United States Patent

[11] **3,554,073**

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[54] **VARIABLE RHYTHM METRONOME**
13 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** **84/484**
[51] **Int. Cl.** **G10b 15/00**
[50] **Field of Search** 58/130; 84/1, 402, 453, 470, 477, 484

[56] **References Cited**

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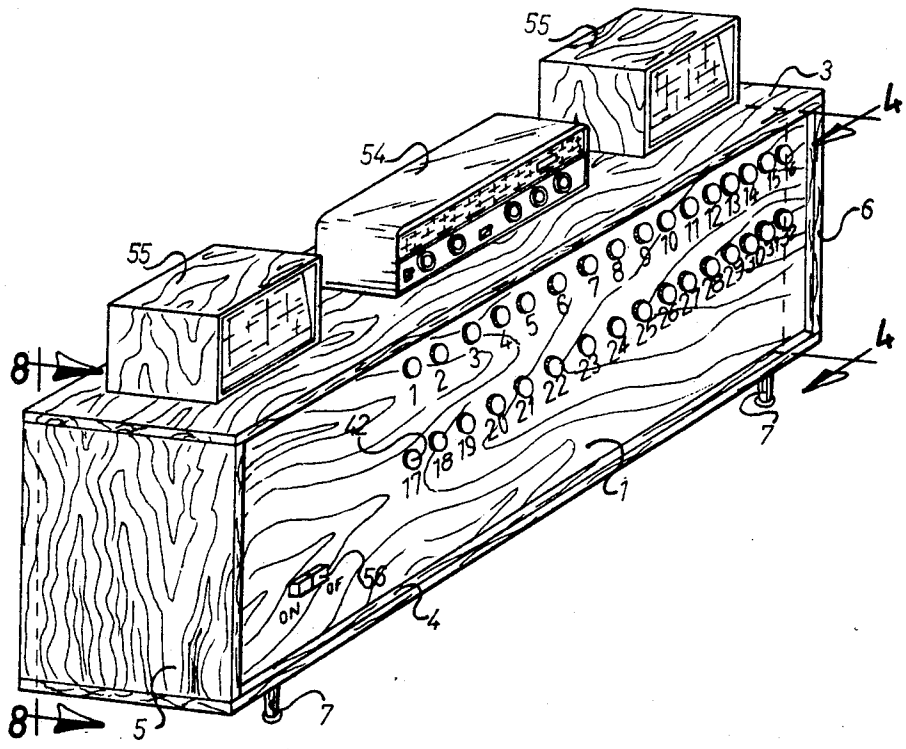
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Primary Examiner—Stephen J. Tomsky
Assistant Examiner—John F. Gonzales
Attorney—Pierre Lesperance

ABSTRACT: A metronome adapted to selectively produce a variety of rhythms, having one or more series of strikers adapted to be selectively set at any one of a number of rest positions and an actuating means extending adjacent said strikers and in cooperation therewith, whereby said actuating means are operated to lift selected ones of said strikers in sequence and to successively drop them such that the selected strikers will produce a rhythmic arrangement upon hitting underlying elements determining the aforementioned rest positions.



