Aug. 25, 1953 M. MACCAFERRI 2,649,828

FRETTED FINGER BOARD FOR STRINGED MUSICAL INSTRUMENTS AND METHOD OF MAKING THE SAME

Filed July 3, 1950 5 Sheets-Sheet 1

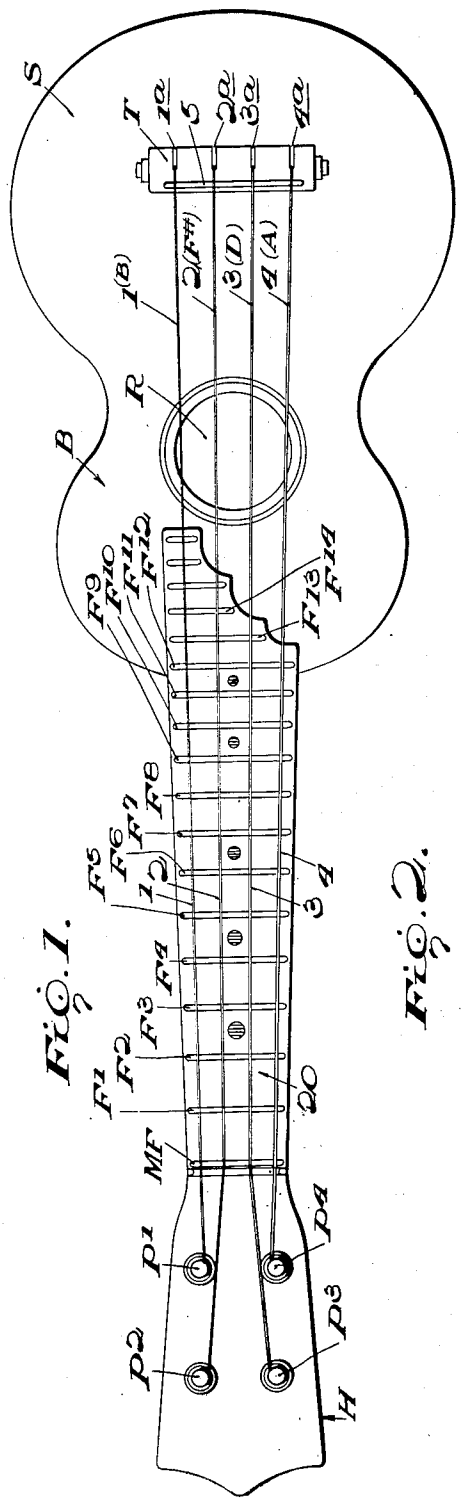


FIG. 1.

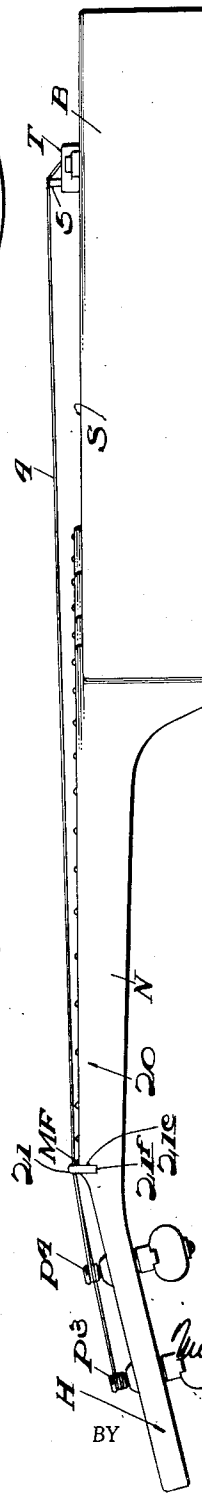


FIG. 2.

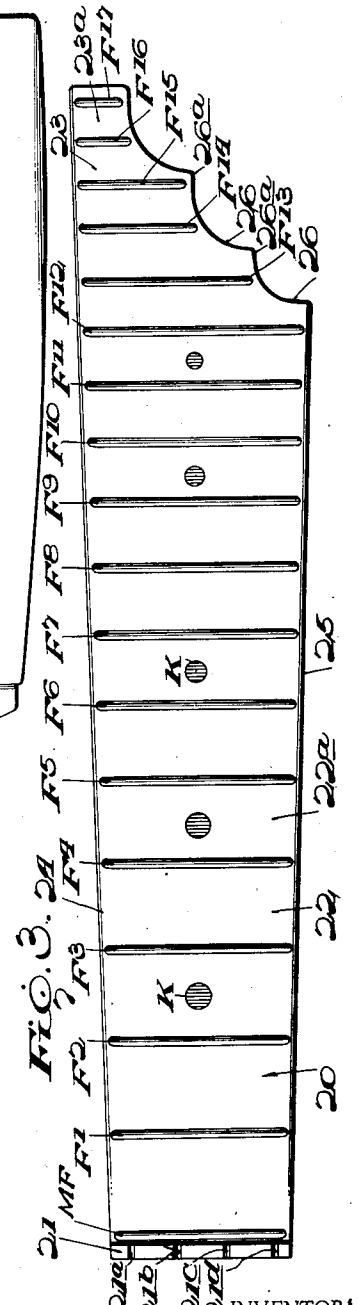


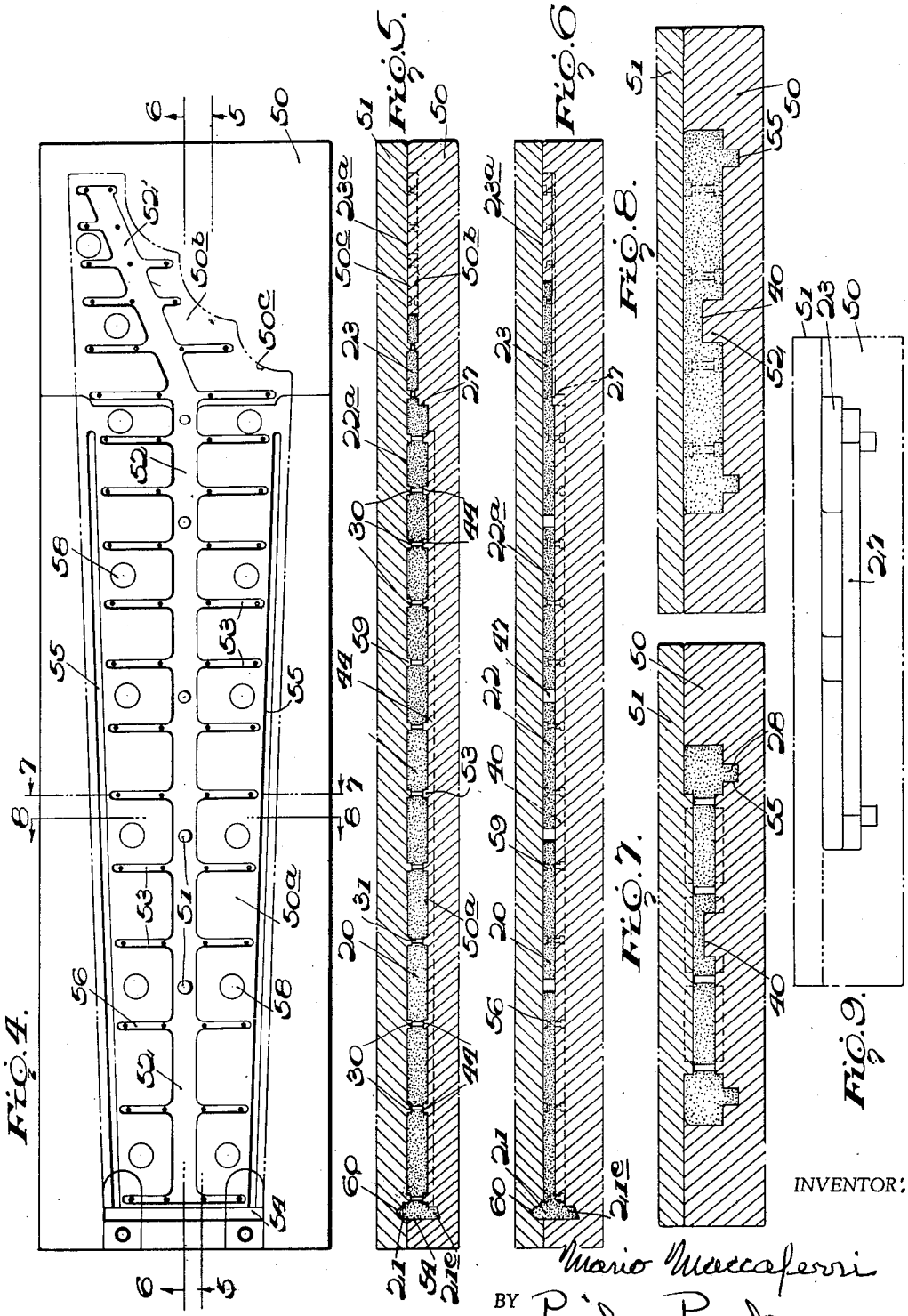
FIG. 3.

