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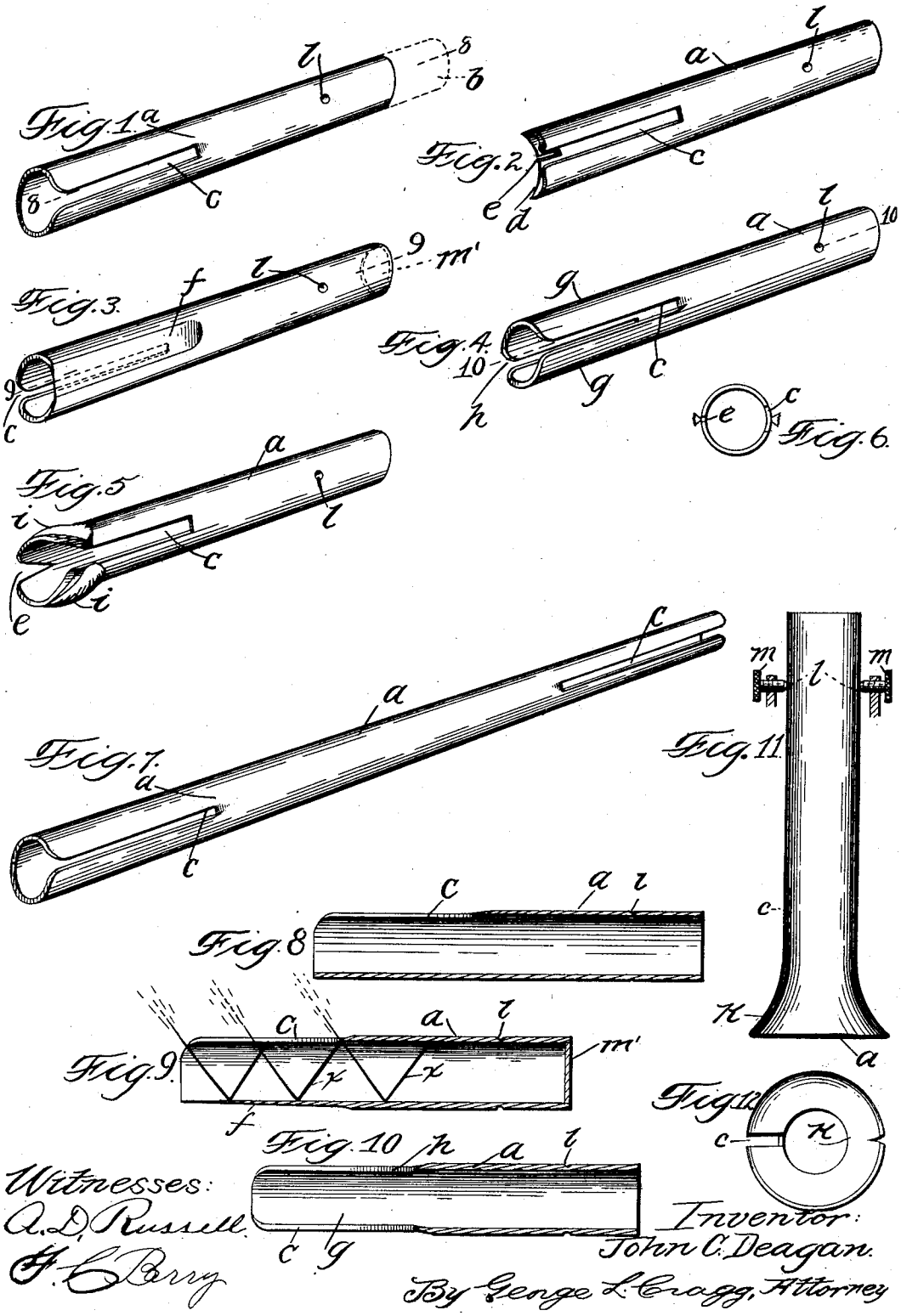
J. C. DEAGAN.

MUSICAL INSTRUMENT.

APPLICATION FILED NOV. 4, 1902.

NO MODEL.



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UNITED STATES PATENT OFFICE.

JOHN C. DEAGAN, OF CHICAGO, ILLINOIS.

MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 734,676, dated July 28, 1903.