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SHEET 1 OF 3

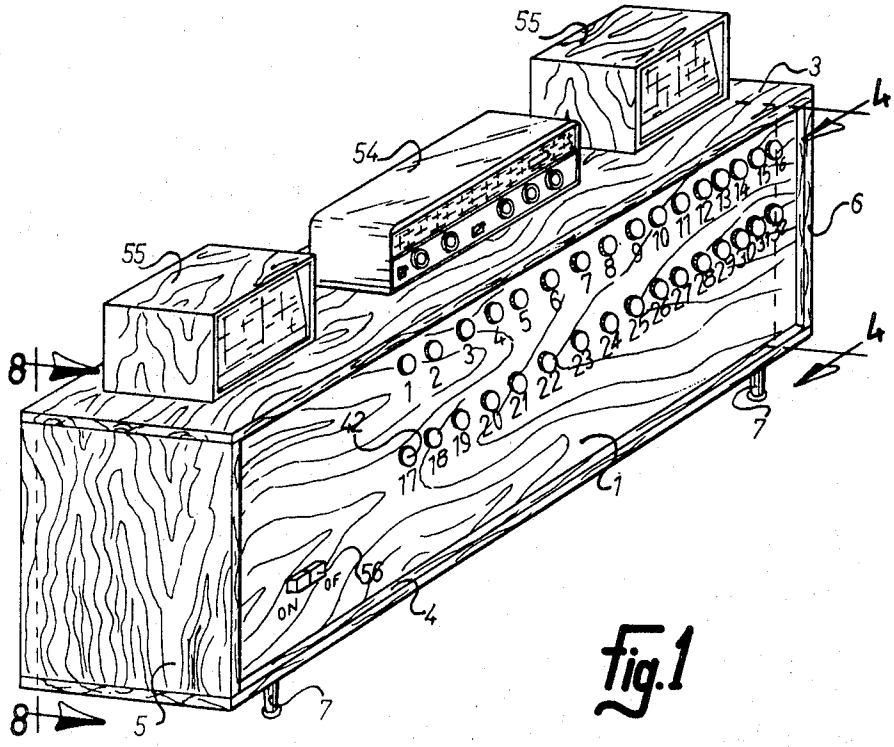


Fig.1

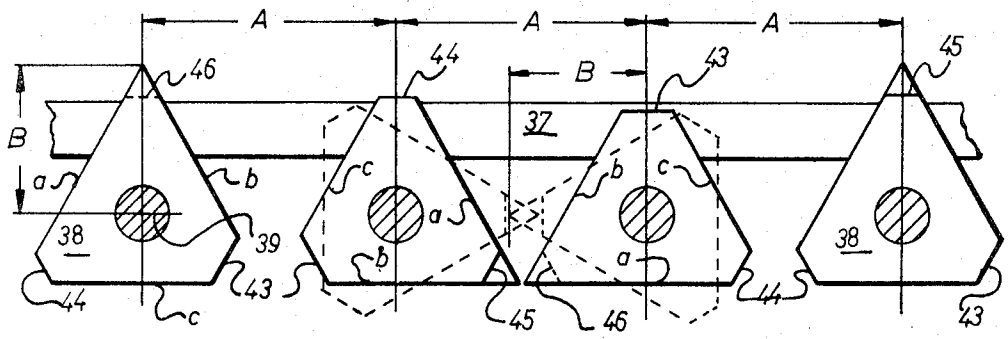


Fig.2

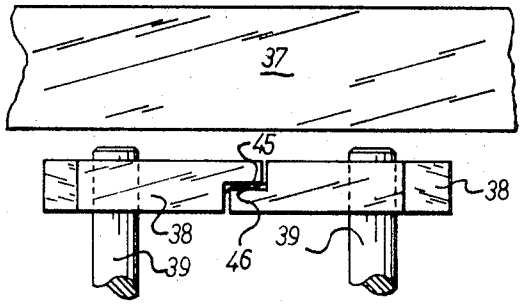


Fig.3

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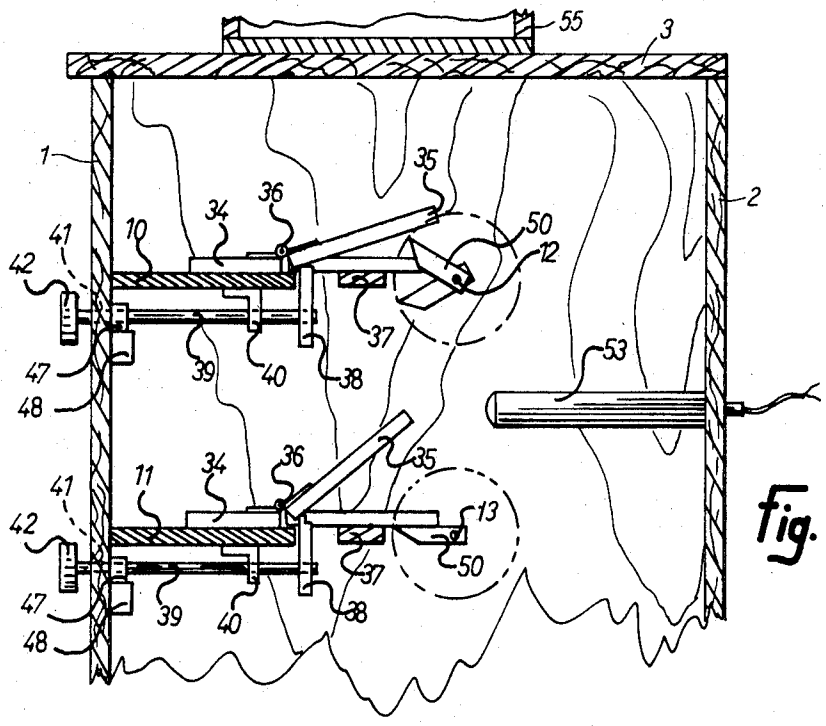