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FRETTED FINGER BOARD FOR STRINGED MUSICAL INSTRUMENTS AND METHOD OF MAKING THE SAME

Filed July 3, 1950 5 Sheets-Sheet 2



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FRETTED FINGER BOARD FOR STRINGED MUSICAL INSTRUMENTS AND METHOD OF MAKING THE SAME

Filed July 3, 1950 5 Sheets-Sheet 3

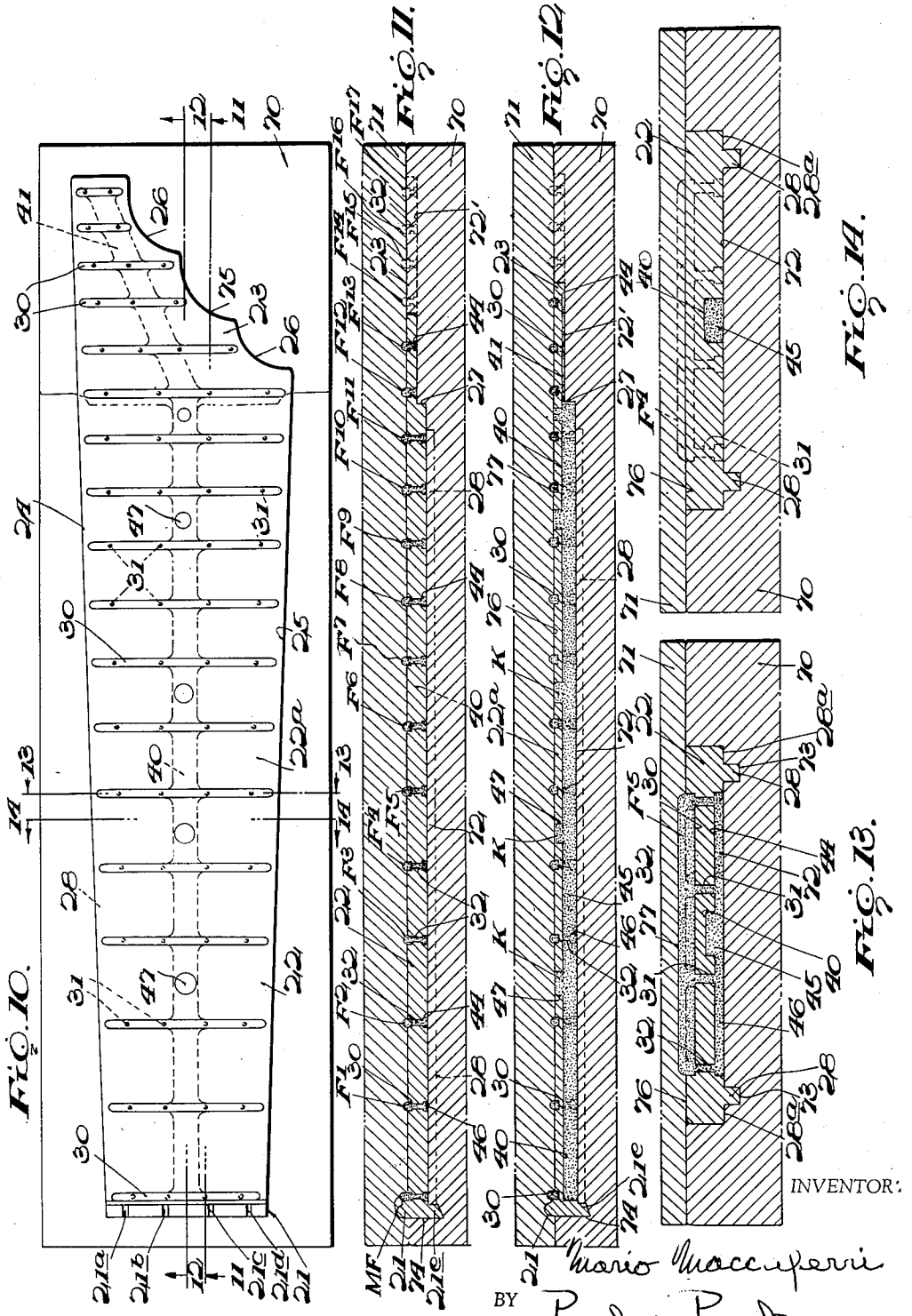


FIG. 10.

FIG. 11.

FIG. 12.

FIG. 14.

FIG. 13.

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FRETTED FINGER BOARD FOR STRINGED MUSICAL INSTRUMENTS AND METHOD OF MAKING THE SAME

Filed July 3, 1950 5 Sheets-Sheet 4

Fig. 15.

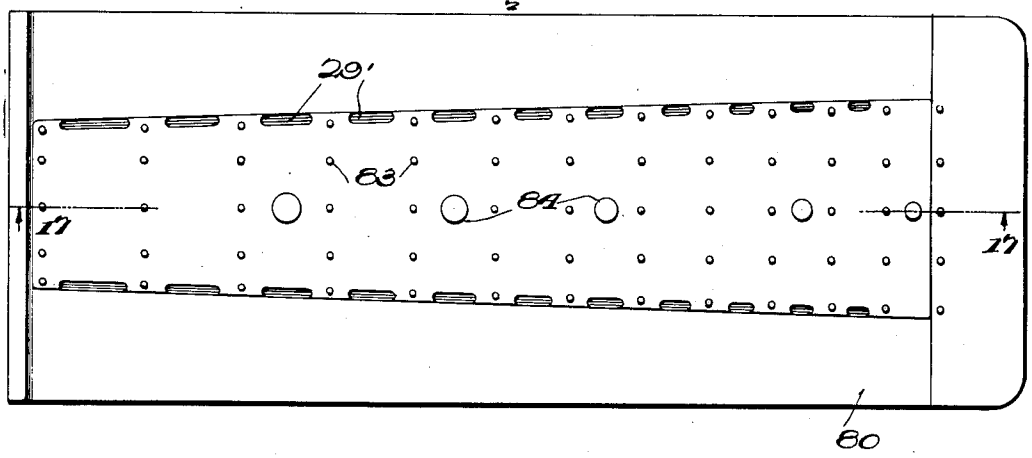


Fig. 16.

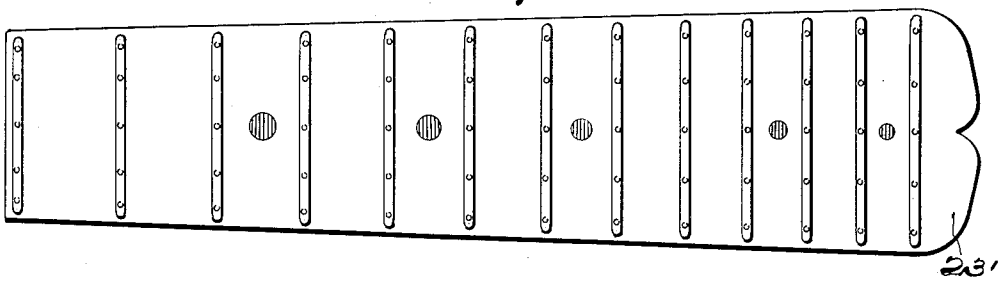
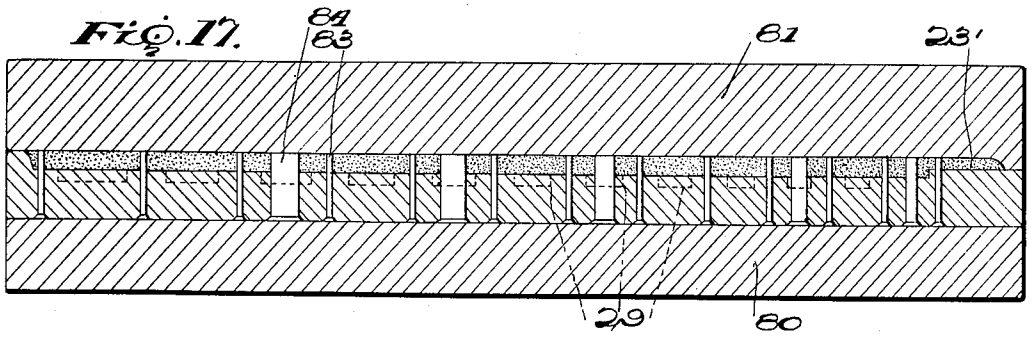


Fig. 17.



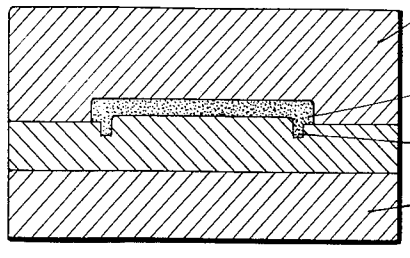


Fig. 18.

