Feb. 21, 1933. L. J. GRUBMAN 1,898,773

SOUND PRODUCING DEVICE

Filed March 5, 1932

Fig. 1.

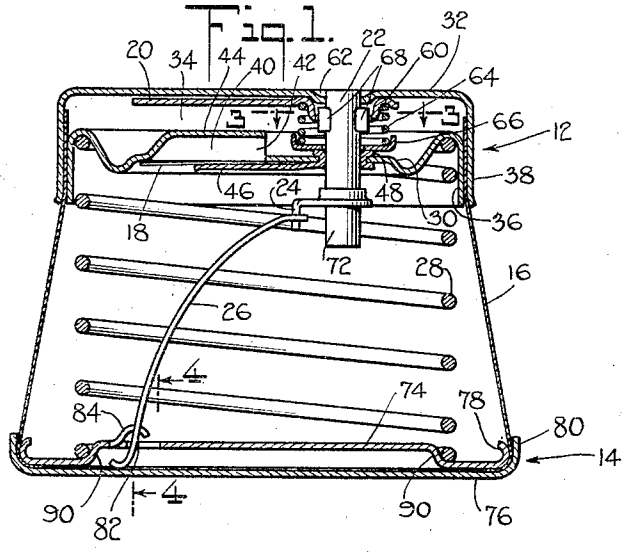


Fig. 2.

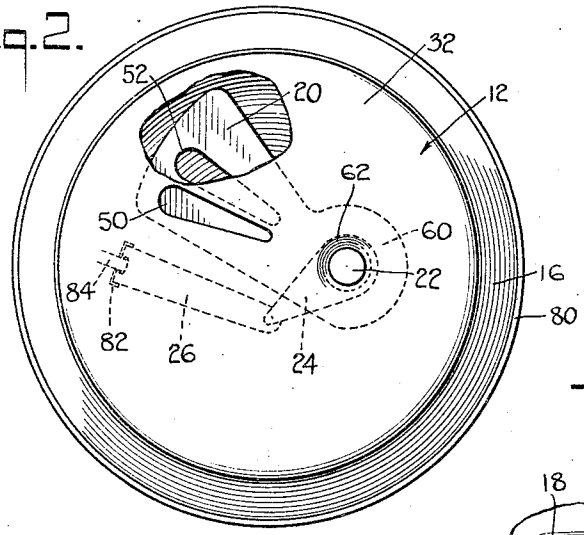


Fig. 5.

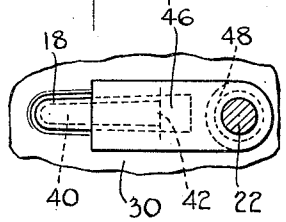


Fig. 4.

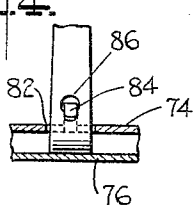
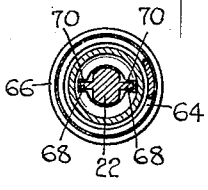


Fig. 3.



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UNITED STATES PATENT OFFICE

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SOUND PRODUCING DEVICE

Application filed March 5, 1932. Serial No. 597,006.

This invention relates to sound producing devices, and more particularly to an articulative sound producing device for use in dolls and similar toys.

The primary and general object of the present invention is to improve articulative sound producing devices with a view to simplifying the construction thereof, reducing the manufacturing cost thereof, and improving the operating characteristics thereof. A more particularized but important object of the present invention resides in the provision of such a sound producing device which will be exceedingly compact in an axial direction, thereby fitting it for use in dolls or other toys in which there is no room for the ordinary relatively lengthy form of sound producing mechanism.