Fig. 4

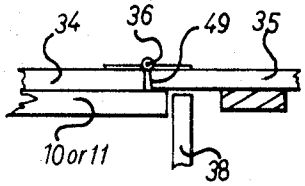


Fig. 5

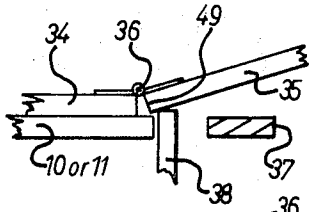


Fig. 6

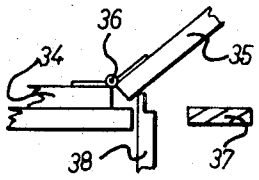
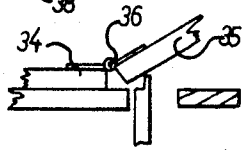


Fig. 11



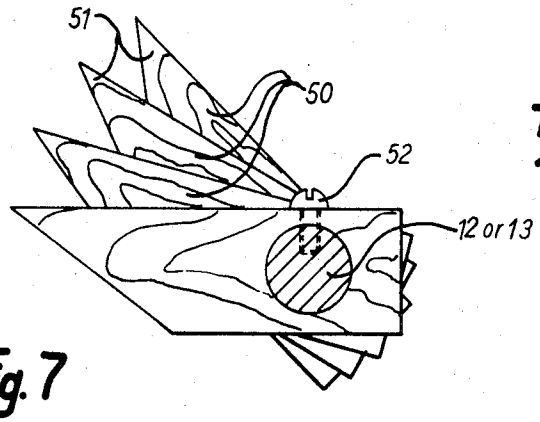


Fig. 12

Fig. 7

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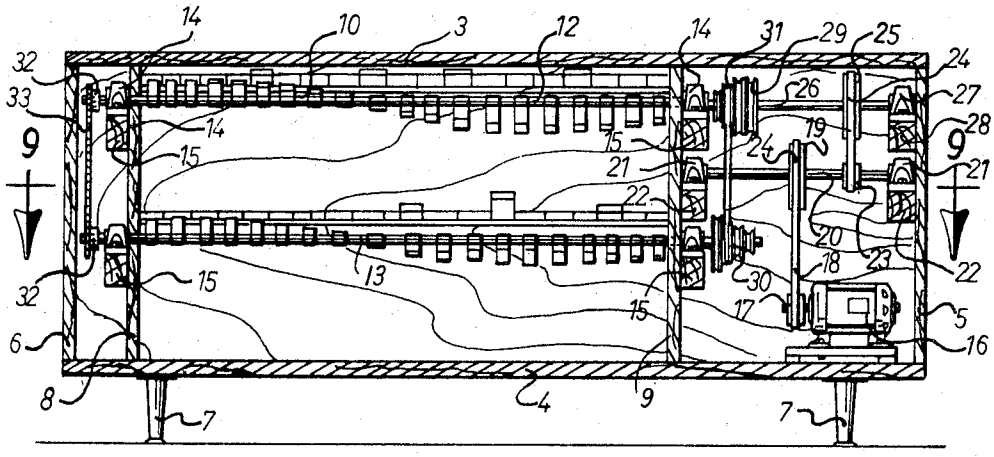


