F. G. GASCHE.

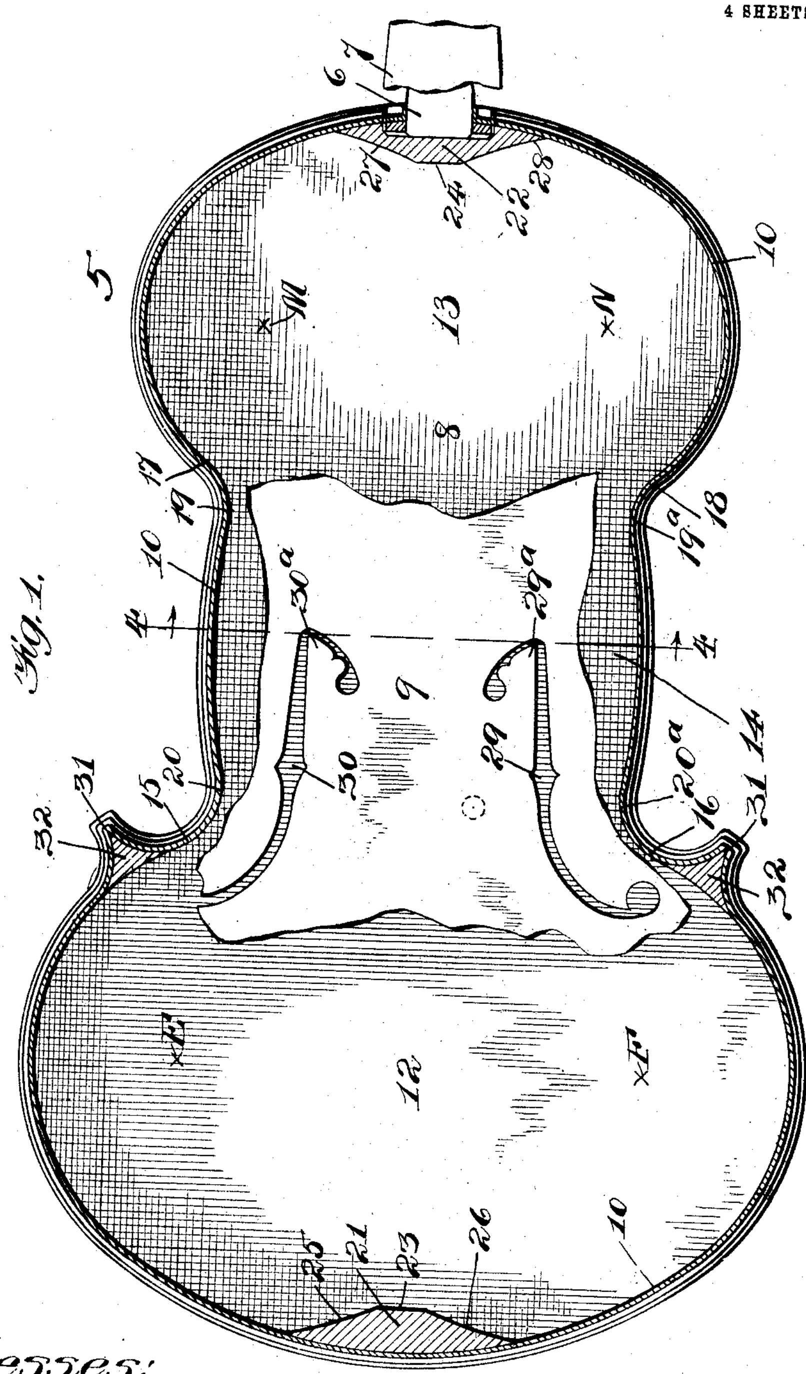
MUSICAL INSTRUMENT.

APPLICATION FILED APR. 27, 1905.

980,938.

Patented Jan. 10, 1911.