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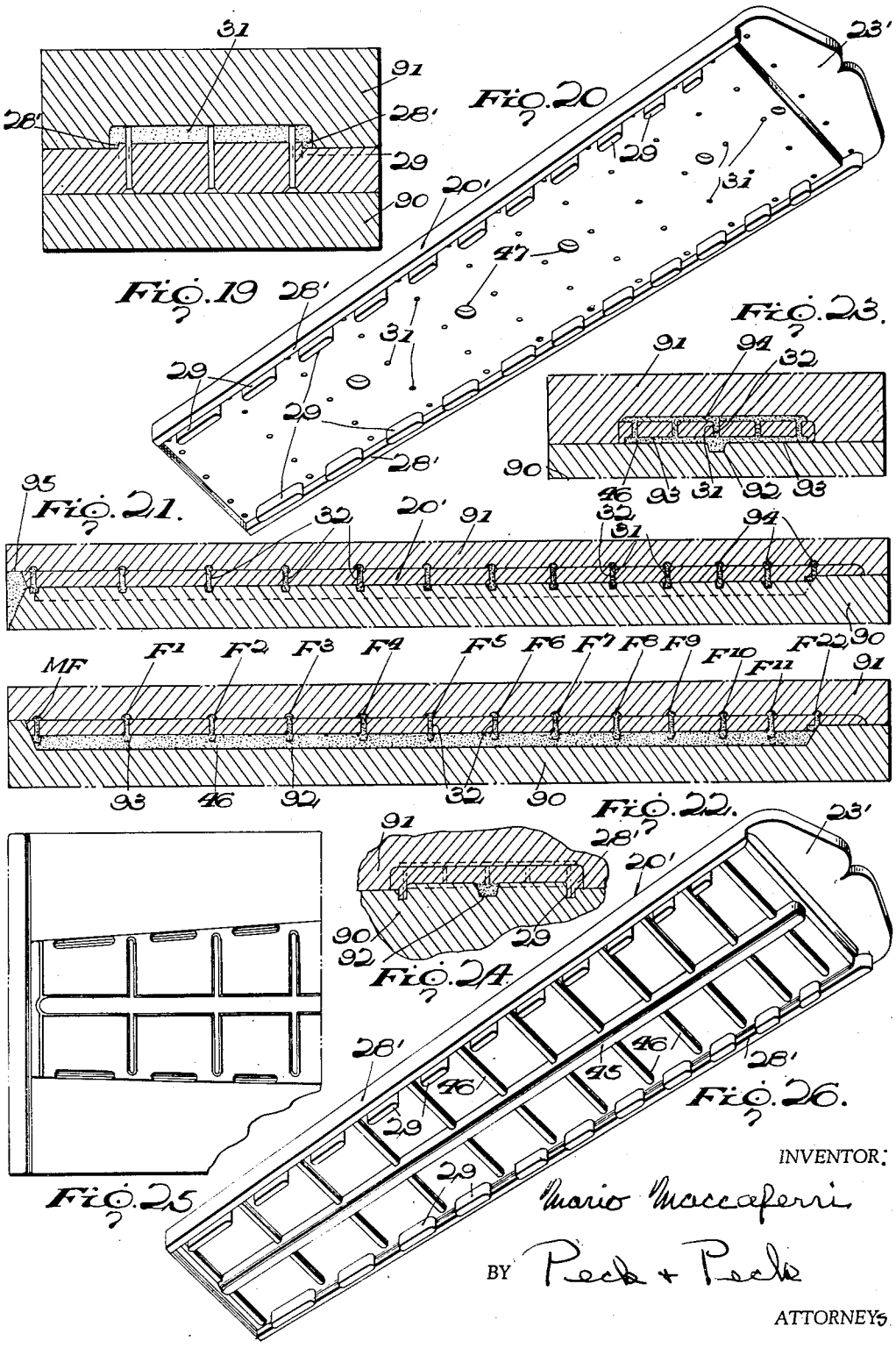
BY Pierce & Pierce

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FRETTED FINGER BOARD FOR STRINGED MUSICAL INSTRUMENTS AND METHOD OF MAKING THE SAME

Filed July 3, 1950 5 Sheets-Sheet 5



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Patented Aug. 25, 1953

2,649,828

UNITED STATES PATENT OFFICE

2,649,828

FRETTED FINGER BOARD FOR STRINGED MUSICAL INSTRUMENTS AND METHOD OF MAKING THE SAME

Mario Maccaferri, Rye, N. Y.

Application July 3, 1950, Serial No. 179,111

12 Claims. (Cl. 84—314)

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My present invention relates to certain improvements in fretted finger boards for stringed musical instruments, and the nature and objects of the invention will be readily understood and recognized by those skilled in the several arts involved in the light of the following explanation and detailed description of the accompanying drawings illustrating what I at present consider to be the preferred embodiments of finger boards, and the preferred steps and sequences thereof constituting the method of the invention, from among other forms, expressions, embodiments, modifications, designs, constructions and combinations of finger board, as well as other steps and sequences thereof for carrying out the method, of which the invention is capable within the broad spirit and scope thereof as defined by the appended claims.

This application constitutes a continuation-in-part of my application Serial No. 149,741, filed March 15, 1950, now Patent No. 2,597,154, dated May 20, 1952, for Improvements in Stringed Musical Instruments.

The invention is concerned generally with various types and forms of stringed musical instruments characterized by a resonant body or bell having a sounding board, with a fretted finger board carried by a neck extended from one end of the body, and vibratory strings secured between tuning pegs or keys at the other end of the finger board and a bridge on the body, the strings being located in positions extended over and along the finger board. In playing such types of stringed musical instruments, each string is capable of producing when vibrated any one of a series of notes within a range as determined by the particular string and the number and spacing of the frets of the finger board therebeneath, through so-called "stopping" of a string. The player carries out such "stopping" by pressing the string against the finger board by placing a finger on the string in position at the rear side of the proper fret to cause the string when so "stopped," to produce when vibrated the desired note of the series of notes capable of production from such string. The strings on such an instrument when "unstopped" or open are completely out of contact with the series of frets of the finger board between the string divider at the outer end of the finger board and the bridge on the body to which the strings are attached. Hence, for any given string of predetermined note producing characteristics in a given instrument, the construction and formation and the spacing of the frets relative to each other

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and with respect to the length of the string between its points of constant contact at the string divider and the bridge are critical factors which determine the precision of note production and the resulting musical efficiency and perfection of the instrument.

It is to the improvement of the design, arrangement and construction and of the functional and musical efficiency of the fretted finger boards for such types of stringed musical instruments that my present invention is primarily directed.

One of the main objects of the invention is to increase the efficiency and accuracy with which a player may execute the finger "stopping" of the strings on a fretted finger board, and to enable the attainment from such stopping, of precision in the pitch, tone and timbre of the notes produced from the vibration of the stopped strings, through a design and construction of the fretted finger board and by a precision of spacing of the frets relative to the board, to each other and to the effective over-all length of the strings. A further object is to provide a novel and efficient system of fret spacing for such fretted finger boards. Another object is to provide a fretted finger board in which both the body or base board and the frets thereon are formed of molded thermoplastic materials.

Another object is to provide such an all-plastic, fretted finger board in which the frets are formed of molded thermoplastic material of a color contrasting with the color of the board or body.

Another object is to provide such an all plastic finger board in which the molded thermoplastic material from which the frets are formed has certain different characteristics from the thermoplastic material from which the board or body is formed.

Another object is to provide such an all-plastic fretted finger board in which the frets are formed of a molded thermoplastic material having certain metallic characteristics and simulating a metal in appearance.

A further object is to provide a fretted finger board provided at its inner or body end with a novel design and construction of fret carrying extension to thereby increase the note range of at least certain of the strings of the instrument in which such a board is embodied.

A further object is to provide an improved design and construction of the so-called "nut" or string divider at the outer end of a fretted finger board and of a master fret constituting the first of the series of frets of the board and

engaging and supporting from the string divider the strings of the instrument.

And a further object is to provide a novel bonding and strengthening arrangement for securing the frets to and on the body of the board when either completely overmolded on the outer face of the board or partially inlaid or inset therein, so that the frets become in effect one part with the body of the board.

With the foregoing general objects, features and results in view, as well as certain others which will be readily recognized by those skilled in the art from the following detailed description and explanation, my invention consists in certain novel features in design, construction, materials and arrangements of parts and in combination thereof, as well as in the novel steps and sequences constituting the method of the invention, all as will be more fully and particularly hereinafter referred to and described.

Referring to the accompanying drawings, in which similar reference characters refer to corresponding parts and elements throughout the several figures thereof:

Fig. 1 is a view in top plan of a stringed instrument of the ukulele type having a finger board of my invention embodied therein.

Fig. 2 is a view in side elevation of the ukulele instrument of Fig. 1.

Fig. 3 is an enlarged view in top plan of the complete finger board removed from the instrument of Figs. 1 and 2.

Fig. 4 is a plan view, more or less schematic, of the mold cavity of one of the mold sections of an injection mold for forming the base or bar constituting the body of the finger board of Fig. 3.

Fig. 5 is a longitudinal section taken as on the line 5—5 of Fig. 4, through the complete mold in closed position and including the mold section of Fig. 4, with a completed finger board forming bar or body therein.

Fig. 6 is a longitudinal section similar to Fig. 5, but taken as on the line 6—6 of Fig. 4.

Fig. 7 is a transverse sectional view through the closed mold of Figs. 5 and 6, and the completed board body therein, taken as on the line 7—7 of Fig. 4.

Fig. 8 is a transverse sectional view similar to Fig. 7, but taken as on the line 8—8 of Fig. 4.

Fig. 9 is a view in end elevation of the completed finger board body formed in the mold of Figs. 5 and 6, the mold being indicated in dotted outline.

Fig. 10 is a view in top plan of one of the mold sections of the mold for overmolding the frets on the finger board produced in the molds of Figs. 4 to 9, a finger board body being shown inserted in position in the mold section preparatory to closing the mold with the mating section thereof shown in Figs. 11 to 14.

Fig. 11 is a longitudinal section through the fret forming mold with the mold sections closed, at the completion of the molding operation, and showing the finger board with the frets and fret bonding ribs and runner or spine therefor molded and bonded thereon, the section having been taken as on the line 11—11 of Fig. 10.

Fig. 12 is a longitudinal sectional view similar to Fig. 11, but taken as on the line 12—12 of Fig. 10.

Fig. 13 is a transverse sectional view through the closed mold of Figs. 11 and 12, with its contained, completed finger board, and taken as on the line 13—13 of Fig. 10.

Fig. 14 is a transverse sectional view similar to Fig. 13, but taken as on the line 14—14 of Fig. 10.

Fig. 15 is a view in top plan, more or less schematic, of the mold section and its cavity, for molding the underside of a modified form of finger board body or bar preparatory to the overmolding of the frets thereon in a second mold.

Fig. 16 is a view in top plan of the completed finger board of the modified form with the frets overmolded thereon and bonded thereto.