Fig. 8

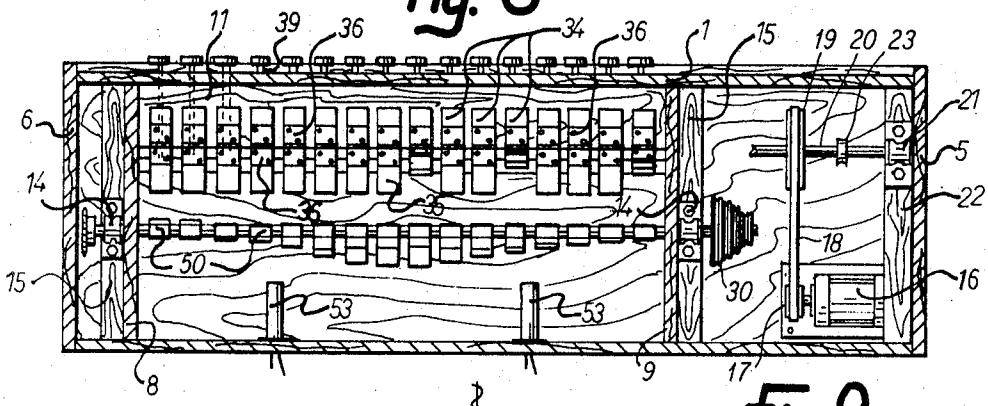


Fig. 9

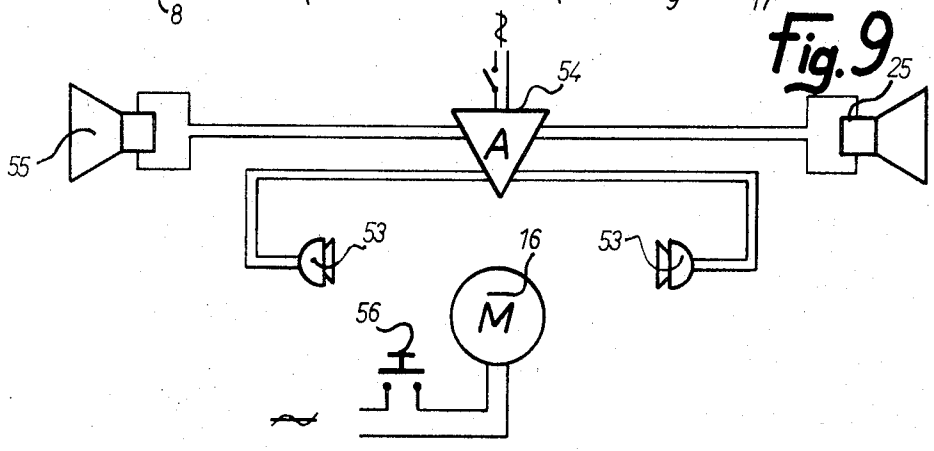


Fig. 10

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VARIABLE RHYTHM METRONOME

This invention relates to an instrument adapted to produce a variety of rhythms. More particularly, this invention relates to a metronome which is selectively operable to produce a desired rhythm by selectively actuating one or more series of striking elements.

The general object of the present invention is to provide a metronome adapted to automatically produce rhythms.

A main object of the invention is to provide a metronome which is adapted to produce a variety of rhythms.

Another object of the invention is to provide a metronome which can be selectively operated to produce a desired rhythm.

A further object of the invention is to provide an instrument adapted to be used by musical performers and composers for the study of known rhythms and the experimenting of new ones.

The invention comprises a housing, one or more series of strikers pivotally mounted within said housing, controls adapted to selectively determine the rest position of each said strikers, an actuating element cooperating with each said strikers and adapted to pivotally and cyclically move said strikers away from said rest position and to drop them successively, whereby the strikers so dropped will hit the rest position determining member to produce a rhythm arrangement. An electronic reproduction system is provided to amplify and reproduce the sound vibrations generated by the strikers.