4 SHEETS—SHEET 1.



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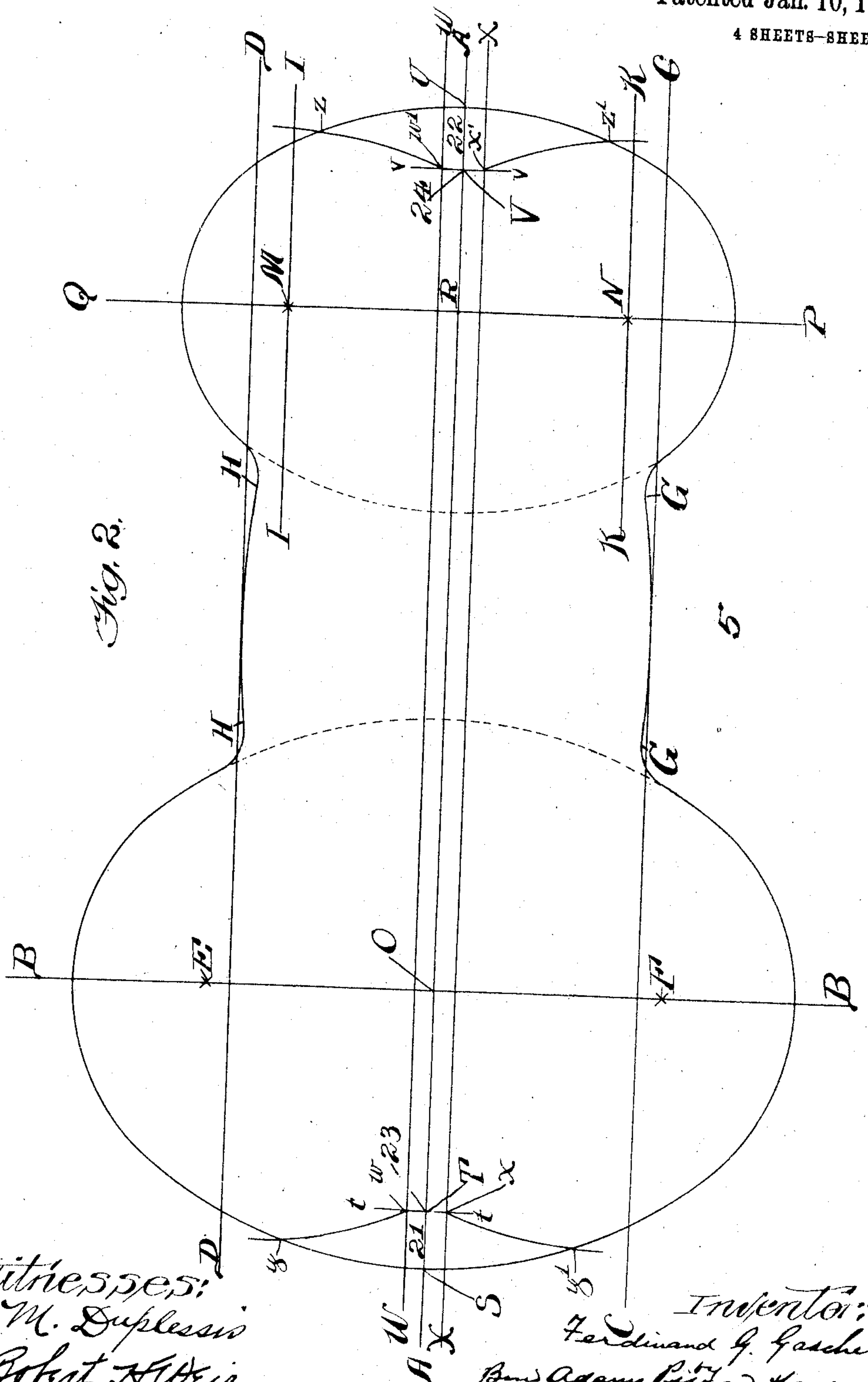

Fig. 2.

