sound bar assembly for a carillon or similar device, a plurality of tone bars of approximately the same configuration and length, a striker element for each of said tone bars, means for supporting said bars in spaced relationship comprising end supports, an intermediate support, means for clamping said bars to said intermediate support, adjustable means associated with said end supports for tuning said bars to control the fundamental tone of each bar or section thereof, and means comprising a threaded end and associated adjustable member for each of said tone bars for selectively applying tensile forces to said bars to control the overtones whereby a more pleasing bell tone is obtained.

9. A sound bar assembly for a carillon or similar device comprising, a plurality of approximately identical tone bars, a pair of spaced supports, means defining a plurality of spaced openings in each of said supports for receiving the ends of said tone bars, said openings being so arranged that said tone bars are disposed in spaced parallel relationship, a first collet having a bifurcated end disposed in each of said openings and surrounding the end of its associated tone bar, means for causing the bifurcated ends of said first collets to clamp the portions of the tone bars disposed in said openings rigidly to said supports, a striker for each of said bars, a skewed intermediate support disposed between said end supports having a plurality of passageways therein for said tone bars, and a second collet bifurcated at each end disposed in each of said passageways, means for clamping the bifurcated ends of each of said second collets to its associated tone bar, said skewed intermediate support being disposed differently relative to each tone bar whereby said tone bars vibrate at different fundamental frequencies when struck by said striker.

10. In a sound bar assembly for a carillon or similar devices, a plurality of tone bars of approximately the same configuration and length, a striker for each of said tone bars comprising an electromagnet having an armature longitudinally movable in response to energization of said electromagnet, means defining an opening in said armature, said tone bar extending through said opening,

8

one edge of said opening comprising a striker for striking said tone bar to produce vibration thereof in response to movement of said armature to a maximum extent in one direction, means for damping said vibrations in response to predetermined movement in the other direction of said armature comprising a snubber member of soft material engageable with said bar in the other extreme position of said armature, and spring means for supporting said snubber member from said armature, said snubber and spring means having a predetermined compliance to prevent too rapid muffling of tones produced by said tone bar.

11. In a sound bar assembly for a carillon or similar device, a plurality of tone bars of approximately the same configuration and length, a striker mechanism for each of said tone bars comprising an electromagnet having an armature vertically movable in response to energization of said electromagnet, means defining an elongated opening in said armature, said tone bar extending through said opening, one edge of said opening comprising a striker for striking said tone bar to produce vibration thereof in response to extreme upward movement of said armature, means for damping said vibrations in response to a predetermined downward movement of said armature following deenergization of said electromagnet comprising a leather snubber member engageable with said bar when said armature is in its lowermost position, and spring means for supporting said snubber member from said armature, said snubber and spring means having a predetermined compliance to prevent too-rapid muffling of tones produced by said tone bar.

References Cited in the file of this patent

UNITED STATES PATENTS

254,910	Blake	Mar. 14, 1882
452,006	Steck	May 12, 1891
491,607	Steck	Feb. 14, 1893
758,879	Weber	May 3, 1904
881,769	Brown	Mar. 10, 1908
1,590,869	Weber	June 29, 1926
2,463,543	Kunz	Mar. 8, 1949
2,479,757	McBride	Aug. 23, 1949
2,484,745	Rowe	Oct. 11, 1949
2,588,295	Rowe	Mar. 4, 1952

FOREIGN PATENTS

14,545	Great Britain	Oct. 18, 1890
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