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(54) **PERCUSSION INSTRUMENT FOR GAMES  
WITH A PERCUSSIVELY OR  
IMPACT-MOVED PLAY BODY**

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### ABSTRACT

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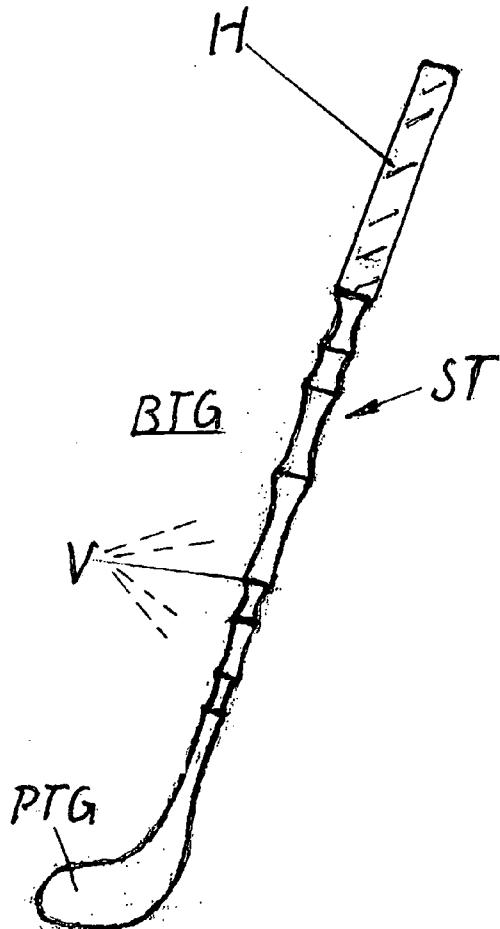
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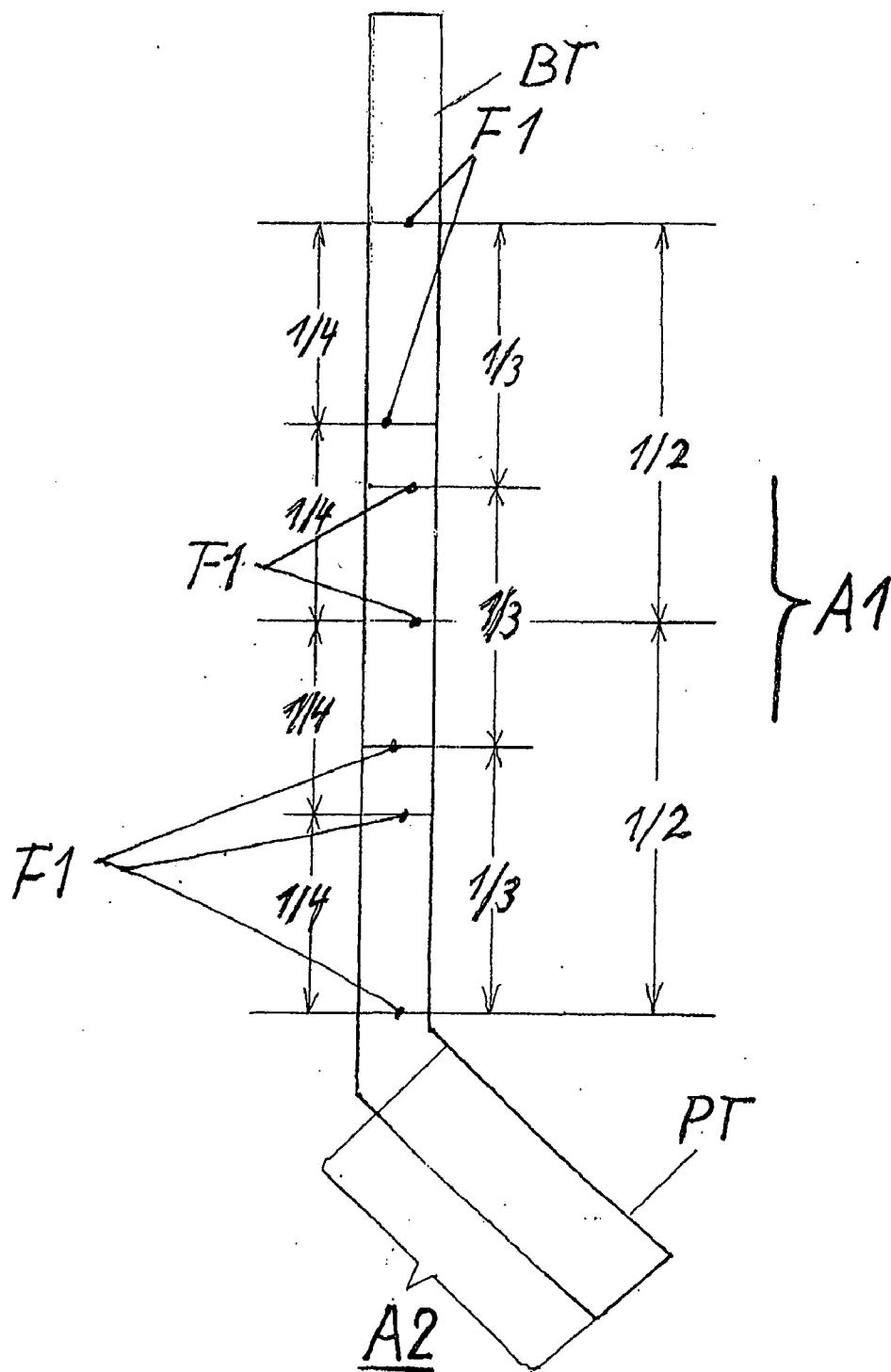
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#### Publication Classification