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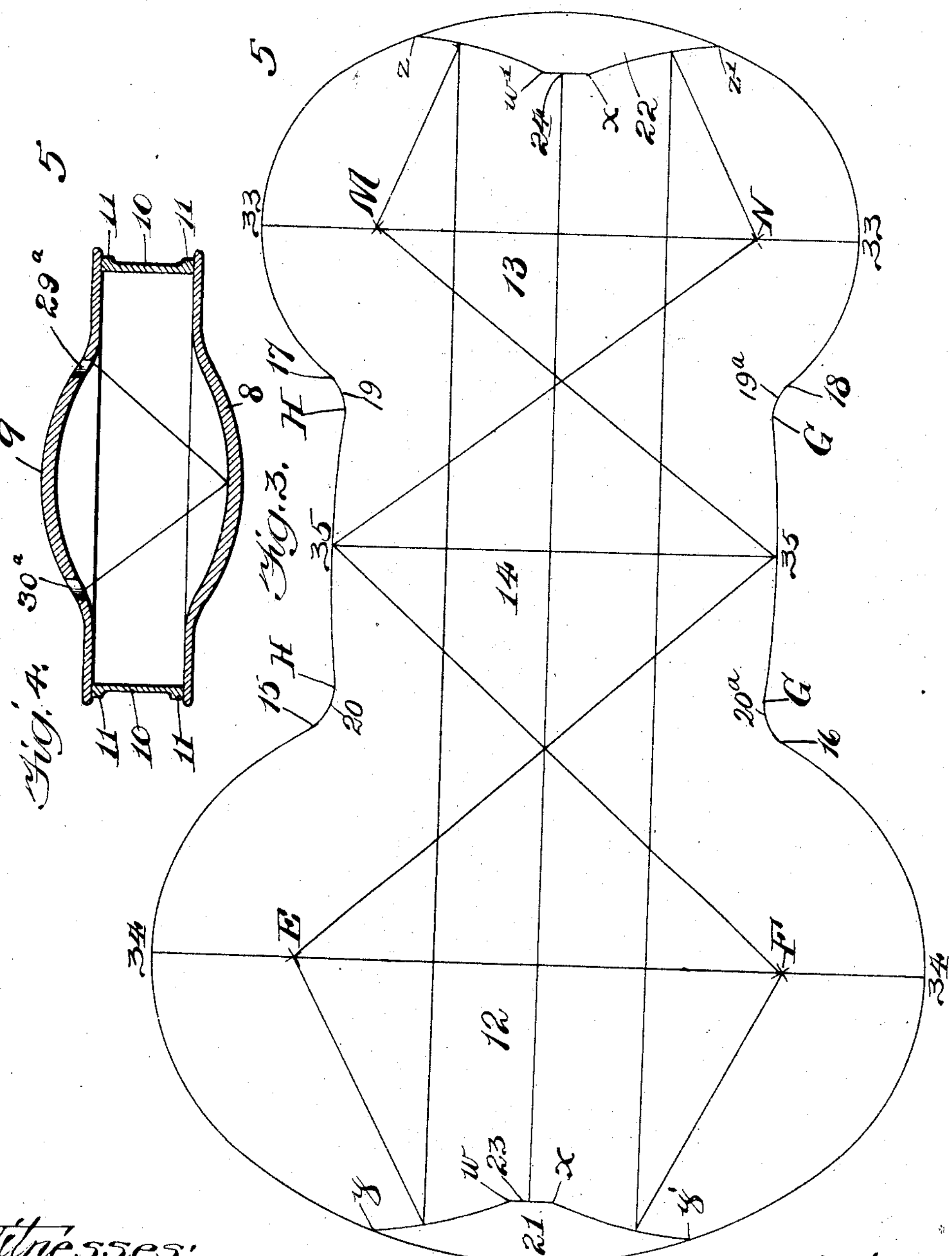

Fig. 3.

Fig. 4.