Fig. 17 is a longitudinal sectional view taken as on the line 17—17 of Fig. 15, through the closed mold which includes the mold section of Fig. 15, with a completed finger board body therein prior to opening of the mold.

Fig. 18 is a view in transverse section through the closed mold of Fig. 17, with the finger board body therein, taken as on the line 18—18 of Fig. 15.

Fig. 19 is a transverse sectional view similar to Fig. 18, but taken as on the line 19—19 of Fig. 15.

Fig. 20 is a perspective view taken from the underside of the completed modified form of finger board body or bar produced by the mold of Figs. 15 to 19.

Fig. 21 is a view in longitudinal section through the closed mold sections constituting the mold for overmolding the frets on the board of Figs. 16 and 20, the mold being shown in closed position at the completion fret overmolding operation with the completed fretted finger board therein.

Fig. 22 is a longitudinal section through the closed mold and its contained finger board of Fig. 21, but taken along the longitudinal center of the mold.

Fig. 23 is a view in transverse section through the closed mold of Figs. 21 and 22, taken as on the line 23—23 of Fig. 21.

Fig. 24 is a transverse sectional view similar to Fig. 23, but taken as on the line 24—24.

Fig. 25 is a fragmentary view in plan of a portion of the mold cavity of the under surface forming mold section of the fret mold of Figs. 21 to 24.

Fig. 26 is a perspective view taken from the underside of the completed, modified form of finger board showing the solid runner or spine and the fret bonding ribs thereon.

As an example of a stringed musical instrument of the fretted finger board type, I have selected a ukulele for purposes of illustrating and explaining the various features of an all-plastic fretted finger board of my invention as adapted to and embodied in such example instrument. While an all plastic finger board of the invention is particularly adapted to embodiment in stringed musical instruments formed of molded thermoplastic materials, such as disclosed and claimed in my U. S. patent application filed May 15, 1950, Serial No. 149,741, now Patent No. 2,597,154, it is to be understood, however, that the use of finger boards of this invention is not restricted to such types of plastic instruments, but is also intended for and adapted to use with any of the stringed musical instruments of the wood or other material forms. Further, finger boards of the invention are not limited or restricted to embodiment in and use with stringed musical instruments of the ukulele type, but are adapted and intended for use as to all or any of the features thereof, with stringed musical instruments requiring or capable of using a fretted finger

board, such for example as all of the types and forms of guitars, banjos, mandolins and such like instruments.

The example instrument may be considered to be a ukulele formed of plastic materials, and, referring now to Figs. 1 and 2, includes the body B of standard shape and plan form with a neck N extending from one end thereof to terminate in an inclined head H which mounts the usual string tuning keys or pegs P–1, P–2, P–3 and P–4. The body B includes at the forward or front side thereof a sounding board S secured thereon and thereacross and having a sound opening R therethrough located in position between the neck N of the body and a bridge T secured transversely on and being located at the outer side of the sounding board S. The body B with sounding board S thus provides a resonant body or bell, and both the body and the sounding board in this example may be considered to be formed of a polystyrene plastic with the sounding board and the walls of the body each formed of a thickness of the order of approximately eight-hundredths of an inch (.08").

A musical instrument of the ukulele type is provided, in its conventional or usual forms with four (4) strings, constituting a B string, an F♯ string, a D string, and an A string. In the example instrument the four (4) strings are identified by the reference characters 1, 2, 3, and 4, in the usual numbering order across the instrument, with string No. 1 being the B string, string No. 2 the F♯ string, string No. 3 the D string, and string No. 4 the A string. The ukulele is a type of instrument utilizing a fretted finger board, and in the example instrument hereof, a fretted finger board 20 produced by the method and embodying the structural and functional features of the invention, is mounted in position in the usual location on and over the outer side of the neck N extending between the adjacent end of body B and the inner end of the head H. In this instance, the finger board 20 is suitably secured, as by cementing, on the outer side of the neck and is held against lateral displacement by suitable structural, longitudinal side flanges or lugs as will be hereinafter referred to more in detail. Thus mounted, the strings 1, 2, 3 and 4 which are connected at their outer ends to the tuning keys P1, P2, P3 and P4, respectively, and at their inner ends to the bridge T, extend longitudinally over and inwardly along and across the finger board 20.

The bridge T to which the inner ends of the strings are releasably secured, provides extended outwardly therefrom a contact bar or strip 5 across which the strings are stretched in contact therewith, so that this bar 5 provides a straight line contact edge at and engaged by the inner end portions of the strings which extend thereacross. In accordance with a feature of my invention to be referred to more in detail hereinafter, the finger board 20 is provided at its outer end in immediate proximity to the inner side of the nut or string divider 21 with a master fret MF which is extended thereacross and which provides a straight line outer edge contact surface across which the strings 1, 2, 3 and 4 are stretched in constant engagement therewith. Thus, the distance between the longitudinal center of the straight line contact edge of master fret MF and the longitudinal center of the straight line contact edge of the contact bar or strip 5 on the bridge T determines the maximum effective vibratory lengths of the strings 1, 2, 3 and 4, with these strings in mounted positions stretched between the tuning pegs on the head H and the bridge T on the sounding board S or body of the instrument. The distance between the string contact edge of bridge contact bar 5 and the contact edge of the master fret MF is determined and established with close tolerances and forms the basing distance factor in accordance with my invention, in the determination of the precision spacing of the series of frets on the fret bar 20, between the master fret MF and the last or innermost fret on the finger board.

In the ukulele of the example thereof, the body B, including the sounding board S, has its greatest length longitudinally or along the axis of the instrument, equal to approximately 8.504", while the overall axial distance between the outer end of the body B and the extreme outer end of the head H is approximately 20.10". The maximum depth or thickness of the body B is approximately 2", while the maximum transverse width at the portion of the body between the sound opening R and the outer end of the body is approximately 6". The distance between the effective contact edge of contact bar 5 of bridge T and the effective contact edge of master fret MF of the fingerboard 20, which determines and fixes the maximum vibratory length of the strings 1, 2, 3 and 4, is in the example instrument, approximately 13.932".

The bridge T, referring to Fig. 1, provides at the outer side thereof spaced outwardly from contact bar 5, the series of spaced string receiving slots 1*a*, 2*a*, 3*a* and 4*a* with the adjacent slots of the series being spaced apart approximately $\frac{5}{16}$". The nut or string divider 21 of the finger board 20 of my invention is provided with string receiving slots or grooves 21*a*, 21*b*, 21*c*, and 21*d*, for maintaining the spacing of the strings as they pass from the master fret MF to the tuning pegs on the head H (see Fig. 3). These string receiving slots of the nut 21 are in this instance spaced apart across the nut with slot 21*b* spaced from slot 21*a* a distance equal to approximately .375"; slot 21*c* spaced from slot 21*b* a distance approximately equal to .374"; and slot 21*d* spaced from slot 21*c* a distance approximately equal to .375".

The finger board 20 of the form of Figs. 1 to 14, comprises a generally rectangular body or bar member 22, referring now to Fig. 3 of the drawings, which provides at its outer side a flat, smooth face or surface 22*a* on and across which a series of frets are transversely disposed in positions spaced apart longitudinally of the board. In the standard ukulele instrument a series of twelve (12) basic frets is provided between the string engaged contact member, such as the master fret MF of the example, at the outer end of the finger board, and the inner end of the board adjacent the body B. These twelve (12) basic frets are spaced apart inwardly from the outer end of the board progressively decreased distances, so that the twelve (12) spaces formed along the board at the rear of the twelve (12) frets provide finger stopping spaces against which the strings may be finger pressed in order to selectively shorten a string to an effective vibratory length to produce when vibrated a certain predetermined note. The precision of location of each fret relative to the fixed or constant maximum effective vibratory length of each string between its end contact points, is determinative for a given string of the trueness of the note and the precision of its pitch. In order,

therefore, to obtain the most efficient and more nearly perfect musical results from an instrument it is essential that the frets have the most precise locations and spacings relative to each other and to and along the fixed maximum vibratory lengths of the strings.

I have developed and produced a system and definite arrangement of spacing for the frets of the finger board of a stringed musical instrument, and I have applied and exemplified this spacing system in the example ukulele instrument, both for the twelve (12) basic frets of such an instrument, and for the additional frets provided by the finger board extension of the form of Figs. 1 to 3 of my present invention.

