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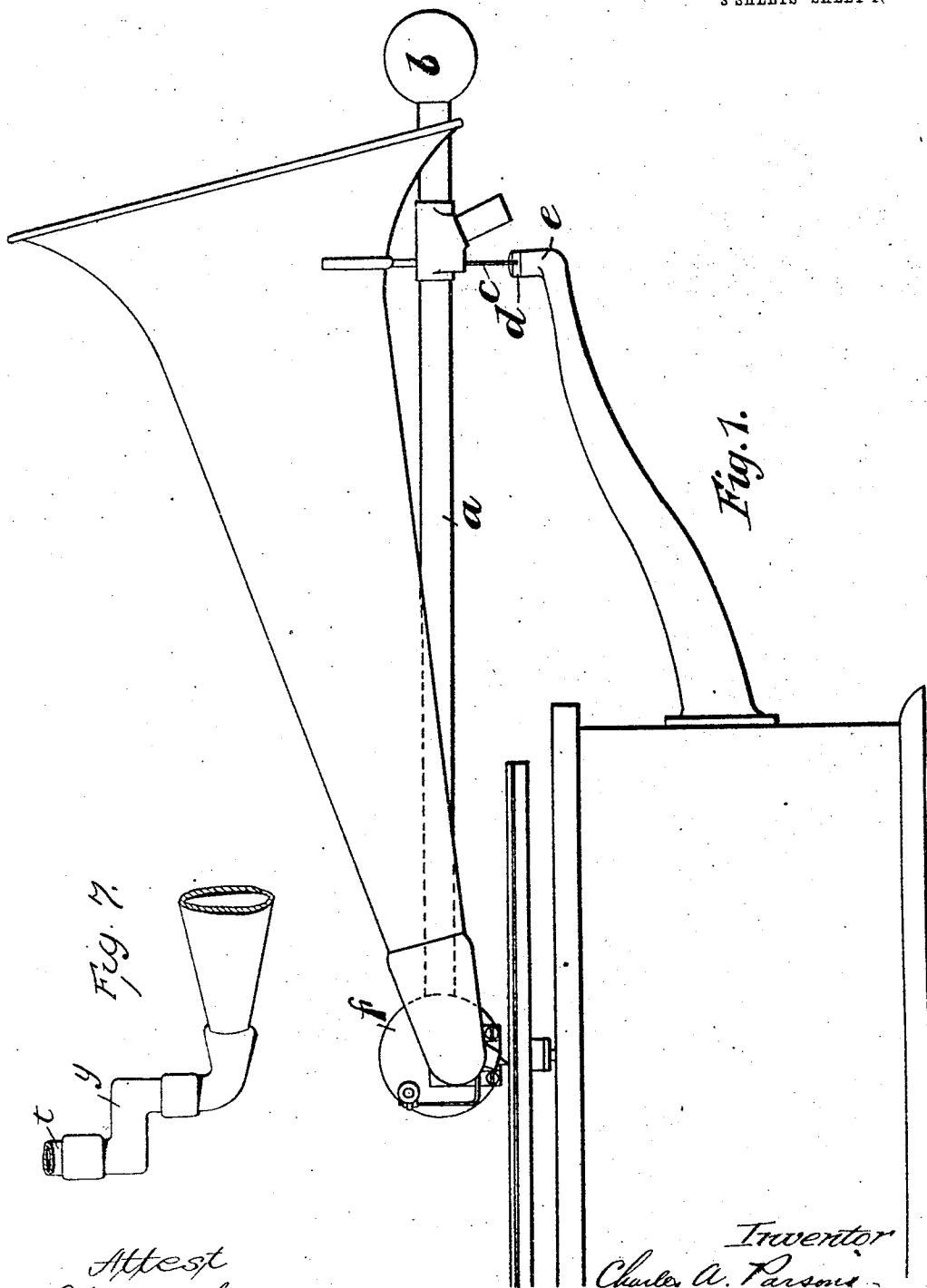
C. A. PARSONS.

PATENTED APR. 17, 1906.

SOUND REPRODUCER OR INTENSIFIER APPLICABLE TO PHONOGRAPHS,
GRAMOPHONES, &c.

APPLICATION FILED APR. 12, 1904.