Articulative sound producing devices generally comprise bellows, a second producing device, and valve mechanism for modulating the sound produced in order to obtain the desired articulation. If the valve mechanism consists of telescopically related tubes with appropriate mating apertures, the resulting mechanism becomes relatively long in an axial direction. Also, if a valve of the vane type is used with the vane moving in a plane parallel to the axis of the sound producing device, such valve adds greatly to the length of the unit. Even if the vane is used in a plane transverse of the axis of the unit, the undesirable large dimension of the unit may remain necessary due to the use, for example, of a twisted shaft or thread for rotating the vane valve. One of the objects of my invention is to overcome the foregoing difficulties and to obtain a compact unit, which I do by means of a sound producing device comprising relatively movable heads interconnected by a flexible bellows, one of the heads being provided with a vane valve oscillatable in the plane of the head, and by providing the necessary oscillation of the vane valve by means of a connecting rod coupled at one end to the valve and at the opposite end to the other head of the unit, so that the valve is operated when the heads of the unit are moved relative to one another. In accordance with a further feature and object of my invention, injury of the parts of the device by reason of excessive movement of the heads is avoided, and large manufacturing tolerances are permitted in the operating mechanism for the valve, by making the aforesaid connecting rod in the form of a resilient or flexible strip of metal which tends to bend rather than break the operating parts of the sound producing device.

In order to articulate a word such as "mama", the valve mechanism must provide small and large sound discharge openings in succession, and when using a vane valve it is necessary to employ small and large openings in the vane valve or/and the surface over which it rides, in order to obtain the desired articulation. The vane valve must slide with a close and accurate fit over the surface with which it cooperates, which in turn requires accurate and careful finish of the various openings in the valve and surface in order to prevent mechanical interference by reason of feathered edges or other imperfections caused when the openings are produced by a simple stamping operation. Furthermore, if the valve is oscillated by a shaft, it must be secured to the shaft with extreme precision, and the shaft must itself be related to the bearing surface with extreme precision if the desired close fit between the vane and surface is to be maintained during oscillation of the shaft. Further objects of the present invention are to overcome all of the various foregoing difficulties, and to simplify and cheapen the construction of the valve mechanism, which objects are fulfilled by providing the valve and cooperating surface with openings intended to permit free discharge, while the valve is spaced slightly from the surface in order to provide a constricted passage when the discharge openings are blanked off by the valve. With this construction it is not necessary to provide small openings in addition to the large openings; the extent of oscillation needed to operate the valve is reduced; imperfections on the valve and cooperating surface are harmless because the surfaces are anyway spaced apart; and frictional re-

sistance to oscillation of the valve is reduced. Furthermore, I prefer to rotate the valve by means of a shaft to which it is loosely splined, the valve meanwhile independently seating itself upon a small bearing surface against which it is yieldably held by resilient means. This construction in turn insures uniform spacing between the valve and cooperating surface, and dispenses with the necessity of accurately relating the valve to the shaft and the shaft to the surface.

As has already been explained, an important feature of the present device is its compactness in an axial direction. In accordance with further features and objects of the present invention, this compactness is enhanced by making the relatively movable heads of the unit themselves thin or compact axially. One of these heads comprises an inner supporting plate and an outer cap spaced therefrom, the supporting plate carrying sound producing means, and the outer cap cooperating with the vane valve. In order to reduce the necessary spacing between the supporting plate and the outer cap, I arrange the reed of the sound producing device in parallel relation to the supporting plate on which it is mounted, and I arrange the vane valve for operation in a plane parallel to the cap on which it is mounted, thus making it possible for the plate and cap to be positioned quite closely together and thereby greatly reducing the thickness of the complete head. A further object of the invention is to provide ample room for the vane and reed particularly when disposed in parallel relation as aforesaid, and with this object in view the operating shaft for oscillating the vane, which shaft extends through the supporting plate and cap of the head, is preferably offset a substantial distance from the center of the head. This eccentric mounting greatly increases the room on one side of the shaft, in which the reed and vane may be located.

Further objects of the present invention reside in the provision of means for securing the flexible bellows to each of the heads of the unit; means to pivotally connect the lower end of the connecting rod to the bottom head of the unit; means adapting the unit particularly for manual operation, including the use of resilient means between the heads for keeping the bellows normally in distended relation; means to accurately fix the location of such a restoring spring; and simplified and combined means for mounting the reed in place and for bearing the valve operating crank shaft.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, my invention consists in the sound producing device and the elements thereof, and their relation one to the other as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by a drawing, in which:

Fig. 1 is a section taken in elevation through a preferred form of manually operable articulative sound producing device embodying features of my invention;

Fig. 2 is a plan view of the same with a portion of the top cap cut away;

Fig. 3 is a section taken in the plane of the line 3—3 in Fig. 1;

Fig. 4 shows a detail looking in the direction of the arrows 4—4 in Fig. 1; and

Fig. 5 is an inverted plan view of a portion of the movable head, showing how the sound producing reed is held in place.