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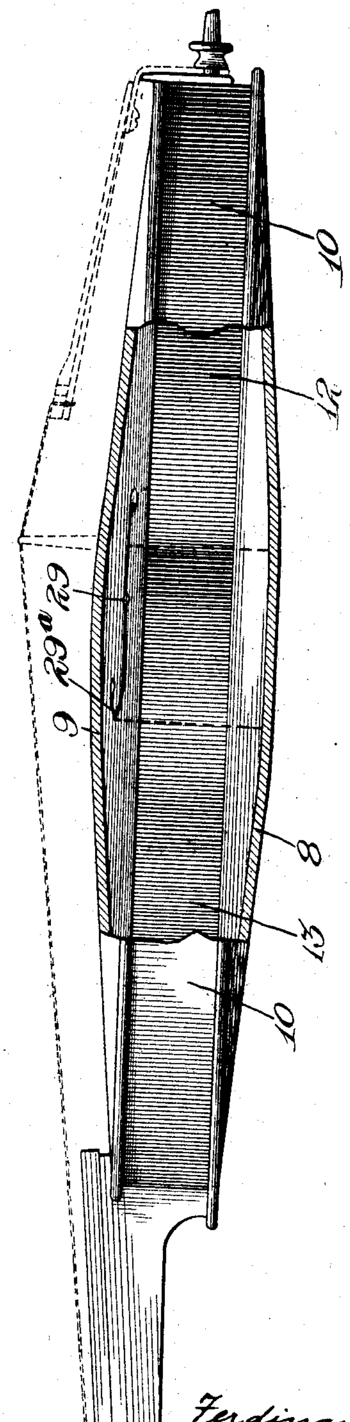

Fig. 5.

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UNITED STATES PATENT OFFICE.

FERDINAND G. GASCHE, OF CHICAGO, ILLINOIS.

MUSICAL INSTRUMENT.

980,938. Specification of Letters Patent. Patented Jan. 10, 1911.

Application filed April 27, 1905. Serial No. 257,766.

To all whom it may concern:

Be it known that I, FERDINAND G. GASCHE, a citizen of the United States, residing at Chicago, in the county of Cook, State of Illinois, have invented certain new and useful Improvements in Musical Instruments, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to musical instruments, and particularly to that class of musical instruments in which the tones are produced by setting strings in vibration and the pitch of the tones is obtained by stopping the strings with the fingers in the well-known manner. This class of instruments is well represented by the violin and instruments of its class, or by the guitar and instruments of its class.

It is the object of my invention to improve the sound-boxes of such instruments by constructing them of a certain predetermined shape, the various dimensions being determined as hereinafter poin'ed out, the bounding walls being formed in general in the preferred construction on parabolic or elliptical arcs, and certain of the dimensions of the various air spaces between the oppositely-disposed portions of the bounding walls being in harmonic relation to each other as hereinafter explained.

The means by which I have accomplished my object in a violin are illustrated in the drawings and hereinafter specifically described.

That which I believe to be new will be set forth in the claims.

In the drawings:—Figure 1 is a top or plan view of the body of such a violin, with the top mostly removed, leaving sufficient to show the position of the sound-holes. Fig. 2 is a diagrammatic view illustrating the method of laying out such an instrument. Fig. 3 is a diagrammatic view illustrating the shape of the sound-box. Fig. 4 is a cross-section on line 4—4 of Fig. 1. Fig. 5 is a side elevation, partly in section.

Referring to the several figures of the drawings,—5 indicates the body of a violin embodying my invention, provided with a neck 6 and finger-board 7, both broken away.

8 indicates the back and 9 the top of the body.

10 indicates the side strips provided with shoulders 11 glued between the top and back of the body as usual.

The sound-box of the violin shown in the drawings may be said to be divided into three main divisions or spaces, two end divisions 12 and 13, and the intermediate division 14. As shown in Fig. 1, the strips 10 are brought to a point at two places, wooden blocks 32 being inserted so as to conserve a smooth unbroken inside surface, as hereinafter explained. End-blocks 21—22 are also introduced, such blocks being formed as hereinafter set forth.

29—30 indicate sound-holes, preferably of substantially the shape shown, forming points 29^a—30^a located as hereinafter described.

The manner of laying out and constructing a violin in accordance with my invention will now be described.