The invention is fully disclosed by way of example in the following description and in the accompanying drawings, in which:

FIG. 1 is a perspective view of the metronome in association with an electronic sound reproduction system;

FIG. 2 is an elevation view of part of the metronome mechanism;

FIG. 3 is a top view of the two adjacent control members shown in dotted lines in FIG. 2;

FIG. 4 is a side sectional view as seen along line 4–4 of FIG. 1;

FIGS. 5 and 6 show two different rest positions of the controls and of the associated strikers;

FIG. 7 is a detailed view of a number striker-actuating elements mounted on the same axle;

FIG. 8 is a sectional elevation view as seen along line 8–8 of FIG. 1 and in the direction of the arrows;

FIG. 9 is a sectional plan view as seen along line 9–9 of FIG. 8;

FIG. 10 is a circuit diagram of the electronic reproduction system; and

FIGS. 11 and 12 are detailed views similar to FIGS. 5 and 6 but showing two other modes of cooperation between each control element and the corresponding striker.

References to these views will now be made by use of like characters which are employed to designate corresponding parts throughout the description.

By way of example, the variable rhythm instrument or metronome is illustrated in FIG. 1 as embodied in a housing on which are disposed an amplifier and two loudspeaker units. Other arrangements of the aforementioned components are possible without departing from the spirit and scope of the invention. For instance, the amplifier and loudspeaker units may be mounted in the same housing than the rhythm-producing mechanism.

Referring now more particularly to FIGS. 1, 8, and 9, the invention comprises a housing having a front wall 1, a rear wall 2, a top wall 3, a bottom wall 4 and end walls 5 and 6. Said housing is supported on legs 7. A pair of partitions 8 and 9 extend transversely between the front wall 1 and the rear wall 2. A pair of platforms 10 and 11 are provided and extend longitudinally within the housing between said transverse partitions 8 and 9. A pair of axles 12 and 13 extend longitudinally of the housing and through pairs of aligned holes in the transverse partitions 8 and 9. The axles 12 and 13 are mounted into pairs of bearing units 14 fixedly attached to traverses 15 extending against the outer faces of the partitions 8 and 9.

A constant speed motor 16 drives an output pulley 17 carrying a belt 18 cooperating with a driven pulley 19 mounted for bodily rotation with shaft 20. The latter is mounted in a pair of aligned bearings 21 fixed on further traverses 22. A further pulley 23 is fixed on shaft 20 and a belt 24 cooperates with the latter and with another pulley 25 mounted on shaft 26 to rotate the latter. Shaft 26 is carried by a pair of bearing units 27 fixedly mounted on traverses 15 and 28 respectively. Referring to FIG. 8, the left-hand side bearing unit 27 is not shown as it is behind bearing unit 14 of axle 12. A stepped pulley 29 is fixed to shaft 26 for rotation therewith. Another stepped pulley 30 is fixedly mounted on an extension of axle 13 such as to be in alignment with pulley 29. A belt 31 runs around cooperating stepped pulleys 29 and 30 such as to transmit rotation of shaft 26 to axle 13. The belt 31 can be selectively placed in any one of the grooves defined on each step of one stepped pulley and in the aligned groove on the other pulley, such as to allow selection of the relative rotational speed of axles 12 and 13 relative to the rotational speed of shaft 26 for a purpose which will be better understood later. Axles 12 and 13 extend into a space defined between end wall 6 and transverse partition 8. Two identical sprocket wheels 32 are fixed on the end of each of said axles 12 and 13 projecting into said space and a sprocket chain 33 surrounds said pair of sprocket wheels to positively transmit rotation of axle 13 to axle 12 in an angularly synchronized manner.

A series of blocks 34 are serially arranged on platforms 10 and 11 in a transverse direction thereof. One striker 35 is provided for each block 34 and is pivotally connected thereto by a hinge 36. It is obvious that the series of individual blocks 34 could be replaced by one or more longitudinal block to each of which a plurality of strikers 35 could be pivotally attached. One longitudinal rest plank 37 is provided in spaced-apart and coplanar relationship with regard to each of platforms 10 and 11. A cam control member 38 is adapted to cooperate with each striker 35 to set the angular rest position thereof around the corresponding hinge 36. Cam control member 38 comprises a plate element having a generally triangular contour adapted to determine three rest positions of the strikers 35. Each cam control member 38 is disposed transversely of its corresponding striker 35 and in cooperation with the latter, whereby rotation of the cam control member will cause engagement of the striker 35 by the cam control member 38 and pivoting of the striker 35 around its hinge 36. Each cam control member 38 is transversely mounted on a rod 39 for rotation therewith. Rods 39 carrying cam control member 38 are supported by brackets 40 fixed under the platforms 10 and 11 and in holes 41 through the front wall 1 of the housing. A control knob 42 is fixed at the end of rod 39 in any manner well-known in the art.