The finger board **20**, of this example, provides projecting from and across the outer surface **22***a* thereof, the series of twelve (12) basic frets **F1**, **F2**, **F3**, **F4**, **F5**, **F6**, **F7**, **F8**, **F9**, **F10**, **F11** and **F12**, and on the extension **23** of the finger board **20**, the series of additional frets **F13**, **F14**, **F15**, **F16** and **F17**, projecting from and across the flat outer surface **23***a* of the extension **23**. The distance between the longitudinal centers of the master fret MF and the string contact bar **5** of bridge T, which distance determines the effective string lengths, is in this example instrument, 13.8070''. The fret **F12** located at the inner end of the main finger board body **22** adjacent the extension **23**, is positioned in accordance with my invention, on the finger board with its longitudinal center spaced from the longitudinal center of the master fret MF at the outer end of the finger board, a distance equal to 6.9035'', that is, one-half the effective string length. In this distance the remaining eleven (11) basic frets are spaced apart progressively decreasing distances inwardly from the master fret MF, and in accordance with my invention, the spacing between the longitudinal centers of these frets is as follows:

	Inches
MF to F1	.77499
F1 to F2	.73148
F2 to F3	.69043
F3 to F4	.65168
F4 to F5	.61510
F5 to F6	.58057
F6 to F7	.54799
F7 to F8	.51722
F8 to F9	.48819
F9 to F10	.46079
F10 to F11	.43492
F11 to F12	.41051

The spacings between the additional frets **F13** through **F17**, of the extension **23** of the finger board **20**, progressively decrease inwardly of the extension, and these spacings, measured between the longitudinal centers of the additional frets, are as follows:

	Inches
F12 to F13	.38750
F13 to F14	.36574
F14 to F15	.34522
F15 to F16	.32584
F16 to F17	.30755

By this system and arrangement of ukulele finger board fret spacing, it is a characteristic of the spacings that the spacing between the first additional fret **F13** of the board extension **23** and the last or innermost fret **F12** of the series of basic frets, equals one-half the distance of the spacing between the outermost pair of frets on board **20**; that is, between the fret **F1** and the master fret MF: and that each succeeding spacing between the additional frets on extension **23** equals one-half (½) of each succeeding spacing between basic frets inwardly of the finger board. Thus, the spacing between frets **F13** and **F14** equals one-half (½) the spacing between frets **F1** and **F2**; the spacing between frets **F14** and **F15** equals one-half (½) the spacing between frets **F2** and **F3**; the spacing between frets **F15** and **F16** equals one-half (½) the spacing between frets **F3** and **F4**; and the spacing between frets **F16** and **F17** equals one-half (½) the spacing between frets **F4** and **F5**. If, as is contemplated by and included within the scope of the invention, the extension **23** of the finger board **20** is increased in length and provided with additional frets inwardly thereof, this same progressive spacing relationship between the additional frets and the basic frets would be carried out in accordance with the spacing system and arrangement of my invention.

With respect to the progressively decreasing spacing between the twelve (12) basic frets, inwardly of the finger board **20**, it is to be noted that the increments of decrease constantly become smaller. Within the practical limits of production the mathematically exact figures are rounded off at five decimals, otherwise it would be necessary to work with impractical figures carried out to ten, twenty or more decimals.

The fret spacings in accordance with my invention are computed and determined as follows:

Identifying the twelve (12) intervals or spacings between the series of basic frets MF through **F12**, as a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8, a_9, a_{10}, a_{11}, a_{12}, the ratio between each note of the twelve (12) notes produced therefrom is such that repeated twelve (12) times it doubles the frequency, or halves the length, or

$$r^{12}=\frac{1}{2} \text{ giving}$$

$$r=\sqrt[12]{\frac{1}{2}}=.9438744$$

Consider the distance between MF and bar **5** of the bridge T (see Figs. 1 and 2), or open string length as L, then the string length or distance between MF and **F12**=$L/2$.

If the fret spacings from MF to **F12** are known, then the fret spacings from **F12** to **5** will be exactly half as large as the corresponding spacings from MF to **F12**.

Thus, it is only necessary to compute the twelve (12) fret spacings from MF to **F12**.

Since the sum of all the fret spacings between MF and **F12** must equal $L/2$ and the sum of a geometric series is given by

$$\frac{a_1(1-r^n)}{1-r}$$

where n is the number of terms and r is the "rate," then

$$\frac{L}{2}=\frac{a_1\left(1-\frac{1}{2}\right)}{1-.9438744}=\frac{a_1}{2}\,\frac{1}{.0561256}$$

as $r^{12}=\frac{1}{2}$ and $r=\sqrt[12]{\frac{1}{2}}=.9438744$

it follows that the fret spacings may be computed for any string of open length L, by the formula:

$$a_n=.0561256L\times(.9438744)^{n-1}$$

where n denotes the number of the fret spacings desired starting from MF.

As the string length L of the example instrument is 13.8070'' then by using the above formula, the fret spacings for the example instrument will be determined to be as hereinbefore listed.

It is to be noted that a_1 is to L exactly as a_2 is to $L-a_1$. That is to say, that the first fret spacing is always the same fraction of the whole open string length considered or, since $a_1=.05613\times$open string, then if a_1 is subtracted from open string length, a_2 is the same fraction of what is left.

For example, when $L=13.807$,

$$a_1=.77491=.056125\times 13.807$$

$$L-a_1=13.807-.77491=13.0321$$

then

$$a_2=.056125\times 13.032=.7314$$

The two numbers in the formula

$$a_n=.0561256\times(.9438744)^{n-1}$$

are complements of each other, that is, they add up to 1, since

$$.9438744=\sqrt[12]{\frac{1}{2}} \text{ or } \left(\frac{1}{2}\right)\frac{1}{12}$$

In accordance with the invention the formula may be used in one or other of the following forms:

$$a_n=\left(1-\sqrt[12]{\frac{1}{2}}\right)\left(\sqrt[12]{\frac{1}{2}}\right)^{n-1}L$$

or

$$a_n=\left[1-\left(\frac{1}{2}\right)\frac{1}{12}\right]\left[\left(\frac{1}{2}\right)\frac{1}{12}\right]^{n-1}L$$

or

$$a_n=\left[1-\left(\frac{1}{2}\right)\frac{1}{12}\right]\left[\frac{1}{2}\right]^{\frac{n-1}{12}}L$$

or

$$a_n=(1-b)(b)^{n-1}L$$

where

$$b=\sqrt[12]{\frac{1}{2}}=.9438744$$

In the formula of any of the above forms, if L is the length of the open string on any fretted instrument then the width of the n^{th} fret space is given by the formula. While it is only necessary to compute the first twelve (12) basic fret intervals or spaces, as the ones higher up are sub-multiples of the first twelve (12), yet the formula will apply equally well to the frets of higher numbers than 12. It is merely necessary to make n the fret number desired whether it be the 17th or the 30th, or any other.

For practical purposes the figures hereinabove given may be considered to be critical for the example finger board of the specified dimensions, through three (3) decimals or to thousandths of an inch with a tolerance of one thousandth of an inch (.001). Hence, any deviations in mathematical exactitude in the figures given is without material significance within such a tolerance, and is due to the arbitrary rounding off or reduction to four (4) or to five (5) decimals, of the mathematically exact figures resulting from the computations with the formulae given by the invention.

It is to be understood that the fret spacing system of my invention, as hereinbefore described and explained, is not in any sense limited to

adaptation and use with the all-plastic finger board forming another feature of my present invention. Such spacing may be effectively and efficiently utilized for positioning the standard or conventional fret forming metal, or other material strips which are inset into position on and across a wood or other material finger board body, or for finger boards of the types in which the frets are formed integral with and from the material of the board, and it is contemplated and intended that such fret spacing may be so used.

According to another phase of my invention, I provide a design, arrangement and construction of an all-plastic, fretted finger board which is adapted generally to stringed musical instruments, and I have selected as examples of this phase of my invention, two forms of all-plastic finger boards particularly adapted for the ukulele type of musical instrument. Essentially, such an all-plastic finger board of the invention is characterized by a plastic material finger board body or bar across the outer side of which are overmolded, either as complete over molds across the outer surface of the board, or as partially inset or inlaid into the board, a series of plastic frets formed of a plastic material, preferably having certain different characteristics from those of the body forming plastic and being of a color contrasting with the color of the body.

The finger board **20** of Figs. 1 to 14, is an example of one form of board of the invention provided with an additional fret carrying extension **23** and having the frets overmolded on and partially inset or inlaid in the material of the board body and the extension thereof.

Referring to Figs. 1, 2 and 3 in particular, the finger board **20** comprises the body or flat bar member **22** which is injection molded or otherwise suitably formed from a thermoplastic material which in this example is a polystyrene plastic, preferably pigmented to have a relative dark color, say a mahogany color. The polystyrene utilized for the board body preferably has the following characteristics:

Tensile strength, ⅛'' bar, p. s. i.	5500–6500
Elongation, percent	1.4–2.0
Modulus in tension×105 p. s. i.	4.3–4.7
Impact strength:	
Izod notches, ⅛'' bar, ft. lbs./in. of notch	0.3–0.6
Izod unnotches, ⅛'' bar, ft. lbs./in. of width	2–6
Flexural strength, ⅛'' bar, p. s. i.	12,000–15,000
Heat distortion, ⅛'' bar, °F.	164–168
Flammability, in./min	1
Rockwell hardness	M68–80
Specific gravity	1.05–1.07
Dielectric constant:	
60 cycles	2.45–2.55
10^6 cycles	2.45–2.55
Power factor:	
60 cycles	0.0001–0.0003
10^6 cycles	0.0001–0.0004

For the example instrument, the finger board **20** formed of the indicated polystyrene plastic, has the nut or string divider **21** molded or formed integral therewith on and across the outer end thereof. At the opposite or inner end the main body **22** of the finger board is extended inwardly from the innermost fret **F12** of the series of basic frets, to provide the extension **23** which has formed thereon the series of additional frets **F12** to **F17**, inclusive. The outer or finger side of

the finger board 20, when the ukulele instrument of the example is being held in playing position by a player, is constituted in this example by the longitudinal edge 24 of the board which extends from the nut 21 to the extreme inner end of the extension 23. The opposite or inner longitudinal edge 25 of the board is terminated at its inner end at a location intermediate the spacing between innermost basic fret F12 and the outermost or first additional fret F13. The inner longitudinal edge of the extension 23 is of decreasing width inwardly of the extension, so that this edge follows a general inward and outward inclination across the board, the edge being of scalloped form comprising consecutive arcuate recesses 26 joined by projecting portions 26*a* with the recesses being opposite the inner ends of the additional frets on the extension 23 respectively adjacent thereto. This construction and conformation of the inner longitudinal edge of the finger board extension 23 will be clear by reference to Fig. 3.