Application filed November 4, 1902. Serial No. 130,041. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. DEAGAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Musical Instruments, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to tubular bells.

It is a part of my invention to so construct the bell that the tubular structure thereof or substantially the entire tubular structure will act to encompass or determine the resonating or sympathetic air column, while a portion of the tube will be especially adapted to determine or sound the note while performing the additional function of determining or confining a portion of the air column.

In the device of my United States Patent No. 644,817, dated March 6, 1900, the note-sounding element performs substantially no part in confining or determining the location or extent of the air column, being practically a single-reed extension of a closed tubular structure that served to determine the air column, the main vibrating element of the instrument of the prior patent and the tubular continuation thereof performing distinct and uncommon functions. In addition to the structural advantage that is gained I am enabled to secure bells that produce most effective sounds or tones of remarkable timbre or tone color, the bells at the same time being adapted, according to their construction, to a wide range of pitch and intensity.

In practicing my invention I construct each tube of a length suited to an air column corresponding to a selected note or sound, the tube being preferably cut from a continuous length of tubing corresponding approximately to the desired size. I do not, however, wish to be limited to the precise way in which the invention is practiced. The air column may be accurately gaged before the tube is modified to complete the same into a bell by those skilled in this art, a tube of a diameter corresponding to a particular range of octave being selected. The tube thus initially selected and gaged is not in its primitive character adapted to constitute an effective bell.

The invention, broadly speaking, therefore comprises the tube that has a portion of its length constructed to vibrate in consonance with a selected note or sound, which vibrating tubular portion is so constructed as not to lose its function in defining or encompassing a sympathetic air column.

In completing the device of the invention I modify the structural characteristics of a portion of the tube, which will not deprive it of its primary function of gaging or determining the air column, yet which will supply to the tube an additional function of producing musical tones of requisite intensity and pitch. To this end the cross-section of the tube is modified, preferably by removing a portion of the tube, to permit the remainder thereof in the same zone to musically vibrate. In the preferred embodiment of the invention the portion of the tube that is to have the musical function added to it is preferably longitudinally cut away in part and to an extent to free this part of the tube and permit the same to vibrate. The segmental section of the tube that remains subdivides itself into symmetrical tone-producing elements that vibrate transversely in respect to the axis of the tube.

I have found that a tube having its cross-sections modified only by the provision of a single slot at one end thereof is well adapted to produce a short acute sound. It is frequently desirable to assist the modified portion of the tube in musically subdividing itself into symmetrical halves, to which end the cross-section of the portion of the tube is modified at diametrically opposite points, supplemental modification being effected either by weakening the metal opposite the slot or providing a second slot in the tube. I find that where a tube or bell is provided with a long slot upon one side and a short slot diametrically opposite and at the same end a tone less acute than the tone of the previous construction is secured, which is also longer in duration. When the cross-section of the tube opposite the slot is modified without entirely removing the metal, a more singing bell-like tone is secured that is less acute and of

longer vibration, this being true especially where the modification of the cross-section is accomplished by filing the tube partially away through a length corresponding to the length in the slot.

In another form I have provided diametrically opposite slots throughout a portion of the length of the tube, which are coextensive, by which construction there results two distinct segments at one end of the tube, which together constitute a vibrating fork, yet which coöperate with the modified balance of the tube in determining the sympathetic air-column.

An instrument constructed as just stated produces a tone that is very bell-like or singing and that is not so acute in its vibrations. The adjustment of the tube may not only be effected by removing or grinding metal away, but the tube may also be adjusted by adding metal—as, for example, by supplying solder thereto or making the end of the tube bell shape.

In some instances I have provided a tube having both ends slotted, serving to greatly intensify the vibration of the air column between the slotted ends. As a general proposition, where a number of tubular bells constructed in accordance with my invention are assembled into a composite musical scale to get the best effects the notes in the scale are dependent upon the length of the tubes and their diameters, the tubes corresponding to any particular octave, being preferably of the same diameter and of different lengths, while the tubes corresponding to different octaves are of different diameters. A tube sounding a note in one octave, however, may be forced to sound a corresponding note in the octave next beneath by closing up one end of the tube and weakening the tone-producing part of the tube, preferably at the base of the slot, thus modifying the sympathetic character of the air column to such an extent as to cause the same to sound a note in the octave below. The tubes may be constructed of any metal or other material having suitable resonant properties, cold-drawn steel tubing being well adapted to the purpose.