Suitable marking may be provided on the knob 42 and on the outer surface of front wall 1 adjacent each knob 42 in order to indicate the relative angular position thereof and to readily identify each knob 42. For example, a number can be placed adjacent or on each knob 42 to provide proper identification thereof.

As best shown in FIG. 2, the cam control members 38 have three sides *a*, *b*, and *c* and flats 43 and 44 determined by the truncated apices between sides *b* and *a*, *c* respectively. The third apex determined by converging sides *a*, *b* is truncated for only part of its thickness, as best shown in FIGS. 2, 3, 11, and 12. Alternate cam control members 38 are truncated at 45 adjacent one face of said control members while the intermediate members 38 are truncated at 46 adjacent the other face thereof, such that the adjacent cam control members 38 are truncated on opposite sides such that the partly truncated apices can intermesh each other. The partly truncated apices of adjacent cam control members 38 do not need to intermesh but, in order to keep the metronome instrument relatively small, this intermeshing expedient is used. As shown in FIGS. 2, 5, 6, 11, and 12, cam control members 38 can be set in one of three different positions: a first position with the partly truncated apex pointing upwardly; a second position with the flat 44 directed upwardly; and a third position with the flat 43 pointing upwardly.

A detent system is connected to each rod **39**, whereby the latter and the associated cam control member **38** can be releasably set and retained in one of sad three aforementioned angular positions. In the embodiment illustrated, said detent system comprises an annular element **47** fixed to rod **39** for rotation therewith and provided with three notches or cavities (not shown) on the periphery of said annular element **47** angularly spaced to correspond to the said three angular positions of the cam control member. A member **48** is fixed to the inner surface of the front wall **1**, in closed and operative relationship adjacent the periphery of annular element **47**. A stud or bolt, not shown, projects from said member **48** towards the annular element **47** to engage into said notches or cavities when said stud or bolt aligns radially relative to said annular element **47**.

Before proceeding further, it is proper to state at this point that the generally triangular contour of the cam control members **38** is not essential and can be replaced by a variety of other geometrical contours having a different number flats and/or partly truncated apices defining a different number of control positions and of angular rest positions of the strikers **35**. For instance, sides *a*, *b*, and *c* instead of being rectilinear could be curved.

As stated earlier, the rest plank **37** and the adjacent platform **10** or **11** are coplanar; that is, the top surfaces of said elements are located in the same plane. When a cam control member **38** is positioned with the longest flat **43**, that is the flat nearer to the axis of rod **39** located upwardly, the surface of said flat **43** is adapted to lay lower than the plane determined by said top surfaces, whereby the corresponding striker **35** is allowed to rest on plank **37**, as best shown in FIGS. **2**, **4**, and **5**. The hinged end of each striker **35** is tapered at **49** to ensure that the striker **35** will contact rest shank **37** before contacting the end of the associated block **34**.

When the shortest flat **44**, that is the flat which is farther from the axis of rod **39** is located upwardly, the surface of said flat is adapted to lay slightly higher than said coplanar top surfaces in order to arrest the associated striker in a slightly inclined angular rest position. When, on the other hand, the partly truncated apex of the cam control member is directly upwardly, the associated striker **35** is rotated and held at a larger angle of rest.

The purpose of said three basically angular rest positions will be better understood later in connection with the operation of other elements of the metronome mechanism.

It will be readily seen from comparing FIGS. **11** and **12** that, depending whether the truncation is adjacent one face or the other of the cam control member **38**, there will be a slight difference in the angles of inclination of the corresponding strikers **35**.

Axles **12** and **13** are longitudinally disposed in parallel relationship with respect to rest planks **37**, such that there is one axle cooperatively associated with and adjacent each of said rest planks **37**.