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The invention relates to a percussion instrument for games with percussively or impact-moved play body. According to the invention, the percussion instrument comprises an actuating part (BT) and an impact section (PT) embodied at least partially as a dimensionally stable solid body interacting with the play body in a directly dynamic manner. A plurality of excellent spatial areas and/or flat areas and/or linear areas are provided in order to enable a structure to be made, said structure having an improved adaptation to the vibrational behaviour to the events involved in the playing actions and the requirements and particularities of the player. Said areas are distinguished by means of at least one vibration-relevant material parameter, especially one resonance-relevant material parameter and/or form or measuring parameter, especially differing mass, density, resistance to deformability and/or damping of at least one part of the respective environment, forming a sequence extending over at least one part of the percussion instrument corresponding to at least one arranged sequence.





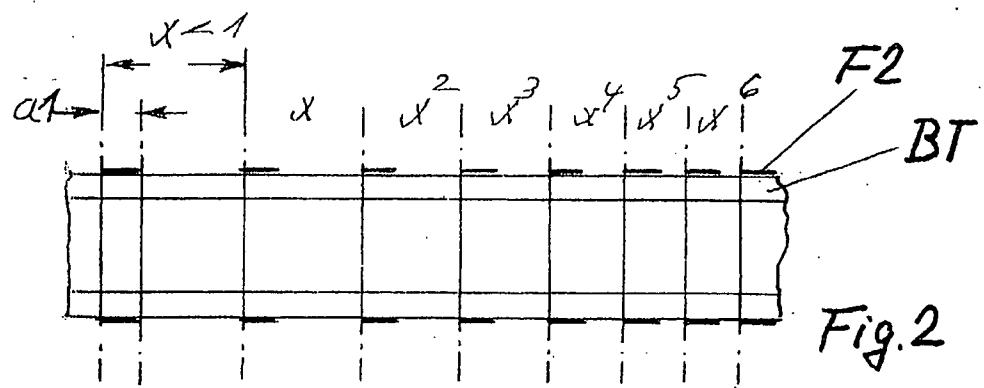


Fig. 2

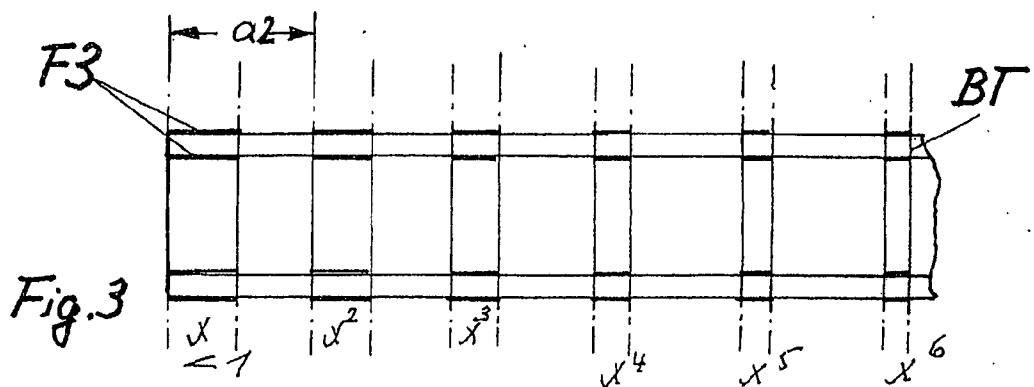


Fig. 3

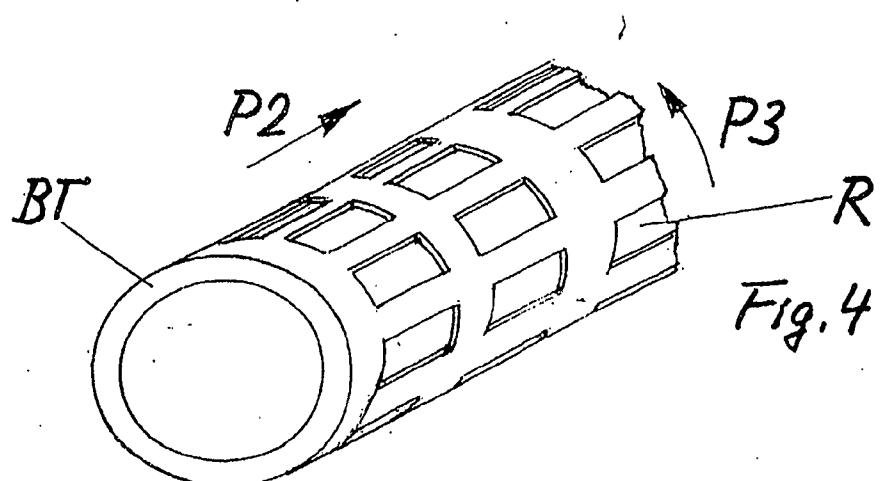
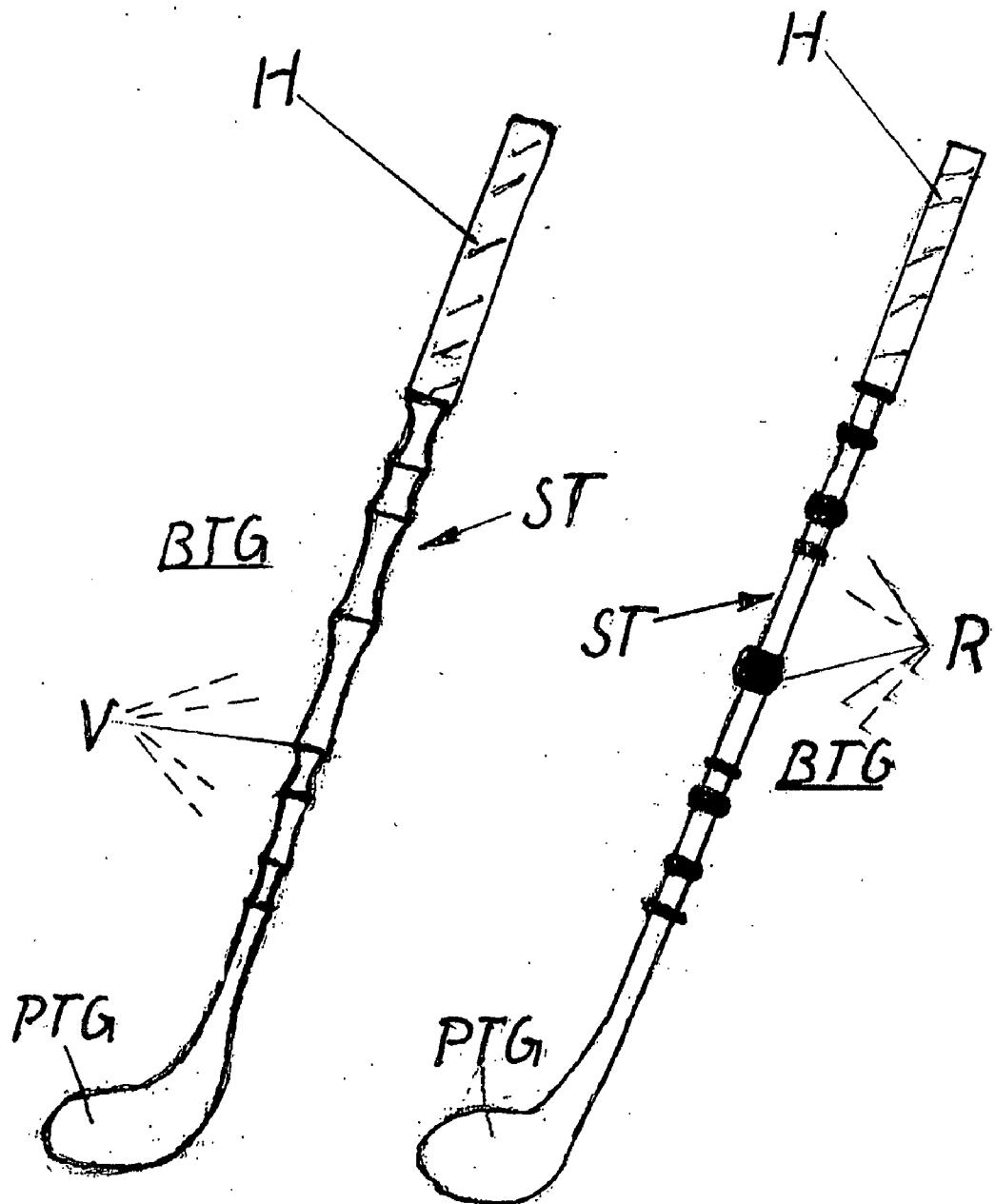
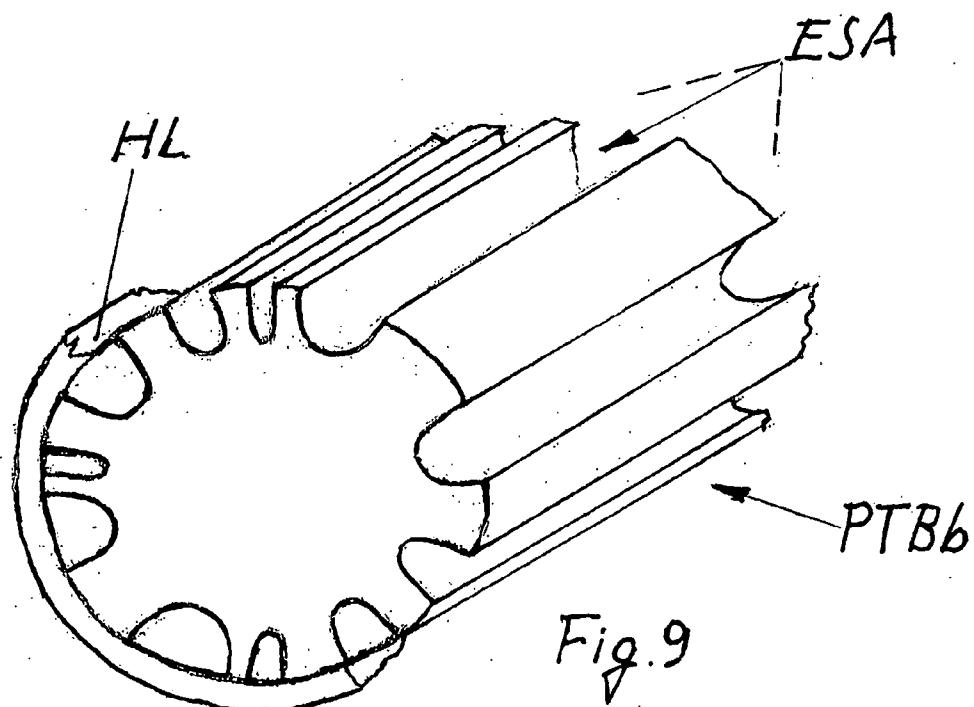
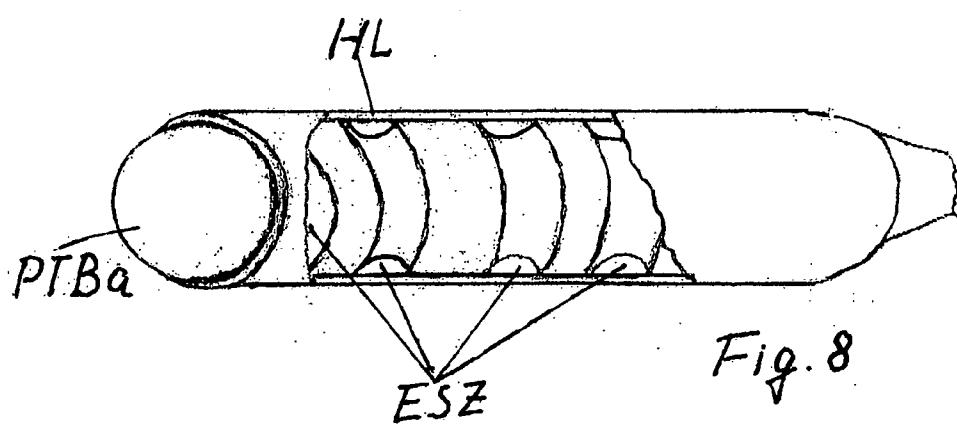
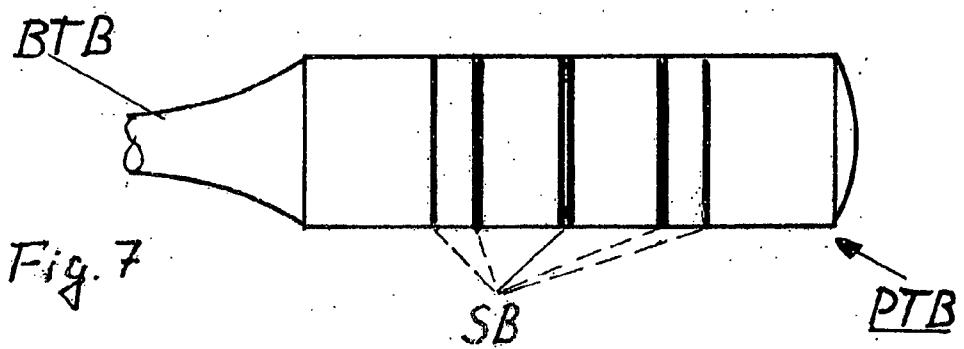