The first step is the determination of a basic or fundamental length. This will be, in the case of a violin, preferably a length such that a closed air column of that length set into vibration without forcing will produce the note known as middle C,—namely, thirteen inches. In different instruments this fundamental length might be different, but in the following description I shall take such length as thirteen inches, the same being represented by L. At any point O along a line A—A (see Fig. 2), erect a line B—B perpendicular to said line A—A. Lay off on the lines O—B distances O—E and O—F each equal to 2/9 L. About E and F as foci lay out an ellipse whose major axis is 2/3 L and whose eccentricity is 2/3, as shown in said Fig. 2, said ellipse cutting the line A—A at S. Then lay off the lines D—D and C—C parallel with the line A—A and at a distance from it of 3/16 L. The lines I—I and K—K are next to be laid off also parallel with the line A—A and at a distance from it of 1/6 L. Then about E as one focus an ellipse whose major axis is L is drawn tangent to the lines C—C so that the other focus will be in the line I—I. About F as one focus, another ellipse whose major axis is L is drawn tangent to the line D—D so that its other focus will be in the line K—K. These foci are found to be the points M in the line I—I and N in the line K—K. Next about the points M and N as foci an ellipse is to be laid out whose major axis is 1/2 L and whose eccentricity is 2/3, as shown in Fig. 2, said ellipse cutting the line A—A at U.

The end-blocks 21—22 are located and determined as follows:—The portion of the line A—A between the points S and U will be found to be greater than L, the predetermined fundamental length. At a distance from S and T, respectively, equal to one-half the difference between L and the line S—U, the lines t—t, and v—v are next to be drawn perpendicular to the line A—A. Then lay out the straight line W—W parallel to the line A—A which will intersect the line t—t at w, and the line v—v at w', and at such a distance from A—A that the sum of the lines from E to w, from w to w' and from w' to M will equal 3/2 L, or one and one-half times the fundamental length. Similarly, lay out on the other side of the line A—A a second line X—X, parallel thereto, and intersecting lines t—t and v—v at x and x', respectively, and at such a distance from the line A—A that the sum of the lines from F to x, from x to x', and from x' to N will equal 3/2 L, or one and one-half times the fundamental length. With E as a focus and a line passing through E and parallel to the line A—A as an axis, draw a parabolic arc intersecting the line t—t at w and the larger ellipse at a point y. With F as a focus and a line passing through F and parallel to A—A as an axis, draw a parabolic arc intersecting the line t—t at x and the larger ellipse at y'. These parabolic arcs w—y and x—y' together with the portion of the straight line t—t included between the points w and x, will define the end-block 21. With M as a focus and a line passing through M and parallel to A—A as an axis, draw a parabolic arc intersecting the line v—v at w' and the smaller ellipse at z. Similarly with N as a focus and a line passing through N and parallel to A—A as an axis, draw a parabolic arc intersecting the line v—v at x', and the smaller ellipse at z'. These parabolic arcs w'—z and x'—z', together with that portion of the line v—v included between the points w' and x', will define the end-block 22. The portions of the ellipses thus described, as shown in solid lines in Fig. 2, are then to be joined by short arbitrary curves, thus finishing up the outline in accordance with which the side strips or ribs and the reinforcing blocks are to be formed and secured in place.

The location of the sound-holes 29—30 in the top 9 of the violin is determined by the position of the points 29^a—30^a. The point 29^a defined by the sound-hole 29 is located at a distance of 1/2 L from the focus E and at a distance of 2/5 L from the focus F. The point 30^a defined by the sound-hole 30 is located at a distance of 1/2 L from the focus F and at a distance of 2/5 L from the focus E. The top itself and the back 8 are to be curved arbitrarily to conform to any approved standard, with the exception of the portion of the back opposite to the sound-holes. This portion of the back,—say that portion opposite the sound-holes from the points 29^a—30^a to the foot of the bridge,—is to be bent so that the greater portion thereof between its edges conforms to a surface generated by the arc of an ellipse,—of which ellipse the foci are at the points 29^a—30^a, any such ellipse being utilized which extends between and beyond the lower edges of the ribs 10 as shown in Fig. 4,—when such ellipse is moved toward the bridge with its foci coinciding as nearly as possible, with the inner edges of the sound-holes. With the major axis of the ellipse partially bounding the space 12 equal to 2/3 L as described, it is evident that the length is such that a closed air column of the same length would without forcing produce the fifth above the fundamental tone, such fundamental tone being of course the tone produced by a closed column of air having a length equal to the fundamental length L, the distance between the faces 23—24 of the end-blocks 21—22. In case the fundamental tone were as above suggested middle C, then the tone produced by the closed column of air of a length equal to 2/3 L would be the G above middle C. The tone produced by a closed column of air of a length equal to 1/2 L, the length suggested for the major axis of the ellipse bounding the space 13, would be the octave of the fundamental tone, which in the case suggested would be the C above middle C. The tone produced by a closed column of air of a length equal to 3/8 L, the distance between the arcs H—H and G—G of the space 14, would be the octave of the major fourth of the fundamental tone, which in the case suggested would be the octave of the F above middle C.