A series of actuating arms **50** are fixedly attached on axles **12** and **13** such that each arm extends radially relative to said axles and angularly shifted relative to any other arm fixed on both axles. In the embodiment illustrated, the arms **50** are equally angularly shifted relative to one another in an helix fashion around each of axles **12** and **13** so that the entire series of arms form a full circle on the two shafts. Preferably, the series of arms are equally divided on axles **12** and **13** so that they extend through half a circle on each shaft. The reason for providing two shafts is to make the housing shorter. It is obvious that instead of using individual actuating arms **50**, a continuous screw-like web, or surface, may be used in cooperation with each axle to sequentially actuate the strikers **35**. The screw-like web or surface being coiled in helix form around each axle **12** or **13**.

Each actuating arm **50** is formed with a pointed end **51** extending at the leading edge of the arm **50** for a purpose which will be better defined in relation to the operation of the instrument. Any well-known expedient may be used to fixedly attach each actuating arm **50** to axle **12** or **13**. For instance, in the embodiment illustrated in FIG. **7**, the actuating arms **50** are provided with a hole allowing them to be inserted on the axles **12** and **13** and a screw **52** is used to fix the arms **50** for bodily rotation with its carrying axle **12** or **13**.

To operate the metronome mechanism, the constant speed motor **16** is energized, causing rotation of all the various pulleys, shafts and axles **12** and **13**. In order to select a desired rhythm, the knobs **42** on the front wall of the instrument housing are individually and manually set at the position corresponding to the required setting of the associated cam control member **38** and striker **35**. When so set, some strikers **35** are laying on the rest planks **37**, some are resting on flats **44** and the others are supported by the partially truncated apices. When a striker **35** is laying on rest plank **37**, the free end thereof projects in the path of travel of its corresponding actuating arm **50**, whereby, as can be seen in FIG. **4**, said striker **35** will be lifted upwardly until the pointed end **51** clears the latter, which then falls under gravity and slams the rest plank **37**. When a striker **35** is resting on a flat **44**, it is held slightly inclined but not sufficiently to clear the path of rotation of its corresponding actuating arm **50**, whereby said striker **35** is lifted upwardly a short angular distance until the pointed end **51** clears said striker **35** which immediately falls back on flat **44**.

The fall of the strikers **35** normally resting on flats **44** will be more gentle than the fall of the strikers normally resting on rest planks **37**, thereby resulting in the production of soft sounds. The strikers **35** which are resting on the partly truncated apices are at such an angle that they will be out of the path of travel of their corresponding actuating arms **50** and, therefore, will not be actuated by the arms and will not produce any sound.

From the preceding explanation of the operation of the metronome mechanism, it can be realized that any striker **35** may be set to produce no sound, a soft sound or a louder sound. One can therefore see that a large number of different rhythm arrangements can be produced by sequentially blending at will the combinations of "silences," "softs" and "louds."

In order to amplify the sound and/or to reproduce it at a remote location, an electronic amplification and reproduction system is provided. The electronic amplification system proposed is adapted for stereophonic reproduction and comprises two microphones **53** mounted at spaced-apart locations within the housing of the instrument. The microphones **53** are connected to the input circuit of a stereo amplifier **54**, whose dual outputs are connected to suitable loudspeakers **55**. As is well-known in the art of stereophonic reproduction, the amplifier **54** is provided with manual controls to adjust the outputs of the amplifier.

The motor **16** is switched on and off by means of a switch **56** suitably disposed on the housing of the instrument, such as on the front wall **1**, as shown in FIG. **1**.

Although a specific embodiment of the invention has been illustrated and described, it will be understood that various alterations in the details of construction may be made without departing from the scope of the invention. For example, a different number of strikers can be used, assembled in any number of rows or series. In the embodiment illustrated, **16** strikers are shown in each of two rows for one full 360° cycle of rotation of the axles **12** and **13**.

It is obvious that if more strikers are included in one 360° cycle of rotation, the metronome will be able to produce a richer and more complex rhythm. The speed of the motor and/or of the axles **12** and **13** could be varied to change the tempo.