Referring to the drawing and particularly to Fig. 1 thereof, the sound producing device of my invention comprises a pair of relatively movable heads, generally designated 12 and 14, interconnected by a flexible bellows 16. The head 12 is provided with a sound producing device 18 and with valve mechanism for modulating the sound produced thereby, said valve mechanism including a vane valve 20 oscillated by a crank shaft 22, the crank 24 of which is in turn moved by a connecting rod 26 extending from crank 24 to the other head 14 of the complete unit. When the unit is intended for manual operation, as is here the case, it is preferably provided with resilient restoring means 28 mounted between the heads 12 and 14 of the unit and serving to normally keep the bellows 16 in distended condition. Upon relative movement of the heads 12 and 14, as by compression of the unit, it will be evident that air will be expelled from bellows 16 through sound producing means 18, and that the sound thus produced will be discharged from head 12 only as permitted and modulated by valve 20, which in turn is moved during the compression of the unit by reason of the crank and connecting rod mechanism 24, 26.

In the more detailed description which follows, I shall for the sake of convenience refer to the head 12 as the upper or movable head, and to the head 14 as the lower or stationary head, but it will be understood that in actual operation either or both of the heads 12 and 14 may be moved so long as relative movement results, and the unit may be positioned upside down, horizontally, or in any desired direction. Of course, when placed in a doll for manual operation, the unit is preferably arranged with its axis horizontal when the doll is erect, and the unit preferably extends in the conventional manner from the stomach to the back of the doll so that it may be operated by squeezing the body of the doll. It is with this position in mind that it becomes exceedingly desirable to reduce the axial dimension of the

unit so that it may be mounted in dolls of small and medium size.

Movable head 12 consists of an inner supporting plate 30 and an outside cap 32 which are spaced apart to form a sound chamber 34. The elements 30 and 32 are both stamped from sheet metal and are drawn with downwardly depending mating flanges 36 and 38 respectively. The bellows 16 may be made of thin flexible fabric and is preferably in the shape of the frustrum of a cone the upper open end of which is secured between the flanges 36 and 38.

The sound producing means comprises a vibratile reed 18 cooperating with a channel 40 having an open discharge end 42 leading into sound chamber 34. Channel 40 is formed by striking a portion of the sheet metal supporting plate 30 upwardly, as is indicated at 44. Reed 18 is in the form of a thin elongated strip of resilient metal the stationary end of which is clamped between supporting plate 30 and a securing means 46, the opposite end of which may be formed into an annular flange 48 which acts as a rivet for securing the means 46 to supporting plate 30. The part 48 is thus both a flange on member 46 and a rivet securing member 46 to supporting plate 30. The shape of supporting plate 30 immediately surrounding channel 40 is so related to the free end of reed 18 as to provide clearance for vibration of the reed. The latter meanwhile is directly exposed to the air stream forced from bellows 16 when head 12 is depressed, for except at reed 18 the supporting plate 30 serves to completely close the upper end of the bellows.

The valve mechanism for modulating the sound produced by the reed 18 consists essentially of a reciprocable valve plate 20 which is movable relative to a discharge opening 50 in cap 32. Reciprocable plate 20 is preferably in the form of a vane oscillatable about shaft 22 as a center. Vane valve 20 is provided with a single large discharge opening 52 adapted to register with the discharge opening 50. In actual operation the vane valve is initially positioned as shown in Fig. 2, the discharge opening 50 being blanked off by the leading portion of the vane valve. The vane valve, however, is slightly spaced from the surface of cap 32, as is clearly indicated in Fig. 1, and sound is therefore permitted to flow around the vane between the vane and the cap and finally out of discharge opening 50, thus providing a constricted passage for the sound, which results in the production of the consonant sound "m". When movable head 12 is moved toward stationary head 14, the connecting rod 26 causes a counter-clockwise (in Fig. 2) movement of crank 24 and consequently of the vane valve 20. This brings the opening 52 in the valve into registry with the discharge opening 50 of the cap and thus permits free discharge of sound, and produces the vowel sound "ah". Further movement of head 12 toward head 14 results in further counter-clockwise oscillation of vane 20, causing the opening 52 to pass the opening 50, whereupon the latter is blanked off by the trailing portion of vane 20. Here again a constricted opening remains due to the slight spacing between the valve and the surface of the cap, and consequently the consonant sound "m" is again produced. Continued movement of head 12 toward head 14 results in further counter-clockwise oscillation of vane 20 until even the trailing edge thereof passes discharge opening 50, thus again clearing the discharge opening for free passage of sound, and again producing the vowel sound "ah". The complete compression of the unit therefore articulates the word "mama". It will be noted, from an inspection of Fig. 2, that the entire necessary movement of vane valve 20 covers only a small arc considerably less than quadrature, and the necessary movement is therefore readily obtainable by a crank and connecting rod arrangement such as is herein disclosed.