Fig. 4





**PERCUSSION INSTRUMENT FOR GAMES WITH A PERCUSSIVELY OR IMPACT-MOVED PLAY BODY**

**[0001]** The invention relates to an impacting instrument for games with a playing object moved in an impacting or intermittent manner. These games include, among others, hockey, golf and baseball.

**[0002]** The impacting instrument includes an actuation part, which is also referred to, in brief, as "stick", with a short extension part, called a "shaft", as well as a handle and an impact part, for example, in the form of a blade or a club, entering into direct, dynamic operative connection with the playing object. Various constructions of instruments of this type, also known as bats, clubs or rackets, are on the market and generally known. The impact part is subjected directly to a strong, dynamic stress by the play body, which strikes it at high speed. The dynamic stress is composed essentially of pulse-like impact forces with very steep flanks, which are transferred to the stick and, with that, also to the handle. The stick and the impact part are constructions, which are able to vibrate and, due to the frequencies contained in the pulse flanks, can be excited to oscillate at their characteristic vibrations. Because of the existing coupling, the vibrations are also transferred to the actuating part, especially the handle and, with that, also to the hand and/or the arm of the player.

**[0003]** Depending on their frequency and amplitude, such vibrations have an appreciable potential for interfering with the playing process, for instance, with regard to the differentiated and sensitive dosing of the hardness of the shot or of the return speed desired by the player, as well as with regard to the precise determination of the return direction. Last, but not least, physically damaging effects may also arise therefrom for the player. In this connection, summary and/or roughly dimensioned damping measures have proven to be not very effective or unsatisfactory since, in general, the necessary reflection capabilities of the racket are also affected thereby, as is, in general, also the stroke as sensed by the player.

**[0004]** It is therefore an object of the invention to create a construction, which makes possible a better adaptation of the vibrational behavior to the circumstances of the playing processes and the requirements and peculiar features of the player. The inventive solution of this objective is determined by the distinguishing features of claim 1. Distinguishing features of further significant developments and optimizations of the invention are defined in the claims that follow.

**[0005]** The mode of action of the distinguishing features of the construction of claim 1 depends, among other things, on the effect of the characteristic vibration spectrum of the impacting instrument as a whole. A first step in this connection is the making available of a plurality of singular three-dimensional and/or two-dimensional and/or one-dimensional regions, which differ due to vibrationally relevant, especially resonance relevant, material and/or shape and dimensional parameters of their respective surroundings. Moreover, in practice, as large a number as possible of such singular regions is to be aimed for. These singular regions are then to be arranged in the form of at least one sequence, which extends over at least a portion of the impacting instrument and corresponds to at least one ordered sequence, especially to a mathematically or also an algo-

rithmically determinable series. In practice, comparatively large numbers of sequences, which are to be arranged on the impacting instrument, once again come into consideration here.

**[0006]** Since the singular regions, with their mutual distances and, with that, also with the sequences, are disposed at or in the impacting instrument, the latter represent subdivisions of the vibrating body. In relation to the original, that is, not subdivided vibrating body, this leads to additional and, moreover, in general, higher characteristic vibrations and also to an elevation in the original characteristic vibrations, that is, to a correspondingly changed characteristic vibration spectrum. At the same time, the characteristic vibration density and its distribution over the frequency band in question can be modified and adapted or optimized in various ways in accordance with the given functional requirements by different configurational measures involving the construction and the dimensions as well as the selection of the material of the singular regions and the sequences.

**[0007]** During the impingement with an impact, the energy of which is distributed over a broad frequency range as a result of its flanks, which have become steep in the course of time, the characteristic vibrations of the changed impacting instrument are stimulated with correspondingly higher frequency distribution in accordance with the now given spectrum, which has a point of concentration, which lies generally at higher frequencies. However, since the amplitude of the vibrations at a given vibrational energy decreases as the frequency increases, the vibrational amplitudes, at any rate, in general, are decreased as a result of the organization of the vibrating bodies with the sequences of the singular regions. However, since it is especially the vibrational amplitudes, which are perceived by the player and can affect the playing quality, the basic inventive construction is suitable for accomplishing the object of the invention.