I will explain my invention more fully by reference to the accompanying drawings, in which—

Figures 1, 2, 3, 4, and 5 illustrate different forms of the preferred embodiment of my invention in perspective. Fig. 6 is an end view of the structure shown in Fig. 2. Fig. 7 is a perspective view of a bell slotted at both ends. Fig. 8 is a longitudinal sectional view on line 8 8 of Fig. 1. Fig. 9 is a longitudinal sectional view on line 9 9 of Fig. 3. Fig. 10 is a longitudinal sectional view on line 10 10 of Fig. 4. Fig. 11 is a view in elevation of a tube and illustrating one of many ways that may be employed for supporting the same. Fig. 12 is a view of the lower end of the tube illustrated in Fig. 11.

Like parts are indicated by similar characters of reference throughout the different figures.

In Fig. 1 a tube *a* has had a section, as section *b*, (indicated by dotted lines,) removed therefrom, so as to enable the tube to complete or determine a sympathetic air column that is substantially in correspondence or consonance with the note that is to be produced, which fact may be determined by one skilled in this art by blowing into the tube. In order that the tube may when struck be permitted to vibrate to produce a note corresponding to the sympathetic air column, the cross-section of a portion of the tube is modified to impart to it the requisite characteristic, which result is most desirably accomplished by providing a slot *c*, extending from one end of the tube far enough toward the other end so that when the tube is struck at its slotted end, preferably on the side near the end, the requisite vibration will be set up. A mallet may be used to strike or a bow may be drawn across the slots to produce the sounds.

By the construction illustrated in Fig. 1 the tone is more acute and short than that illustrated in Figs. 2 and 6, which has its tone modified by filing the lower end away, as indicated at *d*, and the provision of a short slot *e* at the same end with the slot *c*. Filing material, as metal, away at *d* sharpens the tone.

In the form indicated in Figs. 3 and 9 instead of slotting the metal at a point diametrically opposite the slot *c* the metal is filed away, as indicated at *f*, or otherwise removed to secure the required tonal adjustment.

In the form illustrated in Figs. 4 and 10 the lower end of the tube is subdivided into segmental tines *g g* by providing in the lower portion of the tube a slot *h* in addition to the slot *c*, the slots being coextensive in length and diametrically opposite. In the form illustrated in Figs. 3 and 9 the tone produced is singing or bell-like and with long vibration.

In the form illustrated in Figs. 4 and 10 the tone is even more bell-like or singing and of longer vibration than that produced by the tube illustrated in Figs. 3 and 9. If the tone is too sharp, it may be modified by increasing the cross-section of the modified portion of the tube, as by the addition of solder at *i i*. (Shown in Fig. 5, the construction illustrated in this figure also having a small slot *e*, similar to the correspondingly-lettered slot in Fig. 2.)

The form of instrument illustrated in Figs. 11 and 12 is one that is capable of producing an extremely beautiful note, which is enhanced by the bell-like terminal *k*. The tubes may be suspended in any suitable way, preferably at the nodal points in the walls thereof, such nodal points being indicated in the particular form of tube shown at *l*. One instrumentality for supporting the tubes is

shown at Fig. 11, wherein trunnion-screws *m* in suitable trunnion-supports are shown in engagement with the nodal sockets *l* in the tube. The plug *m'* in the tube illustrated in Figs. 3 and 9 is adapted to cause this tube to produce a note an octave lower than it would otherwise produce. It is to be understood that each of the tubes is provided with a support at or near the nodal points or neutral zone therein, as indicated in Fig. 11, for example. The form of the support is not material so long as the tube is free to produce the desired note.

The musical tube of my invention is one wherein the sound is reflected, the sound-waves reverberating transversely back and forth, as diagrammatically indicated by the lines *x x*, Fig. 9, that indicate angles of incidence and reflection of the sound, making it very pleasing to the ear.

It will be apparent that I have disclosed in the drawings a variety of constructions whereby metal is provided opposite the slot through which sound is reflected transversely to the tube. In Figs. 2 and 5 are illustrated opposite the main slot slots of smaller size to leave a balance of metal acting as a sound-reflector to reflect the sound transversely. I do not, therefore, desire to be limited to a construction having absolutely no slot opposite the main slot.