The desired slight spacing between vane valve 20 and cap 32 is preferably obtained by arranging a special bearing surface or ring between the valve and the cap. In the present case this bearing surface is made by pressing the surface of the vane upwardly to form a convex bearing ring 60 concentrically related to the shaft 22. Such a bearing ring is obviously capable of accurately seating the vane valve with a minimum of friction. Polished, or even smooth finish, of the vane and cap may be dispensed with.

The surface of cap 32 is preferably indented at 62 so as to provide a bearing support for the upper end of shaft 22 without necessitating projection of the shaft above the surface of the cap. At the same time, the preferably mating fit between depression 62 and bearing ring 60 helps additionally to centrally locate and support the valve as it oscillates. The valve is yieldably and self-adjustably held in the desired and proper seating relation by a light helical spring 64, which is held in compression at its upper end by the under surface of bearing ring 60 and, at its lower end, by a small cup 66 surrounding shaft 22 and resting upon the annular flange, rivet, or bearing 48.

Shaft 22 is splined, feathered, or keyed at 68, the splines being preferably formed integrally with the shaft by excising or pinching parts of the metal. The vane valve 20 is notched to form keyways 70 mating with the splines or keys 68, this feature being best shown in Fig. 3. It is important to note that the fit between the shaft 22 and the

valve 20 is preferably a loose one, particularly in the sense that the valve is permitted to freely and self-adjustably seat itself on the bearing ring 60 under the influence of spring 64, although it is, of course, compelled to rotate with shaft 22 by reason of the splined construction.

Shaft 22 is preferably offset from the center of head 12 because the resulting eccentric mounting greatly increases the room provided at one side of the shaft, specifically the left side looking at Fig. 1, and this in turn increases the room available for valve 20, for sound producing device 18, and for the connecting rod 26. Differently expressed, for a given dimension of valve mechanism, sound producing mechanism, and valve operating mechanism, the diametrical dimension of the unit is greatly decreased. Meanwhile the axial dimension, of course, is reduced to a minimum by the compact parallel arrangement of the valve mechanism and sound producing mechanism in head 12, and by the nature of the valve operating mechanism here employed.

Crank shaft 22 passes through head 12 and is supported at its upper end by cap 32 and at its lower end by supporting plate 30. The latter, however, is equipped with an improved bearing 48 which acts as a support for shaft 22 against transverse pressure exerted by connecting rod 26. The bearing 48 also acts as a seat for cup 66. From one viewpoint, it may be stated that a portion of one of the flanges of bearing 48 is radially extended to form a support 46 for the vibratory reed 18. (See Fig. 5.) From another viewpoint, it may be stated that the support 46 is so riveted to supporting plate 30 by a single annular rivet 48, that the rivet may also be used as a bearing for crank shaft 22. The crank shaft is provided with a crank 24 which may be stamped from sheet metal and which is preferably driven with a force fit over the lower end of shaft 22. The tip 72 of shaft 22 may, if desired, be extended below crank 24 in order to act as a stop for limiting the total permitted downward movement of movable head 12.

Stationary head 14 preferably comprises an inner holding plate 74 and an outer closed cap 76. The holding plate 74 is flanged upwardly at 78, while cap 76 is flanged upwardly at 80. The lower open end of bellows 16 may be clamped between flanges 78 and 80 of the holding plate and cap, as is clearly evident from an inspection of Fig. 1 of the drawing.