**[0008]** The mode of action and the advantages of the invention and of the distinguishing features of its essential further developments are explained in greater detail by means of the examples, which are shown diagrammatically in the drawings, of which

**[0009]** FIG. 1 shows a first embodiment of an inattentive impacting instrument with a plan view of the impact part,

**[0010]** FIG. 2 shows a partially longitudinal section of a tubular handle with an external sequence of singular regions,

**[0011]** FIG. 3 shows a partially longitudinal section of a tubular handle with an external and an internal sequence of singular regions and

**[0012]** FIG. 4 shows a partial perspective view of a handle with an organization of sequences of singular regions, extending multidimensionally,

**[0013]** FIG. 5 shows a hockey stick, the shaft part of which has thickenings, which, in the longitudinal direction of the shaft, are disposed in sequence with respect to their axial distances from one another as well as their axial width and/or their radial thickness,

**[0014]** FIG. 6 shows a hockey stick, the shaft of which has an arrangement of ring-like thickenings, similar to those of

**FIG. 5**, which are constructed in each case concentrated on the regions extending in the longitudinal direction of the shaft,

**[0015]** **FIG. 7** shows a baseball bat, the impact part of which, which is constructed, for example, cylindrically here, has ring-like singular regions, which are disposed consecutively in the longitudinal direction of the cylinder with varying distances from one another and also have varying axial and/or radial dimensions,

**[0016]** **FIG. 8** shows a variation of an embodiment of a baseball bat of **FIG. 7**, for which the singular regions are constructed as circular depressions at the periphery of the impact part and are covered by a cylindrical enveloping element and

**[0017]** **FIG. 9** shows a further variation of an embodiment of a baseball bat, for which the singular regions are constructed as axial depressions at the periphery of the impact part and are covered once again by a cylindrical enveloping element.

**[0018]** The impacting instrument, shown as example in **FIG. 1**, comprises an actuating part BT and an impact part PT, entering into direct dynamic operative connection with the playing object, such as a puck in ice hockey or a ball in lawn or roller hockey. The parts are provided with organizations, which affect the characteristic vibration spectrum and consist of a sequence of a plurality of singular three-dimensional, two-dimensional and one-dimensional regions. These singular regions are determined owing to the fact that they differ from at least a part of their respective surroundings by at least one material and/or shape or dimensional parameter of relevance to vibration and especially to resonance and especially by a different mass, mass density, deformation stiffness and/or damping. Within these sequences, the singular regions in each case form an ordered series, which extends at least over a portion of the impacting instrument.

**[0019]** In the example, a first sequence A1 with singular regions or vibrational elements F1 extends in the longitudinal direction of the actuating part BT.

**[0020]** The vibration elements are constructed here, for example, as sections of a layer, which contain metal and therefore are weight-loaded more heavily than their surroundings, and which are applied by screen-printing.

**[0021]** The characteristics of the sequence A1 are determined by the superimposition of a plurality of singular regions or vibrational elements F1, which, in each case, are in series that are equally spaced apart. These distances vary from series to series and are determined by a whole-number subdivision of a specified section of the length of the actuating part and, moreover, in the sense of a variance of the mutual intervals between the singular regions corresponding to a harmonic series with relative interval amounts  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$ , indicated in **FIG. 1** and related in each case to the whole of the length of the section of the actuating part. For the sake of clarity, the representation of the superimpositions in **FIG. 1** has been omitted after these three first series. Actually, such organizations are continued very much further and up to relatively fine subdivisions. Correspondingly smaller dimensions of the singular regions or of an additional variance of the surface dimensions region are then required for this purpose.

**[0022]** The impact part PT also comprises an actively vibrating organization A2 with singular regions and, moreover, once again in the form of a plurality of superimposed sequences, in each case equidistant from one another. This organization may be constructed as in the case of the actuating part and is indicated only summarily in **FIG. 1**.

**[0023]** In this connection, it should be pointed out that not only progressively or degressively varying graduations or series can be realized with such superimpositions, but also oscillatorically varying graduations or series. In the example of **FIG. 1**, the varying quantities are given by distances between singular regions. Accordingly, for this small number of superimpositions or sequences, two interval minima between the singular regions of the  $\frac{1}{3}$  series and the  $\frac{1}{4}$  series, with reversal between progressivity and degressivity, can already be recognized. However, within the scope of the inventive concept, an oscillatory variance can also be realized possibly with advantage without or with only insignificant or slight superimpositions by directly dimensioning vibration parameters and configuring series.

**[0024]** Quite generally, other vibration parameters, such as material and/or shape or dimension parameters, especially different weights, mass densities, deformation stiffness and/or damping also come into consideration as intervals between singular regions. However, the use of variances in this respect, optionally of constants or of appropriate combinations, at least in one part of at least one sequence, in such a way, that an actively vibrating organization with a plurality of characteristic vibrations results, is important. In this connection, sequences, constructed at least sectionally and at least approximately according to harmonic, but also according to geometric series and extending over five divisions, especially a plurality of such actively vibrating, organized sequences in mutual superimposition, are of special importance. For important applications, sequences extending at least over five divisions, especially a plurality of such actively vibrating, organized sequences in mutual superimposition, have proven to be appropriate or even necessary.