The three tones above-mentioned,—namely the G above middle C, the octave of middle C, and the octave of the F above middle C,—are harmonious with middle C, and it is one of the important features of my invention that the tones produced by two air-columns of the same lengths as the lengths of the major axes of the two ellipses partially bounding the spaces 12 and 13 and a third tone produced by a closed column of the same length as the distance between the arcs G—G and H—H shall be harmonious with the fundamental tone. Thus in my improved sound-box, I provide a plurality of pairs of oppositely-disposed faces, of which, in the construction shown, the plane faces 23—24 of the end blocks are at a predetermined fundamental distance apart, the remaining pairs of oppositely-disposed faces in the construction shown being the ends of the larger and smaller ellipses, respectively, and the oppositely-disposed arcs H—H and G—G, the distances apart of the faces of which several pairs of oppositely-disposed faces are indicated by the lines 34—34, 33—33 and 35—35, respectively, all of which distances are in harmonious relation to the fundamental distance,—that is to say, the distances are such that closed air-columns of such lengths would, vibrating naturally without forcing, produce tones harmonious with the fundamental tone. With this feature in mind, it is evident that other dimensions might well be given to the different parts. For example, the major axis of the ellipse partially bounding the space 12 might be 3/5 L, when the tone would be the major sixth above the fundamental. Or this major axis might be 5/8 L, when the tone would be the minor sixth above the fundamental. Or the major axis might be 4/5 L, perhaps, when the tone would be the major third above the fundamental. The distance between the arcs G—G and H—H might be made, for example, 1/3 L in place of 3/8 L as above suggested, when the tone would be the octave of the fifth above the fundamental. All of these alternative tones, produced by closed air columns of lengths equal to the above-suggested alternative dimensions, are harmonious with the fundamental tone. Other dimensions might be used even in a violin, perhaps, without departing to any very great extent from the usual general shape of the instrument, and it is evident that in instruments other than a violin many different dimensions might be used without departing from my invention. While I have said above that some other distance than thirteen inches might be employed between the end-blocks 21—22, still it is considered preferable in a violin that this distance be used. In other instruments, any other desired distance might be used to as good advantage, thus establishing some fundamental tone other than middle C.

In a violin constructed in accordance with the dimensions first above suggested, it is evident that the distance from the focus E to any point along the arc 15—y or 16—y' plus the distance from that point to the focus F equals 2/3 L, the length of a closed air-column which would produce the G above middle C. Likewise, the distance from the focus M to any point along the arc 17—z or the arc 18—z' plus the distance from that point to the focus N equals 1/2 L, the length of a closed air column which would produce the octave of middle C. Likewise, the distance from the focus E to any point in the parabolic arc y—w, plus the distance from that point along a line parallel with the central longitudinal line of the violin to the point where such line cuts the parabolic arc z—w', plus the distance from that point to the focus M equals 3/2, the length of a closed air column which would produce the F below middle C. On the other side of the instrument, the distance from the focus F to any point in the parabolic arc x—y', plus the distance from that point along a line parallel with the central longitudinal line of the violin to the point where such line cuts the parabolic arc x'—z', plus the distance from that point to the focus N also equals 3/2 L. The distance from the focus E to any point along the arc G—G plus the distance from that point to the focus M, as also the distance from the focus F to any point along the arc H—H plus the distance from that point to the focus N, equals L, the length of a closed air-column which would produce the fundamental tone.

What I claim as my invention and desire to secure by Letters Patent is,—

1. A sound-box for musical instruments comprising a plurality of pairs of oppositely-disposed faces, the faces of one pair of which are at a predetermined fundamental distance apart, the distance between the faces of each of said other pairs of oppositely-disposed faces being in harmonic relation to said fundamental distance.