The holding plate 74 is preferably provided with means for pivotally anchoring the lower end of connecting rod 26. In the particular case here illustrated, the said means comprises a slot 82 for receiving the end of connecting rod 26, together with a curved tongue 84 struck upwardly from plate 74 transversely of the slot 82. Connecting rod 26 consists preferably of a strip of spring metal which is rectangular in cross section. This strip is provided with a bearing hole at its upper end for receiving the crank pin of crank 24, and is further provided with a hole 86 near its lower end for receiving the tongue 84. The lower end of the connecting rod 26 is thus anchored to holding plate 74, first, by being passed through slot 82, secondly, by bearing against outside cap 76; and thirdly, by tongue 84 pressed through hole 86 in the connecting rod, the latter feature being most clearly shown in Fig. 4 of the drawing. The connecting rod 26 is preferably initially bent slightly, as shown in Fig. 1, so as to insure that it will be further yieldable if necessary during the operation of the unit. By using a resilient connecting rod of this nature, the parts may be made with large working tolerances, for accurate fit and dimension are not needed, and safety against breakage during operation is provided, for upon undue or rough handling of the unit, the connecting rod 26 will bend and yield before other working parts, such as the vane valve mechanism, will break or be warped out of true shape.

As here disclosed, the unit is intended for manual operation and therefore is provided with a restoring spring 28. Spring 28 is preferably helical and as large in diameter as location inside of the unit will permit. The upper end of the spring is received and anchored in place by the dished and flanged construction of the supporting plate 30 in the upper head 12. The lower end of spring 28 is preferably accurately located in place by upwardly dishing the center portion of holding plate 74 in the bottom head 14, the annular wall 90 of the upwardly dished holding plate fitting just within the lower end of spring 28. Connecting rod 26 is, of course, located within spring 28, so that no interference between the valve operating mechanism and the spring takes place when the unit is compressed.

It is believed that the mode of constructing and using the improved articulative sound producing device of my invention, and the many advantages thereof, will for the most part be apparent from the foregoing detailed description thereof. The finished unit is smooth in operation and clear in articulation, and is compact diametrically and exceptionally compact in an axial direction. The valve mechanism for modulating the sound produced is exceedingly simple, openings being made only for free sound discharge, the constricted discharge being provided without the necessity of special openings and merely by the use of a slight spacing between the vane valve and its cooperating surface. This in turn makes it possible to stamp the parts from

sheet metal without smooth and accurate finish of the sliding surfaces and without undue friction therebetween, for the true bearing face is reduced to a relatively small circular bearing ring which is self-adjusting and self-seating by resilient means. Accurate fit between or mounting of the valve on the operating shaft is unnecessary. The operating head of the unit is made exceedingly compact in an axial direction by disposing the valve mechanism and the sound producing device in parallel relation, and further is made relatively compact in a radial direction by offsetting the operating shaft from the center of the head. The crank and connecting rod operating means for the valve permit of compact axial dimension, while making of the connecting rod from spring metal prevents injury during operation. The sound producing device is largely formed integrally with the supporting plate of the head, while the reed itself is locked in position by a holding member forming part of a bearing for the crank shaft. The flexible bellows is readily secured to the heads without the provision of special securing means, and accurately located spring restoring means may be provided within the unit.

It will be evident that the valve mechanism may be varied widely and that even using the oscillatable vane valve here shown the arrangement of the openings and leading and trailing edges thereof relative to discharge openings in the cap may be varied as desired. It will also be evident that by omitting the restoring spring 28 and weighting the head of the unit, it may, if desired, be rearranged for gravity operation. It will therefore be apparent that while I have shown and described my invention in preferred form, many changes and modifications may be made in the structure disclosed without departing from the spirit of the invention, defined in the following claims.

I claim:

1. An articulative sound producing device comprising relatively movable heads, modulating means including a reciprocable valve mounted on one of the heads, and a resilient strip of metal extending between and interconnecting said valve and the other head, whereby the valve is reciprocated when the heads are moved relative to one another, said resilient strip being so disposed relative to the heads that it tends to bend and yield upon meeting excessive resistance.

2. An articulative sound producing device comprising relatively movable heads interconnected by a flexible bellows, a sound producing device, and means for modulating the sound produced thereby including a vane valve mounted on and oscillatable in the plane of one of the heads, a crank attached to said vane valve, and a connecting rod extending between said crank and the other head, whereby the vane valve is oscillated when the heads are moved relative to one another.