The nut or string divider 21 formed or molded integral with the board 22 at the outer end thereof is formed with the string spacing slots 21*a*, 21*b*, 21*c* and 21*d*, each of which has a depth to extend below a plane parallel with the face 22*a* of the board and passing through the outer string contact edge of the master fret MF, so that, in assembled position of the finger board on the neck end of the instrument, and with the strings 1, 2, 3 and 4 in operative position stretched between bridge T and the tuning pegs, the strings have only contact with the master fret MF. Thus, the nut or string divider 21 functions solely to maintain the lateral spacing between the strings and is not normally contacted or engaged by the strings.

This integral nut or string divider 21, in the example hereof, is also formed to function as a positioning member for the outer end of the finger board 20. To this end nut 21 is formed of a depth to provide a flange portion 21*e* which extends transversely across the finger board 20 and projects inwardly therefrom at the outer end thereof for seating in a suitable recess or seat 21 (see Fig. 2) of the neck N when the finger board is in assembled, secured position in the instrument.

The overall length of the extension providing form of finger board 20 of Fig. 3, for the example instrument of Figs. 1 and 2, is approximately 8.15", while the length of that portion of the board which mounts the twelve (12) basic frets F1 to F12, inclusive, may be taken to be approximately 7.50". The width of the finger board 20 at its outer end, that is to say, the width of the nut 21 is approximately 35.6 mm.; the maximum width of the board on a transverse dimension at the position of fret 12 is approximately 46.7 mm.; and the width of the innermost end of the extension 23 of the finger board 20 is approximately 12 mm.

Preferably, as in the example of extended finger board 20, the extension 23 has a thickness less than the thickness of the main portion of the board body, as will be clear by reference to the completed finger board 20 as it is shown in the fret overmolding mold of Figs. 11 and 12. In this instance, the thickness of the main portion of the body of the board is 4.6 mm., while the thickness of the extension 23 is 2.2 mm. There is thus formed a shoulder 27 at the under side of board 20 extending transversely thereacross and which serves to engage and seat against the adjacent outer side of the end wall of the body B and adjacent structure of neck N, when the finger board is in assembled position in the instrument. In assembled position the extension 23 extends inwardly on and across the outer side surface of the sounding board S, as is clearly shown in Figs. 1 and 2 of the drawings. Thus, in such assembled position the additional frets F13 to F17 of the extension 23 are located below the strings 1, 2, 3 and 4, but with no one of these additional frets extending to and beneath string No. 4, the A string. The first additional fret F13 extends beneath strings 1, 2 and 3; the additional frets F14 and F15 extend beneath strings 1 and 2, while additional frets F16 and F17 extend only beneath string No. 1, the B string.

The underside of the main body 22 of finger board 20 is provided with the opposite, longitudinal flanges 28 extending therealong but spaced inwardly slight distances from the adjacent inner and outer longitudinal edges 24 and 25, respectively, of the board body. There is thus formed at the under side of the body along the opposite longitudinal edges thereof the seating shoulders 28*a* for seating on and cementing to the complementary opposite outer edges respectively, of the opposite side walls of the neck end (see Fig. 2). In assembled position of the finger board 20 on the neck N, the flanges 28, extend inwardly into the neck at and are engaged against the adjacent inner side walls thereof to thus positively position the finger board on the neck against lateral displacement. The under side flanges 28 and the seating shoulders 28*a* formed thereby, are clearly shown in the completed finger board as it is shown in the mold of Figs. 11, 12, 13 and 14.

Each of the twelve (12) basic frets F1 to F12, inclusive, and each of the additional frets F13 to F17, inclusive, is formed of a metallic polystyrene plastic having metallic characteristics and particularly having the characteristic of a metal in appearance and of a contrasting color to the color of the finished material of which the board body 22 is formed. In this example, the fret forming material is a polystyrene plastic to which has been added a metallic powder, say for example a mixture of aluminum powder and copper powder, to form a plastic mixture of which the metallic powder mixture constitutes approximately 5% to 20%. Such polystyrene is preferably of the natural colorless crystal form and when metallized with the aluminum and copper, the resulting plastic has a silvery or copper-like color.

The polystyrene utilized for metallizing with the metal powder has the following characteristics:

Tensile strength, 1/8" bar, p. s. i.	6000–6500
Elongation, percent	1.4–2.0
Modulus in Tension × 105 p. s. i.	4.3–4.7
Impact strength:	
Izod notches, 1/8" bar, ft. lbs./in. of notch	0.3–0.6
Izod unnotches, 1/8" bar, ft. lbs./in. of width	2–6
Flexural strength, 1/8" bar, p. s. i.	12,000–15,000
Heat distortion, 1/8" bar, °F.	168–175
Flammability, in./min.	1
Rockwell hardness	M68–78
Specific gravity	1.05–1.07
Dielectric constant:	
60 cycles	2.45–2.55
10^8 cycles	2.45–2.55

Power factor:

60 cycles	0.0001–0.0003
10^8 cycles	0.0001–0.0004

In the form of finger board **20**, as shown in Figs. 1 to 14, all the frets including the master fret MF, are formed on and across and projecting outwardly from the outer side or face **22***a* of the body **22**, and each is partially inset or inlaid into suitable grooves **30** formed in and across the outer side **22***a* of the board body **22**, and each is suitably bonded and secured to the board body so as to form therewith what is in effect a one-piece, integral structure, with the frets being of a contrasting color to the color of the board body, as hereinbefore described. The inset or partially inlaid construction and formation of the frets in the board body will be clear by reference to Figs. 11 to 14, showing the completed, fretted finger board **20** in the fret over molding mold before removal therefrom. In this particular example, the master fret MF has a thickness at the exterior of face **22***a* of board body **22**, of .030", that is, fret MF projects that distance from the outer surface **22***a* of the board. Each of the remaining frets F1 to F17, inclusive, projects outwardly or has an external thickness of 0.25", so that, when the strings **1**, **2**, **3** and **4** are in position extended over the finger board **20** between bridge T and the tuning pegs on head H, the strings are normally held out of engagement or contact with the frets F1 to F17, inclusive, as will be clear by reference to Fig. 2 of the drawings.

Each of the frets extends substantially completely across the width of the board body **22** at the location of that fret, but each fret terminates at its opposite ends spaced inwardly from the adjacent side edges, respectively, of the finger board body, such spacing in this instance being of the order of 1/64 of an inch. The opposite ends of each fret are rounded, which together with the inward spacing of the fret ends permits of a player sliding his fingers from one fret to another smoothly and without encountering rough or abruptly edged structure.

A completed finger board forming body **22** and its extension **23**, prior to the overmolding of the frets thereon, is shown in top plan view in Fig. 10, and in longitudinal sectional views in Figs. 5 and 6. In Fig. 10, the body is shown in position in one of the mold sections of the mold for overmolding the frets thereon, while in Figs. 5 and 6, the board is shown in completed condition in the board body forming mold prior to opening of the latter and removal of the completed body **22**. Referring to Fig. 10, the completed board body **22** has the transverse fret inlaying or receiving grooves **30** formed therein across the outer side thereof in proper spacing to space the frets therein in accordance with the spacing arrangement of the invention. Each of these grooves **30** has a series of spaced feed and bond forming holes **31** opening into the bottom of the groove and extending through the board body **22** to the under side thereof.

In the completed, fretted finger board **20**, referring now to Figs. 11 through 14, the master fret MF and the frets F1 to F17, inclusive, are overmolded onto the board **22** and partially inset or inlaid relative to the board in the grooves **30**, respectively. Each of the frets is bonded and tightly keyed and secured on and to the board and in the grooves **30**, by bonds or sprues **32** formed by the portions of the fret forming plastic extended through and set in the feed or bonding holes **31**. Thus, each fret becomes in effect a part of the board, so that, for all practical uses and under all the loads to which the frets will be normally subjected, the board frets and their bonds become a monolithic or integral one-piece structure, but formed of thermoplastic materials having contrasting color and certain differences in physical characteristics.

The invention provides in addition to the bonds **32** for the frets, a further system of bonding at the under or inner side of the body **22**, and utilizes for this bonding system the material in the runners by which the mold feeds and supplies the thermoplastic material under pressure into all the mold cavities. Referring to Figs. 5 through 10, in the molding of the finger board body **22** there is formed at the under side of the body along the longitudinal center or axis thereof and extending throughout the length of the board, a channel or groove **40**. This runner at the inner end of the main body **22** of the board is continued as an inclined section **41** which extends longitudinally of the underside of the extension **23**. A series of rib-forming grooves **44** are formed disposed transversely across the under side of the board body **22** and extension **23** with their longitudinal axes lying in the plane passing through the longitudinal axes of the fret forming grooves **30**, respectively, at the outer side of the board body. These underside rib forming grooves **44** extend transversely across, open into and receive fret-forming material from the central runner **40**. The rib-forming grooves **44** are substantially co-extensive in length with their corresponding grooves **30**, respectively, at the outer side of the board body and the fret groove supply holes **31** open into these underside rib-forming supply grooves **44**, so that there are formed flow paths from the central runner **40** through grooves **44** and holes **31**, to the fret-forming grooves **30** at the outer side of the board body. It is to be noted that in the preferred form of this example, the central runner or channel **40** along the main portion of the body **22** has a greater depth inwardly than the depths of the underside rib-forming channels **44** which open thereinto and receive fret-forming plastic therefrom, and these relative depths may apply to the runner section **41** and the rib-forming grooves **44** at the under side of the extension **23** of the finger board, or the depth of runner **41** may not exceed that of grooves **43**, whichever relative depths may be found preferable.