I claim:

1. A rhythm-producing instrument comprising a plurality of independently operable strikers, control means to set anyone or any number of said strikers in operative position, actuating means extending opposite each striker and adapted, when all the strikers are set in operative position, to engage all the strikers in succession at equal time intervals to cause all the

strikers to successively strike adjoining members to produce a constant rhythm of maximum frequency, a nonconstant rhythm or a slower frequency constant rhythm being produced when said control means allow some of said strikers to remain in inoperative position.

2. A rhythm-producing instrument as claimed in claim 1, wherein said strikers are arranged side-by-side in a row and said actuating means include a rotatably mounted shaft extending along said row of strikers, power means to rotate said shaft at uniform speed and a plurality of arms secured to said shaft, each opposite a striker, each arm extending radially from the shaft in progressively and equally shifted angular positions, all the arms extending through a full circle around said shaft.

3. A rhythm-producing instrument as claimed in claim 2, wherein said control means comprises one cam control member for each of the strikers and operatively associated therewith to selectively vary the rest position thereof, each cam control member being provided with a limited number of determining positions defining a similar number of striker rest positions, and further including a rest plank, said rest plank and said cam control members underlying said strikers and constituting said adjoining members which are sequentially struck by the operative strikers.

4. A rhythm rhythm-producing instrument as claimed in claim 3, wherein each striker is pivotally connected at one edge to a supporting structure such as to project in the field of action of said actuating arms when set in the operative position, said actuating arms lifting the strikers set in operative position and allowing them to fall and strike either said rest plank or said cam control member.

5. A rhythm-producing instrument as claimed in claim 4, wherein each of said cam control members is fixedly mounted on an actuating rod and a manual control knob is fixed at one end of said rod for bodily rotation of said rod with the associated cam control member.

6. A rhythm-producing instrument comprising a plurality of strikers, control means adapted to set the desired number of said strikers in operative position, actuating means adapted to sequentially operate the strikers set in the operative position to cause them to successively strike adjoining members, such as to produce a rhythm arrangement, each striker being pivotally connected at one edge to a supporting structure such as to project in the field of action of said actuating means when set in the operative position, said actuating means being rotatably mounted adjacent said strikers and being adapted, when actuated, to lift the strikers set in operative position and to drop them to cause the same to fall and strike said adjoining members, said control means comprising one cam control member for each of the strikers and operatively associated therewith to selectively vary the rest position thereof, each cam control member being provided with a limited number of determining positions defining a similar number of striker rest positions, and wherein a rest plank and said cam control members are underlying said strikers and constitute said adjoining members which are sequentially struck by the operative strikers.

7. A rhythm-producing metronome as defined in claim 6, wherein said strikers form elongated rectilinear members pivotally connected at one end to a longitudinal platform forming part of said supporting structure, said strikers being serially arranged parallel to each other with the free ends thereof projecting outwardly from one side of said platform.

8. A rhythm-producing metronome as claimed in claim 7, wherein the actuating means comprises an axle mounted in spaced-apart parallel relationship relative to said elongated platform along said one side thereof, and an helix assembly disposed around said elongated axle for bodily movement therewith, such that rotation of said axle and helix assembly will cause said helix to sequentially operate the strikers set in the operative position.

9. A rhythm-producing metronome as claimed in claim 8, wherein said rest plank extends longitudinally in the space between said one side of the platform and the axle and helix assembly in coplanar relationship with said platform.

10. A rhythm-producing metronome as claimed in claim 9, wherein each of said cam control members is fixedly mounted on an actuating rod and a manual control knob is fixed at one end of said rod for bodily rotation of said rod with the associated cam control member.

11. A rhythm-producing metronome as claimed in claim 10, wherein said helix assembly comprises a series of actuating arms, one for each striker, fixed along said axle and extending radially therefrom in progressively and equally shifted angular positions, one relative to another.

12. A rhythm-producing metronome as claimed in claim 11, comprising a second platform and a second axle and helix assembly, strikers and cam control members cooperatively associated with said second platform and second axle and helix assembly and a chain drive between said axles adapted to synchronously drive one axle with regard to the other, the two helix assemblies extending through a full circle.

13. A rhythm-producing metronome as claimed in claim 12, comprising an electric motor and belts and pulleys adapted to transmit the rotation of said motor to said two axles.