3. A manually operable articulative sound producing device comprising relatively movable heads interconnected by a flexible bellows, a sound producing device, and means for modulating the sound produced thereby including a vane valve oscillatable in the plane of one of the heads, a crank attached to said vane valve, a resilient connecting rod extending between said crank and the other head, whereby the vane valve is oscillated when the heads are moved relative to one another, and resilient means between the heads for keeping the bellows normally in distended condition.

4. An articulative sound producing device comprising an oscillatable vane valve mounted for oscillation on a plate, the plate and vane valve being provided with bearing means, a control shaft loosely keyed to said vane valve in order to permit the latter to seat itself on the bearing means, and resilient means for yieldably holding the vane valve in desired bearing relation.

5. An articulative sound producing device comprising relatively movable heads interconnected by a flexible bellows, one of said heads including an inner supporting plate and an outer cap, sound producing means on said supporting plate, and an oscillatable vane valve on said cap, the cap and vane valve being provided with bearing means, a control shaft extending through said head and loosely keyed to said vane valve in order to permit the latter to seat itself on the bearing means, and a helical spring surrounding the shaft and yieldably holding the vane valve in desired bearing relation.

6. A manually operable articulative sound producing device comprising relatively movable heads interconnected by a flexible bellows, one of said heads including an inner supporting plate and an outer cap, sound producing means on said supporting plate, and an oscillatable vane valve on said cap, the cap and vane valve being provided with bearing means, a control shaft extending through said head and loosely keyed to said vane valve in order to permit the latter to seat itself on the bearing means, a helical spring surrounding the shaft and yieldably holding the vane valve in desired bearing relation, means to oscillate the vane valve, and resilient means between the heads for normally keeping the bellows in distended condition.

7. An articulative sound producing device comprising relatively movable heads, a flexible bellows interconnecting said heads, a sound producing device, an oscillatable vane valve for modulating the sound produced

thereby, said vane valve being oscillatable over a surface closed except for a single discharge opening, and means to reciprocate the vane valve upon relative movement of the heads, said vane valve being provided with a single opening and being arranged to blank off the discharge opening, then to clear the same by reason of the opening in the valve, then to blank off the discharge opening, and finally to again clear the same when the trailing edge of the valve passes the discharge opening, and means slightly spacing the vane valve from the surface in order to provide a constricted sound passage when the opening is blanked off, thereby producing a consonant sound without using special constricted discharge openings on the vane valve or/and the surface.

8. A manually operable articulative sound producing device comprising relatively movable heads, a flexible bellows interconnecting said heads, a sound producing device, an oscillatable vane valve for modulating the sound produced thereby, said vane valve being oscillatable over a surface closed except for a single discharge opening, said vane valve being arranged to either clear or blank off the discharge opening, and means slightly spacing the vane valve from the surface in order to provide a constricted sound passage when the opening is blanked off, means to operate the vane valve, and resilient means between the heads for keeping the bellows normally in distended condition.

9. An articulative sound producing device comprising a bottom head, a top head including an inner support plate and an outer cap which extend generally parallel to one another and are positioned relatively closely together, a sound producing reed mounted on and extending generally parallel to the plate, a vane valve mounted on and extending parallel to the cap, a flexible bellows extending between said heads, resilient means within said bellows and between said heads for keeping the same apart, and means for causing rotation of said vane valve upon compression together of the heads, the heads and bellows forming the entire outer walls of the device.

10. An articulative sound producing device comprising a head including an inner support plate and an outer cap which extend generally parallel to one another, a sound producing reed mounted on the plate, an oscillatable vane valve mounted on the cap, and a shaft extending through the cap and plate for oscillating the valve, said shaft being offset from the center of the cap in order to provide ample room for the valve and the reed, and said valve and reed being located between the shaft and the remote portion of the periphery of the head.

11. An articulative sound producing device comprising relatively movable heads interconnected by a flexible bellows, one of said heads including an inner support plate and an outer cap which extend generally parallel to one another and are positioned relatively closely together, a sound producing reed mounted on and extending generally parallel to the plate, an oscillatable vane valve mounted on and extending parallel to the cap, and a shaft extending through the cap and plate for oscillating the vane valve, said shaft being offset from the center of the cap in order to provide ample room for the valve and the reed, and said valve and reed being located between the shaft and the remote portion of the periphery of the head.