2. A resonance-box for stringed instruments having its ends formed on elliptical arcs, the lengths of the major axes of said ellipses being in harmonic relation to each other.

3. A resonance-box for stringed instruments having its ends formed on elliptical arcs, the lengths of the major axes of said ellipses being in harmonic relation to the distance between the oppositely-disposed end faces of the box.

4. A resonance-box for stringed instruments having its ends formed on elliptical arcs, the lengths of the major axes of said ellipses being in harmonic relation to each other and in harmonic relation to the distance between the oppositely-disposed end faces of the box.

5. A resonance box for stringed instruments having its ends formed on elliptical arcs and having blocks in the ends of said box with plane central faces, the lengths of the major axes of said ellipses being in harmonic relation to each other and in harmonic relation to the distance between the plane faces of said end-blocks.

6. A resonance box for stringed instruments with ends formed on elliptical arcs, and blocks in the ends of said box having central plane faces, the central portions of the sides of said box being formed on elliptical arcs whose foci are respectively two of the foci of said first-named arcs, the lengths of the major axes of said ellipses being in harmonic relation to each other and to the distance between the plane faces of said end-blocks.

7. A resonance box for stringed instruments having its ends formed on elliptical arcs and having blocks in the ends of said resonance box, said blocks having central

plane faces and parabolic sides whose foci are respectively the same as the nearest foci of said elliptical arcs, the central portions of the sides of said box being formed on elliptical arcs whose foci are respectively two of the foci of said first-named arcs, the lengths of the major axes of said ellipses being in harmonic relation to each other and to the distance between the plane faces of said end-blocks.

8. A resonance box for stringed instruments with its ends formed on elliptical arcs, and blocks in the ends of said box having central plane faces and parabolic sides, the foci of said parabolas coinciding with the adjacent foci of said ellipses, the axes of said parabolas being parallel with the central longitudinal line of the instrument, and the distance from each focus to the adjacent parabola plus the distance from that point along a line parallel with the central longitudinal line of the instrument to the parabola at the opposite end of the instrument plus the distance from that point to the nearest focus, and also the lengths of the major axes of said ellipses, being in harmonic relation to the distance between the central plane faces of said end-blocks.

9. A resonance box for stringed instruments having its ends formed on elliptical arcs, the central portion of the side of said box at each side of the central longitudinal line of the instrument being formed on an elliptical arc whose foci coincide with the foci of said first-mentioned ellipses that are located on the opposite side of said central longitudinal line of the instrument, the lengths of the major axes of all of said ellipses being in harmonic relation to the distance between the inner end faces of said instrument.

10. A resonance box for stringed instruments having its ends formed on elliptical arcs, the central portion of the side of said box at each side of the central longitudinal line of the instrument being formed on an elliptical arc whose foci coincide with the foci of said first-mentioned ellipses that are located on the opposite side of said central longitudinal line of the instrument, the lengths of the major axes of all of said ellipses and the distance between said second-mentioned elliptical arcs being in harmonic relation to the distance between the inner end faces of said instrument.

11. A resonance box for stringed instruments having its ends formed on elliptical arcs and having blocks in its ends, said blocks having central plane faces and parabolic sides, the foci of said parabolas coinciding with the adjacent foci of said ellipses, the axes of said parabolas being parallel with the central longitudinal line of the instrument, the central portion of the side of said box at each side of said central longitudinal line being formed on an elliptical arc whose foci coincide with the foci of said first-mentioned ellipses that are located on the opposite side of said central longitudinal line, the distance from each focus to the adjacent parabolic arc plus the distance from that point along a line parallel with the said central longitudinal line to the parabolic arc at the opposite end of the instrument plus the distance from that point to the nearest focus, and the distance between said elliptical arcs which form the central side boundaries, and the lengths of the major axes of all of said ellipses, being in harmonic relation to the distance between the faces of said end-blocks.

12. A sound-box for musical instruments having a back, a top, and side ribs, and having pointed sound-holes in its top, and having the inner surface of the back opposite the sound-holes curved in the form of a cylindrical surface whose generating curve is a portion of an ellipse whose foci are the points of the sound-holes.

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