**[0025]** **FIG. 2** shows an example of a regional sequence in tubular handles, varying in accordance with a geometric series. Two-dimensional, ring-like vibrational elements or singular regions F2, for example, of a metal-containing film or similar screen-printed layers, are disposed here in the longitudinal direction of the tube with mutual intervals at the outside of the tube. The elements F2 have the same width  $a_1$ , whereas their intervals are dimensioned in accordance with a degressive geometric series  $x, x^2, x^3 \dots (x < 1)$ .

**[0026]** **FIG. 3** once again shows the use of a geometric series, however with constant intervals  $a_2$  between the vibrational elements or singular regions F3, which follow one another in the longitudinal direction of the tube and the widths  $a_2$  of which, however, are now dimensioned in accordance with a degressively geometric series  $x, x^2, x^3 \dots (x < 1)$ . In the example, such elements are disposed not only at the outside of the tube, but also at the surface of the inner cavity in quite an appropriate manner.

**[0027]** **FIG. 4** shows, once again at a tubular actuating part BT, vibrational elements R, which determine singular regions with a spatial extent. In the example, these vibrational elements or singular regions are to be understood as countersunk intercalations, perhaps of a material with a comparatively high mass density, in the wall of the outer surface of the actuating part BT.

**[0028]** The vibrational elements are provided in two multidimensional, essentially orthogonal sequences, namely, in accordance with arrow P2, in the axial direction of the tube and, in accordance with arrow P3, in the peripheral direction of the tube. This signifies an important difference from the superimpositions of **FIG. 1**, which are disposed in each case in one direction. This variant makes possible a differentiated, optionally accordant effect on waves progressing in the longitudinal direction and circumferential direction of the tube and of standing waves extending in these directions.

**[0029]** In the case of the golf club of **FIG. 5**, an actuating part BTG, consisting of a shaft ST and a handle H, as well as a club-like impact part PTG, are indicated. In the longitudinal direction with respect to their mutual axial intervals as well as their axial width and/or their radial thickness, the shaft has thickenings V, which are disposed in sequence. The latter act as singular regions or vibrational elements in the sense of the invention. It is a question here of a repeatedly superimposed structure in the above described sense with equidistant series structures, their respective equal distances as a whole forming a harmonic series or several such series. This is also the case for the golf club of **FIG. 6**, the shaft ST of which once again has an arrangement of ring-like thickenings R, which are constructed, however, as discrete annular bodies and, accordingly, are concentrated in the axial regions extending in the longitudinal direction of the shaft.

**[0030]** The baseball bat, given as an example in **FIG. 7**, has a stick-shaped actuating part BTB, as well as an essentially cylindrical constructed impact part PTB with ring-like singular regions or vibrational elements SB, which are disposed consecutively in the longitudinal direction of the cylinder with varying mutual distances from one another and also have varying axial or radial dimensions. The optionally approximately cylindrical outer surface of the intact part is in any case maintained smooth, which can be achieved by an appropriate configuration of the outer surface of the ring-like vibrational elements. These annular bodies can be produced, for example, divided or severed only on one side and then inserted in and snapped into appropriate annular grooves of the impact part. In the case of plastic impact elements, a positive embedding and, moreover, covering by an external, hollow cylindrical enveloping element also come into consideration. In view of the generally comparatively large mass of baseball bats, the material of the vibrational elements preferably has a relatively large mass density.

**[0031]** In the case of the variation of a baseball bat of **FIG. 7**, the singular regions are constructed as circular depressions ESZ at the polyphony of an impact part PTBa and covered by a cylindrical sleeve HL. Between these depressions, singular regions or vibrational elements are formed, which represent, with regards to the mutual distances between them or their axial distance from one or both ends of the organization, an overlapping of a multitude of at least approximately equidistant sequences of these singular regions. With that, sensitive adaptations in accordance with different optimization requirements can be achieved.

**[0032]** The variation of a baseball bat of **FIG. 9** shows vibrational elements or singular regions, which are formed by depressions ESA extending at the periphery and in the axial direction of, for example, a cylindrical impact part and are covered once again by a cylindrical enveloping element HL. Here also, these vibrational elements overall represent

a superimposition of a plurality of at least approximately equidistant sequences of these singular regions, which extend here however in the peripheral direction of the impact part. With one such construction, clear optimizations can be achieved even with relatively short impact parts.