12. A manually operable articulative sound producing device comprising relatively movable heads interconnected by a flexible bellows, one of said heads including an inner support plate and an outer cap which extend generally parallel to one another and are positioned relatively closely together, a sound producing reed mounted on and extending generally parallel to the plate, a vane valve mounted on and extending parallel to the cap, a stub shaft extending through the cap and plate for rotating the vane valve, said stub shaft being offset from the center of the cap in order to provide ample room for the valve and the reed, and being exceedingly short in order to permit compression of the heads toward one another, and resilient means between the heads for keeping the bellows normally in distended condition.

13. An articulative sound producing device comprising relatively movable heads, one of said heads being provided with sound producing means and modulating means including a reciprocable valve, the other of said heads including an inner holding plate and an outer closed cap, and a connecting rod coupled at one end to the valve and at the other end to mating means on the holding plate.

14. An articulative sound producing device comprising relatively movable heads interconnected by a flexible bellows, one of said heads being provided with sound producing means and modulating means therefor including an oscillatable vane valve and a crank for controlling the oscillation of said valve, the other of said heads including an inner holding plate and an outer closed cap, and a connecting rod coupled at one end to the crank and at the other end to mating means formed on the holding plate.

15. A manually operable articulative sound producing device comprising relatively movable heads interconnected by a flexible bellows, one of said heads being provided with sound producing means and modulating means therefor including an oscillatable vane valve and a crank for con-

trolling the oscillation of said valve, the other of said heads including an inner holding plate and an outer closed cap, a resilient connecting rod coupled at one end to the crank and at the other end to pivotal connecting means on the holding plate, whereby the vane valve is oscillated upon relative movement of the heads, and resilient means between the heads for keeping the bellows normally in distended condition.

16. An articulative sound producing device comprising top and bottom relatively movable heads interconnected by a flexible bellows, said top head including an inner supporting plate and an outer flanged cap receiving the supporting plate and spaced therefrom by the flange of the cap to form a generally flat hollow enclosed top head, sound producing means mounted on the supporting plate, a reciprocable valve plate cooperating with a discharge opening in the top cap, and a connecting rod coupled between the valve on the top head and the bottom head.

17. An articulative sound producing device comprising top and bottom relatively movable heads interconnected by a flexible bellows, said top head including an inner supporting plate and an outer cap spaced therefrom, said bottom head including an inner holding plate and a closed outer cap, sound producing means mounted on the supporting plate, an oscillatable vane valve cooperating with a discharge opening in the top cap, a stub crank shaft extending through the top head for oscillating the vane valve, and a connecting rod interconnecting the crank on the top head with the holding plate on the bottom head.

18. An articulative sound producing device comprising top and bottom relatively movable heads interconnected by a flexible bellows, said top head including a flanged inner supporting plate and a flanged outer cap spaced therefrom with one end of the bellows secured between said flanges, said bottom head including a flanged inner holding plate and a flanged closed cap with the other end of the bellows secured between said flanges, sound producing means mounted on the supporting plate, an oscillatable vane valve cooperating with a discharge opening in the top cap, a stub crank shaft extending through the top head for oscillating the vane valve, and a connecting rod interconnecting the crank on the top head with the holding plate on the bottom head, and thereby causing oscillation of the vane valve upon relative movement of the heads.

19. A manually operable articulative sound producing device comprising top and bottom relatively movable heads interconnected by a flexible bellows, said top head including a flanged inner supporting plate and a flanged outer cap spaced therefrom with one end of the bellows secured between said flanges, said bottom head including a flanged inner holding plate and a flanged closed cap with the other end of the bellows secured between said flanges, sound producing means mounted on the supporting plate, an oscillatable vane valve cooperating with a discharge opening in the top cap, a stub crank shaft extending through the top head for oscillating the vane valve, a connecting rod interconnecting the crank on the top head with the holding plate on the bottom head, and thereby causing oscillation of the vane valve upon relative movement of the heads, and resilient means between the top head and the bottom head.