3 SHEETS—SHEET 1.



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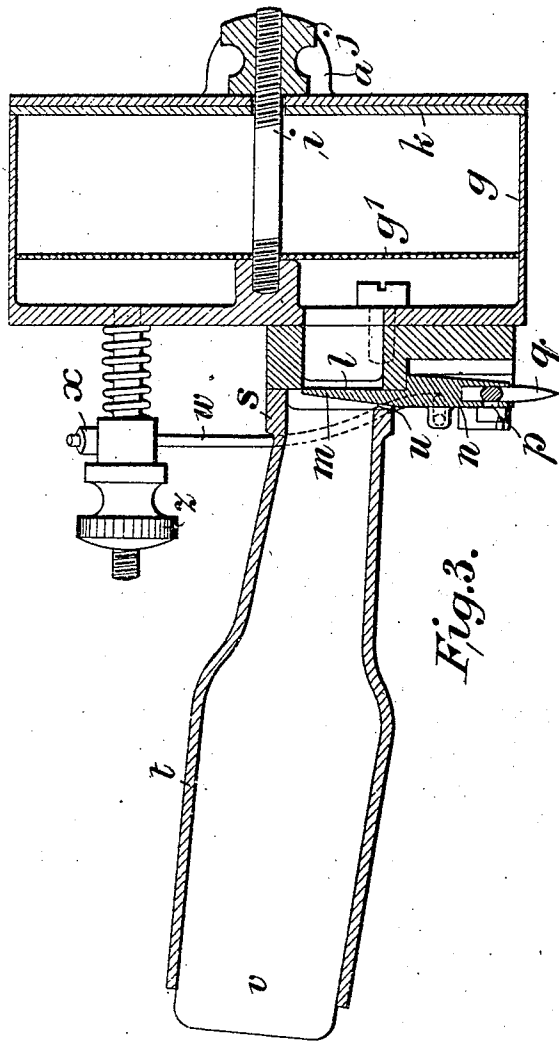
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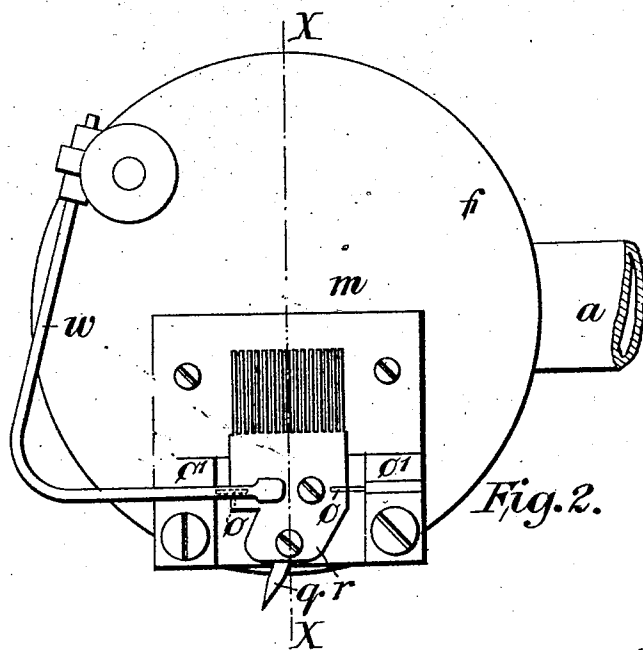
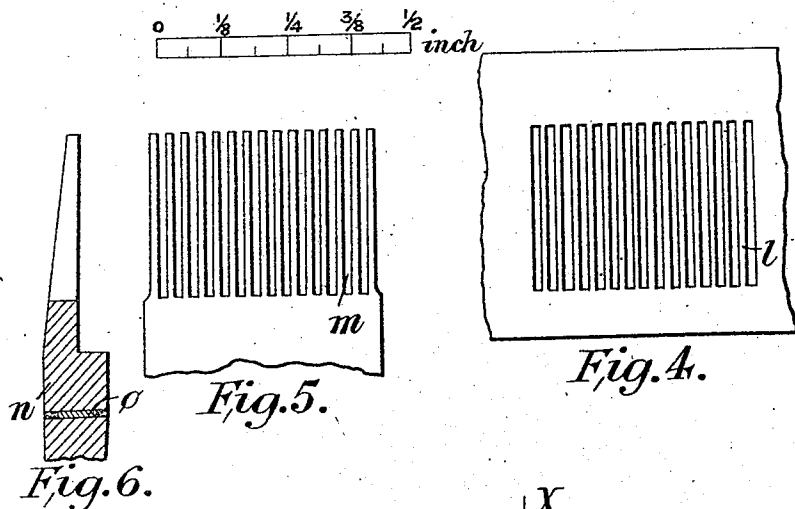
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

CHARLES ALGERNON PARSONS, OF NEWCASTLE-UPON-TYNE, ENGLAND.

SOUND REPRODUCER OR INTENSIFIER APPLICABLE TO PHONOGRAPHS, GRAMOPHONES, &c.

No. 817,868.

Specification of Letters Patent.

Patented April 17, 1906.

Application filed April 12, 1904. Serial No. 202,866.