**[0033]** Furthermore, a combination or superimposition of the constructions of **FIGS. 8 and 9** also come into consideration. With that, with respect to a cylindrical section within the impact part or at the inside of the enveloping element, a plurality of radially protruding vibrational elements with an angular or also a rounded cross section, arises. This is a high vibrationally active or resonance-active arrangement of the characteristic frequency spectrum of the impact instrument.

1. Impacting instrument for games with a playing object moved in an impacting or intermittent manner, comprising an actuating part and an impact part, which enters into direct dynamic operative connection with the play object and is constructed at least partially as a stiff solid object, a plurality of singular three-dimensional and/or two-dimensional and/or one-dimensional regions, which differ from at least a part of their respective surroundings by at least one vibration-relevant, especially resonance relevant material parameter and/or shape parameter or dimension parameter, especially by a different mass, mass density, deformation stiffness and/or damping and form the at least one sequence, extending over at least one part of the impacting instrument and corresponding to at least one ordered series.

2. The impacting instrument of claim 1, wherein at least one sequence of singular regions is disposed at or in the impact part.

3. The impacting instrument of claim 1, wherein with an actuating part, constructed particularly as a handle, at least one sequence of singular regions is disposed at or in the actuating part

4. The impacting instrument of claim 1, wherein at least one sequence of singular regions is provided, which extends at a surface or in a part of the impacting instrument body near the surface.

5. The impacting instrument of claim 1, wherein at least one sequence of singular regions is provided, which extends within the volume of the solid body or in an inner space of the impacting instrument body.

6. The impacting instrument of claim 1, wherein at least one sequence is formed by extended, especially strip-like singular regions.

7. The impacting instrument of claim 1, wherein in at least one part of at least one sequence, the mutual edge distances and/or the distances between the centers of singular regions are dimensioned in such a manner in the sequential direction of the series, that a vibrationally active organization with a plurality of characteristic vibrations results.

8. The impacting instrument of claim 7, wherein in at least one part of at least one sequence, a variance, progressive and/or degressive with respect to the sequential direction, is provided with respect to the singular regions or their vibrationally-relevant parameters.

9. The impacting instrument of claim 7, wherein at least one sequence of singular regions, vibrationally varying at least sectionally, is provided.

10. The impacting instrument of claim 7, wherein at least one sequence of singular regions, varying at least sectionally

in accordance with a statistically varying series, which can be generated especially by a random generator, is provided.

**11.** The impacting instrument of claim 1, wherein at least one sequence of singular regions, formed at least sectionally and at least approximately according to a harmonic series, is provided.

**12.** The impacting instrument of claim 1, wherein at least one sequence of singular regions, formed at least sectionally and at least approximately according to a geometric series, is provided.

**13.** The impacting instrument of claim 1, wherein at least one vibrationally active organization, which contains at least one one-dimensionally, two-dimensionally or three-dimensionally extending superimposition structure of a majority, especially a plurality of different interval and/or subdivision and/or value sequences.

**14.** The impacting instrument of claim 13, wherein the superimposition structure contains at least two different, however at least approximately equally distant interval and/or subdivision and/or value sequences.

**15.** The impacting instrument of claim 13, wherein the value and/or the distribution of at least one vibrational parameter of the singular regions are dimensioned at least approximately equally within one of the mutually superimposed sequences.

**16.** The impacting instrument of claim 13, wherein the values and/or the distribution of at least one vibrational parameter of the consecutively following singular regions in each case are dimensioned within one of the mutually superimposed series at least approximately or at least sectionally according to at least one harmonic or at least one geometric series or according to a superimposition of such series.

**17.** The impacting instrument of claim 1, wherein at least one varying, especially harmonically or geometrically varying sequence of singular regions, extending multidimensionally or in a plurality of two-dimensionally or three-dimensionally directions, is provided.

**18.** The impacting instrument of claim 1, wherein at least one vibrationally active sequence of singular regions is provided, which extends at least over five divisions and preferably over a plurality of divisions.

**19.** The impacting instrument of claim 1, wherein at least one superimposition of at least two vibrationally active sequences of singular regions, especially a superimposition of a plurality of such vibrationally active sequences is provided.

**20.** The impacting instrument of claim 1, wherein at least one vibrationally active varying series of singular regions, disposed distributed along at least one edge of the impacting instrument body, is provided

**21.** The impacting instrument of claim 1, wherein at least one vibrationally active, organized surface layer or at least one layer section with a granulate, lacquer and/or film coating, especially with a metal content is provided.

**22.** The impacting instrument of claim 1, wherein the construction is a hockey stick.

**23.** The impacting instrument of claim 1, wherein the construction is a golf club.

**24.** The impacting instrument of claim 1, wherein the construction is a baseball bat.

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