20. An articulative sound producing device comprising relatively movable top and bottom heads interconnected by a bellows, said top head including an inner supporting plate and an outer cap having a sound discharge opening, a stub crank shaft extending through said top head, a vane valve oscillatable with said crank shaft for cooperation with said discharge opening, bearing means spacing the vane valve slightly from the cap, sound producing means mounted on the supporting plate, and a connecting rod extending from the crank to the bottom head.

21. An articulative sound producing device comprising relatively movable top and bottom heads interconnected by a bellows, said top head including an inner supporting plate and an outer cap having a sound discharge opening, a stub crank shaft extending through said top head in offset relation thereto, a vane valve loosely splined to and oscillatable with said crank shaft for cooperation with said discharge opening, bearing means spacing the vane valve slightly from the cap, and a sound producing reed mounted on the inner supporting plate, said bottom head including an inner holding plate and an outer closed cap, and a connecting rod extending from the crank to said holding plate.

22. An articulative sound producing device comprising relatively movable top and bottom heads interconnected by a bellows, said top head including a downwardly flanged inner supporting plate and a downwardly flanged outer cap with one end of the bellows secured between said flanges, a stub crank shaft extending through said top head in offset relation thereto, a sound discharge passage in said top head, a vane valve loosely splined to and oscillatable with said crank shaft for cooperation with said discharge opening, bearing means spacing the vane valve slightly from the cap, and a sound producing reed mounted on and extending parallel to the inner supporting plate, said bottom head including an up-

wardly flanged inner holding plate and an upwardly flanged outer closed cap, one end of the bellows being secured between said flanges, and a connecting rod extending from the crank to said holding plate.

23. A manually operable articulative sound producing device which is compact in an axial direction, comprising relatively movable top and bottom heads interconnected by a frustro-conical bellows, said top head including a downwardly flanged inner supporting plate and a downwardly flanged outer cap with the small end of the bellows secured between said flanges, a stub crank shaft extending through said top head in offset relation thereto, a sound discharge passage in said top head, a vane valve loosely splined to and oscillatable with said crank shaft for cooperation with said discharge opening, bearing means spacing the vane valve slightly from the cap, and a sound producing reed mounted on and extending parallel to the inner supporting plate, said bottom head including an upwardly flanged inner holding plate and an upwardly flanged outer closed cap, the large end of the bellows being secured between said flanges, a resilient connecting rod extending from the crank to mating pivotal means on said holding plate, and a helical restoring spring located within the bellows and between the supporting plate of the top head and the holding plate of the bottom head.

24. An articulative sound producing device comprising valve means operated by a shaft extending through a plate, a vibratile reed, and means to hold said reed on said plate including a strip of metal secured to the plate by an annular flange or rivet, said annular flange or rivet serving at the same time as a bearing for the aforesaid shaft.

25. An articulative sound producing device comprising relatively movable heads interconnected by flexible bellows, valve means in one of said heads operated by a shaft extending through the head, a sound producing device in said head including a channel struck integrally from the material of the head, a vibratile reed positioned over said channel, and means to hold said reed in place including a strip of metal secured to the head by an annular flange or rivet, said annular flange or rivet serving at the same time as a bearing for the aforesaid shaft.

26. A manually operable articulative sound producing device comprising a generally flat bottom head, a generally flat top head, flexible bellows interconnecting said heads, sound producing and sound modulating means in the top head, resilient means between said heads for keeping the same apart, and means interconnecting the top and bottom heads for causing movement of the sound modulating means upon compression together of the heads, the flat top and bottom heads with the bellows interconnecting the same forming the entire outer surface of the sound producing device, and said device being compressible until the heads are brought substantially together.

27. A manually operable articulative sound producing device comprising a generally flat circular bottom head, a generally flat circular hollow top head, flexible cloth bellows secured to the peripheries of and interconnecting said heads, sound producing and sound modulating means in the top head, a coiled spring interposed between said heads within the bellows for keeping the heads apart, and resilient means interconnecting the top and bottom heads for causing movement of the sound modulating means upon compression together of the heads, the flat top and bottom heads with the bellows interconnecting the same forming the entire outer surface of the sound producing device, whereby said device is compressible until the heads are brought substantially together.

Signed at New York, N. Y., in the county of New York and State of New York this 2d day of March A. D. 1932.

LEO J. GRUBMAN.