In the completed, fretted finger board a central stem or spine **45** of metallic fret-forming plastic is completely inlaid into and along the runner or channel **40**—**41** at the underside of the board **20**, with a series of transverse branches or ribs **46** completely inlaid into the body and extending from the spine, across the underside of the board and bonded through the board to the frets overmolded at the outer side thereof by the bonds or sprues **32** formed by and set in the holes **31**. In this form of the invention a spine **45** and ribs **46** are completely inlaid with their outer surfaces flush with the underside of the body. There is thus provided an integrated bonding system at and along the under side of the board to which the frets at the outer side of the board are attached and bonded, and this under side bonding system not only results in effective bonding of the frets but also functions to stiffen the completed finger board against twisting or distortion, so that a very rigid board-structure results.

The finger board **20** may also include, if desired,

a series of markers K in the form of disks inlaid at the desired positions between frets along the longitudinal center or axis of the board and having their outer surfaces flush with the outer surface 22A of the board. These markers K, in this instance, happen to be five (5) in number, but the invention is in no sense limited to this or any particular number of such markers, or to the frets between which they may be located. Each marker is formed from the metallic plastic material of which the frets are formed and thus have a color contrasting with the color of the body of the board, such color being in this example a silver or aluminum shade with the body of the board a dark mahogany color. These markers are formed as inlays in bores 47, referring now to Fig. 10, which are formed through the board body 22 in the molding of that body, and each bore opens into and is adapted to receive marker forming material from the supply of fret forming material in the runner 40 at the under side of the board body.

Instead of the frets being partially inset or inlaid in grooves such as the grooves 30 formed in and across the outer side of the board body, the frets may be formed on and across the outer side of the body as complete overmolds on the body outer surface, while being bonded to the body and to the bonding system at the under side of the body by bonds or sprues 32. An all-plastic finger board having the master fret MF and the twelve (12) basic frets F1 to F12, inclusive, formed as complete overmolds on the outer surface of modified form of finger board 20', is illustrated, together with the molds for forming the same, in Figs. 15 to 25 of the drawings.

In the form of finger board 20', the fret extension such as extension 23 of fingerboard 20, is eliminated, so that the board merely extends in assembled position to an inner end flange portion 23' adapted to fit over the adjacent outer side of the sounding board S of instrument body B. At the under side of the board 20' the same fret bonding and board stiffening system is employed that is described and explained in connection with the finger board 20 of the form of Figs. 1 to 3, such system including at the under side of board 20' the central spine 45 with the transverse fret bonding ribs 46. In the form of finger board 20', the bonding system of spine and ribs are not inset or inlaid in the under side of the board but are provided as complete overmolds onto such under side. The completely overmolded frets MF and F1 to F12, inclusive, on the outer side of finger board 20' are bonded and keyed to the completely overmolded bonding system at the under side of the board, by the bonds or sprues 32 which connect integrally the frets and bonding ribs through the bond forming holes 31, similar to such holes as provided for the finger body 20.

The form of finger board 20' is further modified from the form of the finger board 20, in that the integral nut or string divider 21 is not molded as an integral part of and positioned across the outer end of the board. With the board of the form of Fig. 20, a separate string divider or strip is provided similar to divider 21, which separate divider is seated and secured in the end of the neck N of the instrument in proper position at the outer end of the finger board. Such separate divider is provided with string receiving slots similar to the slots of divider 21, which will pass the strings therethrough in proper spacing while permitting the strings to engage solely at their outer end lengths with and on the master fret MF.

The finger board 20' instead of being provided with the mounting and positioning flanges 28 of the form of finger board 20 has the opposite longitudinal side flanges 28' at the under side thereof to provide by their inner edges seating surfaces for fitting down on the outer edges of the opposite sides, respectively, of the neck N. A series of spaced inwardly projecting mounting and positioning lugs 29 are provided in conjunction with flanges 28', in positions projecting inwardly from the under side of the board along the inner side of each of the flanges. The positioning lugs 29 are of greater depth than and project inwardly from the inner side of that flange 28' with which associated, and, in this instance, are located in positions between the series of bonding ribs 46 at the underside of the board. However, this form of the invention is not limited to any particular number, spacing or positioning of the lugs 29. A lesser number than that disclosed herein may be utilized with the lugs being provided only between alternate pairs of bonding ribs 46, or in other spacing arrangements. The function of the lugs 29 is the same as that of the positioning flanges 28 of the finger board 20.

By my invention I have devised a method for forming all-plastic fretted finger boards embodying the features and characteristics of the invention hereinbefore described and explained, by which method the metallized plastic frets on the outer side of the board, the fret bonding and board strengthening system of ribs at the under side of the board, and the position markers in the board, are overmolded in either complete overlay or overmold, or as being partially inlaid or inset in the body of the board. By my method I first form, preferably by injection molding, the body of the finger board and then by a separate injection molding operation in a separate mold, I overmold or overlay the frets on and across the outer side of the board body and the fret bonding system at the under side of the body, with the frets keyed or bonded through the board integrally with the bonding system. Further, in carrying out this method I utilize a thermoplastic material, such as the polystyrene having the characteristics of the example hereof, in which the melting point is lower than the melting point of the metallized plastic utilized for forming the frets, the bonding ribs and position markers, so that, there results a further bonding or welding between the metallized plastic and the plastic of the board body.

I have shown, more or less schematically, in Figs. 4 to 14 inclusive, the finger board body forming injection mold and the separate, fret overlaying or overmolding injection mold, for the form of finger board 20 of Figs. 1 to 3. These molds as schematically shown may be taken to be molds of the general character familiar in the art of injection molding.

In Figs. 4 to 9, are shown the mold for forming therein as a separate component the board body 22 for the finger board 20. This mold includes a mold section 50 and a mating section 51. The mold cavity of section 50 for forming the under side of the mold body 22 is shown in Fig. 4, and includes: the main bottom surface 50*a* with the section 50*b* extended at one end thereof of less depth than section 50*a* and having the scalloped edge 50*c* for forming extension 23; the raised, longitudinal rib 52 for forming the longitudinal channel or runner 40 in the

under side of the body, together with the reduced thickness inclined section 52' of the rib 52 along surface 50c for forming the section 41 of the runner at the under side of the board extension 23; the transverse ribs 53 for forming bonding rib inlaying grooves 44; the transverse channel 54 across one end of the mold cavity for forming the flange 21e of the integral nut or string divider 21 of board 20; and the opposite longitudinal side grooves 55 for forming the positioning flanges 28 at the underside of the board. In addition, the mold section 50 may include; the series of core pins 56 for forming through board body 22, the feed holes or gates 31 by which the metallized plastic is fed from the runner 40 through the grooves 44 to the fret forming grooves 30 at the outer side of the board body; the core pins 57 for forming the holes or bores 47 in which the markers K are formed; and a series of knock-out pins 58 in accordance with usual injection mold practice.

The mold section 51 which forms the outer side of the board provides, referring now to Figs. 5 and 6, the series of transverse parallel ribs 59 thereacross spaced apart longitudinally of the mold cavity to form across the outer side of the board 20, the fret inlaying grooves 30. The mold section 51 also includes transversely across one end of the mold forming cavity, the channel 60 for forming integrally with the board body the nut or string divider 21. The injection inlet or sprue opening for the mold 50—51 may be provided at any suitable location, but in this instance may be taken to be located at the left-hand end of the mold as viewed in Figs. 5 and 6, so that, the board forming plastic is injected under pressure at the nut or string divider end of the mold cavity.

Thus, in carrying out the first step of my method, the finger board body for the all-plastic, fretted finger board of Figs. 1 to 3, is first molded as a separate component in the mold 50—51, by injecting into the mold and distributing therethrough under pressure, the polystyrene plastic having the characteristics hereinbefore given for such body forming plastic. The body forming plastic is suitably pigmented to provide the desired color when molded, such as the dark mahogany color hereinbefore specified.

With the polystyrene plastic of the herein defined characteristics the plastic has a melting point of between 360° F. to 380° F. and is injected into the mold 50—51 at a molding pressure within the range of 12,000 to 15,000 pounds per square inch, and at a temperature of 480° F. to 520° F.

Upon completion in the mold 50—51 of the finger board body 22, the mold may be opened and the completed board body knocked out or ejected in the usual manner. The completed board body is shown in Figs. 5 and 6 in the mold preparatory to removal and to the carrying out of the next step of overmolding the frets and their bonding on the board, in accordance with the method of the invention.

The mold in which the fret overmolding and fingerboard completing step of the invention is carried out, is shown in Figs. 10 to 14, as comprising the mating mold sections 70 and 71. The mold section 70 is formed to overmold the bonding spine 45 and the ribs 46 on the under surface of the board body 22, while the section 71 when mated with section 70 is formed to overmold on and across the outer surface 22a of the board body 22, the master fret MF and the series of frets F1 to F17, inclusive.

In the fret overmolding step, a completed fingerboard body 22 previously formed in the body mold 50—51, is placed in position in and over the mold cavity of the mold section 70 of the fretting mold 70—71, with the under side of the body facing inwardly over the mold cavity and the outer side facing outwardly to be received and fit into the mold section 71 when the latter is mated with section 70 to close the mold. Referring to Figs. 13 and 14 in particular, the mold cavity of mold section 70 provides a flat, plane surface 72 against which is seated and pressed the under surface of the body 22, so that, the runner 40 and the transverse bonding rib forming grooves 44 thereof are closed across their open sides. The mold cavity also provides the grooves or channels 73 for receiving the positioning flanges 28 located along the opposite longitudinal edges of the board, as well as providing a groove or cavity 74 into which fits and tightly seats the flange 22e of the integral nut 21 formed across the outer end of the board body. The mold cavity of section 70 for receiving a completed finger board body 22, is also formed with an end portion of less depth than the main portion of the cavity to provide the flat surface 72' to receive the extension 23 and close the open sides of the runner section 41 and the bonding rib grooves 44, of the under side of the extension, as will be clear by reference to Figs. 11 and 12. One edge of the shallow cavity for receiving the extension 23 is formed with an edge 75 formed complementary to and receiving and tightly fitting against the scalloped edge 26—26a of the board body 22.