It will be observed that the slot *c* in each tube is narrower than the diameter of the tube to afford overhanging metallic portions that are capable of having vibrations set up therein that are reflected from the metal opposite the said slot—a construction that is distinct from structures of the prior art where the tube is cut away to its diameter, leaving no portions overhanging the diametrical plane. These overhanging marginal portions of the slot perform the function of setting up the vibrations that are directed toward the metal back of the slot and by this metal reflected through the slot.

It is well known that ordinary flaring bells are rarely capable of producing sounds without overtones, because it is so difficult to make them homogeneous or of even cross-section throughout. By my invention I am enabled to make the tube of uniform cross-section or homogeneous throughout, so that the overtones may readily be eliminated.

The preferred embodiment of the invention resides in the tube having one slot that is of considerable length, opposite which slot the tube is closed either in the manner indicated in Figs. 1, 3, 7, 8, and 9 or in the manner indicated in Figs. 2, 5, 6, 11, and 12. In the figures of the drawings just mentioned there is always present a surface opposite the slot in each particular tube that serves to promote the reflection of sound-waves transversely to the tube to reinforce the sound, giving a result that has hitherto never been accomplished.

The uses to which the device of my invention may be put are numerous, and I do not, therefore, wish to be limited to the precise disclosure herein set forth, as it is obvious that changes may be made without departing from the spirit of my invention.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A bell in the form of an open tube having a slot extending longitudinally of the tube, the portion of the tube where this slot is located and the balance of the tube together determining the air column, the metal of the tube being tuned to correspond to said air column, the tube being closed opposite the slot therein to promote the reflection of sound-waves transversely to the tube, substantially as described.

2. A bell in the form of an open tube having a slot extending longitudinally of the tube, the portion of the tube where this slot is located and the balance of the tube together determining the air column, the metal of the tube being tuned to correspond to said air column, the tube having a portion opposite the slot therein, to promote the reflection of sound transversely through the said slot, substantially as described.

3. A bell in the form of a tube, having a slot extending longitudinally of the tube, the said slot being narrower than the diameter of the tube, whereby both portions of the tube that margin the said slot overhang a diametrical plane, the overhanging marginal portions of the slot extending sufficiently toward each other so that these marginal portions will when set in vibration, direct sound-waves against the metal opposite the slot which latter metal in turn serves to reflect the sound-waves through the slot, the tube being closed opposite the slot therein to promote the reflection of sound-waves transversely to the tube, substantially as described.

4. A bell in the form of a tube having a slot extending longitudinally of the tube, the portion of the tube where this slot is located and the balance of the tube together determining the air column, the metal of the tube being tuned to correspond to said air column, the tube being closed opposite the slot therein to promote the reflection of sound-waves transversely to the tube, substantially as described.

5. A bell in the form of a tube having a slot extending longitudinally of the tube, the portion of the tube where this slot is located and the balance of the tube together determining the air column, the metal of the tube being tuned to correspond to said air column, the tube having a portion opposite the slot therein to promote the reflection of sound transversely through the said slot, substantially as described.

6. A bell in the form of a tube, having a slot extending longitudinally of the tube, the said slot being narrower than the diameter

of the tube whereby portions of the tube that margin the said slot overhang a diametrical plane, the overhanging marginal portions of the slot extending sufficiently toward each other so that these marginal portions will when set in vibration, direct sound-waves against the metal opposite the slot which latter metal in turn serves to reflect the sound-waves through the slot, the tube having metal opposite the slot to promote the reflections of sound-waves transversely to the tube, substantially as described.

7. A tubular bell in the form of a tube having two slots extending longitudinally thereof, the said slots being of different sizes whereby metal remaining at the smaller slot acts to promote the reflection of sound-waves transversely to the tube through the larger slot, substantially as described.

8. A tubular bell formed of a tube having two slots extending longitudinally thereof, the said slots being of different lengths whereby metal remaining at the shorter slot acts to promote the reflection of sound-waves transversely to the tube through the longer slot, substantially as described.

In witness whereof I hereunto subscribe my name this 31st day of October, A. D. 1902.

JOHN C. DEAGAN.

Witnesses:

J. C. DEAGAN, Jr.,

GEORGE L. CRAGG.