The section 71 of mold 70—71, is formed to provide a mold cavity to fit over and receive the outer surface of the board body when section 71 is mated with section 70. The body receiving cavity of section 71 provides a flat, plane surface 76 which fits tightly onto and against the outer other surface 22a of body 22 and surface 23a of the extension 23, as clearly shown in Figs. 11 to 14. Fret forming grooves 77 are formed in and transversely across mold surface 76 for precise alignment with the complementary inlaying grooves 30 formed in and across the outer side 22a of the body, as shown particularly in Fig. 13.

With a finger board body 22 inserted in the enclosed mold 70—71, the metallized fret forming plastic having a melting point in the range from 400° F. to 430° F. is then injected into the channel or runner 40, preferably through an inlet or sprue opening at the left-hand end of the mold when viewing Figs. 11 and 12. The injection of the metallized plastic is carried out under a pressure in a range from 10,000 to 12,000 pounds per square inch, and at a temperature preferably of the order of 510° F. to 530° F. The fret forming plastic is thus forced through channel 40 and is distributed therefrom through the grooves 44, and from grooves 44 through the feed holes 31 into the fret forming cavities formed by the sets of grooves 30—77, until the runner and all of the grooves and the feed openings 31 between the grooves, are filled with plastic. Thus, there is overmolded on the board body 22 in partial inlay across the outer side of the finger board the master fret MF and the series of frets F1 to F17, and there is overmolded in complete inlay at the under side of the board, the bonding system comprised of the spine 45

and the ribs 46, with the latter bonded and keyed through the board body to the frets by the integral bonds or sprues 32. At the same time the bores are filled from the runner 40 with the metallized plastic to form therein the completely inlaid position markers K. And, as the melting point of the polystyrene plastic of which the body 22 is formed is lower than the melting point of the fret forming metallized plastic, there is a fusing or melting of the plastic of the finger board by the heated metallized plastic to thereby further bond the frets and their under surface bonding spine and ribs, to the body of the board.

There is thus formed by these two (2) molding steps a complete fretted, all-plastic finger board in which the frets are formed of a metallized plastic having a metallic appearance which in color contrasts sharply with the color of the body of the board, and in which the frets have certain different physical characteristics, yet are so bonded and joined with the board as to provide what is in effect a one-piece, integral, fretted, all-plastic finger board.

The form of finger board of the completely overmolded fret type exemplified by the finger board 20' shown in Figs. 15 to 25, is produced by the same injection molding method as described above in producing the finger board 20 of the partially inlaid type of fret. A completed board body 22' is formed by injection molding in a mold comprising the mold sections 80 and 81. The cavity provided by section 80 forms the under side of the body 22' and includes the recesses 29' for forming the positioning lugs 29, but as the bonding spine 45 and ribs 46 at the under side of the board 20' are formed as complete overmolds, the main surface area of the mold cavity is formed as a flat, plane surface. Suitable core pins 83 are mounted and provided in and across the mold cavity of section 80 to provide the feed holes or gates 31 for supplying metallized plastic to form the frets at the outer side of the board body. Additional core pins 84 are also provided for forming the openings 47 through the board in which the position markers may be formed.

Referring to Figs. 20 through 24, the mold for overmolding on a body 22' the series of frets and bonding ribs to complete the finger board, comprises mold sections 90 and 91. Mold section 90 provides a mold cavity within which there is formed the central channel or runner 92 and transverse grooves 93 thereacross at spaced intervals therealong to form the bonding ribs 46. The mold section 91 which receives the outer side of board body 22 is formed with a series of fret overmolding grooves 94 thereacross and spaced apart therealong. A finger board body 22' is placed in the mold 90—91 with the rows of feed holes 31 therethrough aligned with the aligned grooves 93—94, the mold is closed, and metallized fret forming plastic is then injected under pressure in the channel 92 at one end of the mold as more or less schematically indicated at the left hand end of Fig. 21 at the inlet or sprue opening 95. Plastic is thus distributed through and fills channel 92, rib forming grooves 93, feed holes 31 and fret forming grooves 94, to form in the latter the frets MF and 1 to 17, as complete overmolds on the outer side of the board, and to form on the under side of the board as complete overmolds the spine 45 and bonding ribs 46 with the frets keyed to such ribs by the bonds or sprues 32 formed in the feed openings 31. As the metallic plastic used for forming the frets has a higher melting point than the plastic used for forming the body 22', there will be a further bonding or welding of the frets and bonds to the board body, as hereinbefore explained in connection with the molding of the finger board 20.

It will also be evident that various other changes, modifications, substitutions and eliminations might be resorted to without departing from the spirit and scope of my invention and, hence, I do not desire to limit the invention in all respects to the exact and specific disclosures of the example of the invention herein described, except as may be required by specific intended limitations thereto included in any of the appending claims.

What I claim is:

1. A fretted finger board for stringed musical instruments comprising, a body member of molded plastic material, said body member being formed with a series of transversely disposed spaced rows of holes therethrough, frets of plastic material positioned on said body member along said rows of holes, respectively, and sprues of the plastic material of each fret being extended into the row of holes in said body member for such fret to bond the fret to the body member.

2. An all-plastic, fretted finger board for stringed musical instruments comprised of, a body member of molded plastic material, a series of frets formed of plastic material positioned on and transversely across the outerside of said body member, a series of bonding ribs formed of plastic material positioned on and transversely of the under side of said body member, and a series of sprues of plastic material extending through said body member and integrally connecting said frets with said bonding ribs to bond said frets into fixed positions on said body member.

3. An all-plastic, fretted finger board comprised of, a molded plastic body member formed with a series of transversely disposed rows of holes therethrough, said rows being spaced apart longitudinally along the body member, frets of plastic material positioned on and across the outer side of said body member along said rows of holes, respectively, a series of transversely disposed plastic bonding ribs positioned on the under side of said body member along said rows of holes, respectively, and sprues of plastic material extending through the holes of each row an integrally bonding the frets to the ribs, respectively.

4. A fretted finger board for stringed musical instruments comprising, a body member of molded plastic material having in the outer side thereof a series of transversely disposed fret inlaying grooves therein spaced apart longitudinally thereof, said body member being provided with holes therethrough opening into said inlaying grooves, frets of molded plastic material on and across the outer side of said body member in positions partially inlaid in said grooves, respectively, and sprues of said fret-forming plastic material being extended into said holes, respectively, to bond said frets to said body member.

5. An all plastic, fretted finger board comprising a body member of molded plastic material, a string divider formed integrally with and disposed transversely across the outer end of said body member, said string divider being extended outwardly beyond the outer side of the body member and being provided with string receiving and spacing slots thereacross, and said string divider being also extended outwardly beyond the under-

side of said body to form a positioning flange for mounting the finger board.

6. An all-plastic fretted finger board comprised of a body member of plastic formed with a string divider integral therewith at and across the outer end of said plastic body member, and a master fret as a separate component molded onto and across the outer side of said body member and fixed thereto in rigid position thereon in immediate proximity to the inner side of said string divider.

7. An all-plastic fretted finger board comprising, a molded plastic body member formed with a string divider integral therewith disposed transversely across the outer end thereof, said string divider being formed with string spacing slots thereacross, a master fret molded as a separate component secured in rigid position across the outer side of the said body member immediately adjacent the inner side of said string divider, a series of frets each formed of plastic molded as separate components on and transversely across the outer side of said body member in rigid positions thereon spaced apart longitudinally thereof between said master fret and the inner end of said body member, and said master fret being formed of a thickness to project from the outer side of said body a greater distance than the distance of projection from the outer side of the body of each of the remaining frets.

8. An all-plastic fretted finger board comprised of; a plastic body member formed with a series of transversely disposed rows of holes therethrough spaced apart longitudinally along the member, frets of plastic material formed as separate components positioned on and across the outer side of said body member over said rows of holes, respectively, a plastic material bonding spine at and disposed longitudinally along the under side of said body member, a series of transversely disposed bonding ribs of plastic material at the under side of said body member extending across and being integrally joined with said bonding spine, and sprues of plastic material extended through the holes of each row of holes of said body member and being integrally joined with said frets and ribs to bond said frets into rigid positions on said body member.

9. The combination as defined in claim 8, in which the bonding spine and transverse bonding ribs are completely inlaid into the under side of the body member.

10. The combination as defined in claim 8, in which position markers integral with and formed from material of said bonding spine are inlaid in said body member.

11. A fretted finger board for stringed musical instruments comprising, a body member of plastic material, frets of plastic material formed as separate components positioned on said body member disposed transversely thereacross and spaced apart longitudinally therealong, said body member being formed with holes therethrough, and sprues of plastic integral with said frets extended into said holes of said body member to bond said frets to the body member.

12. An all-plastic fretted finger board comprising, in combination; a plastic string divider positioned disposed transversely across the outer end of said body member and being formed with string spacing slots therein extending transversely therethrough; a master fret of plastic material on said body member in position disposed transversely across the outer side thereof immediately adjacent the inner side of said string divider; a series of frets formed of plastic material disposed transversely across the outer side of said body member in positions thereon spaced apart longitudinally thereof between said master fret and the inner end of said body member; and said master fret being formed of a thickness to project from the outer side of said body a greater distance than the distance of projection of each of the remaining frets constituting said series of frets on said body member.

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