To all whom it may concern:

Be it known that I, CHARLES ALGERNON PARSONS, a subject of the King of Great Britain and Ireland, residing at Heaton Works, Newcastle-upon-Tyne, in the county of Northumberland, England, have invented certain new and useful Improvements in Sound Reproducers or Intensifiers Applicable to Phonographs, Gramophones, Telephones, and the Like, (for which I have made application for Letters Patent in Great Britain, No. 10,468, bearing date August 5, 1903,) of which the following is a specification.

I am aware that mechanically or automatically operated valves with air or steam—such, for example, as sirens—have been proposed and are in use for the production of sound. I am also aware that Edison proposed the use of an air relay and valve moved by a diaphragm operated by sound, the air from the valve operating a second diaphragm, and this in turn operating a microphone for the purpose of intensifying sound. Also several persons since that date have proposed and described air-relays and similar apparatus for the purpose of intensifying sound, such relays being operated either by a diaphragm moved by the sound-waves or by phonograph or gramophone records.

The present invention relates to the construction and proportioning of such valves or sound reproducers and intensifiers, so as to render them successful and efficient.

Referring to the accompanying drawings, Figure 1 is a front elevation showing the general arrangement of my improvements as applied to a gramophone. Fig. 2 is an enlarged elevation of the compressed-air chamber and its connections, the pipe leading to the trumpet being removed, while Fig. 3 is a section on the line X X, Fig. 2. Fig. 4 is an enlarged elevation of the stationary part of the valve, while Figs. 5 and 6 are respectively an enlarged elevation and sectional end view of the valve-cover. Fig. 7 is a plan view showing means for connecting the trumpet to the reproducer.

Referring to Figs. 1, 2, and 3, *a* is a hollow arm carrying the reproducer at one end and a counterbalance-weight *b* at the other. The arm *a* is carried by a flat spring *c* in one piece with a post *d*, which can rotate in a socket *e* on a fixed part of the gramophone. The compressed-air chamber *f*, supplied with

compressed air from any convenient source through the hollow arm *a*, consists of a cylindrical casing *g*, forming the front of the chamber and clamped to the plate *h*, carried by the arm *a*, by the bolt *i* and thumb-screw *j*, a layer of soft material *k* being clamped between the edge of casing *g* and plate *h*. The chamber *f* is divided by a circular piece of wire-gauze *g'*, the part of the chamber on the air-supply side of the gauze being filled with cotton, wool, or other suitable material and acting as an air-filter. In the front face of the chamber *f* is fixed a grating *l*, forming the stationary part of the valve (more fully described below) and also forming part of the boundary of the compressed-air chamber *f*. A grating *m* forms the valve-cover and is attached to a small steel weigh-bar *n*, which may be mounted, as shown in Figs. 2 and 3, on two very short but flexible flat springs *o o*, parallel to its axis, fixed to supports *o' o'* on the face of the chamber *f* and allowing the weigh-bar *n* to oscillate rotationally only about its axis. In one piece with the weigh-bar, and thus in rigid connection with the valve-cover *m*, is the actuating-arm *p*, which in the gramophone forms a socket for the reproducing-style *q*, held in the said socket by a set-screw *r* or other convenient means. The rectangular base *s* of the conical pipe *t*, leading to the trumpet, is removably seated on the face of the compressed-air chamber *f* and closely surrounds the valve-grating *l*. In one side of the base *s* is a rectangular opening *u* to allow the pipe *t* to be placed in position over the valve-cover *m*. The base *s* of the pipe *t* should give just sufficient clearance to allow the oscillations of the valve-cover *m*, so that as little air as possible passes into the pipe *t*, and so to the trumpet, except through the slots of the valve-cover *m*, and as little air as possible escapes around the valve-cover through the openings *u*. A central diaphragm *v*, parallel to the tongues of the grating *m*, divides the conical pipe *t*. To the weigh-bar *n* is rigidly attached a steel spring-wire *w*, lying in the direction of the axis of the weigh-bar near its point of attachment and bent so that its other end, fitted with a rubber sleeve *x*, bears against an adjustable thumb-screw *z*. The spring-wire *w* always tends to move the valve-cover *m* toward the stationary grating *l*, and by turning the screw *z* the position of the valve-cover *m* when at rest can be adjusted.

Referring to Figs. 4, 5, and 6, the fine gratings *l* and *m*, forming the valve, are of the

same pitch. The slots in the grating *l* may be of rather greater breadth than the tongues of the grating *m*. When the gratings are placed together with the tongues of *m* above the slots of *l*, very little air can pass through them; but when slightly separated in a direction almost normal to their faces by the rotation of *m* about the axis of the weigh-bar *n* air passes through the openings formed at both edges of each tongue. The tongues of the valve-cover are formed wedge-shaped in order to reduce the mass of the moving part of the valve as much as possible consistently with preserving rigidity. The valve I have shown enlarged four times in Figs. 4, 5, and 6 is of dimensions which have been found to work well as applied to a gramophone. Such a valve may be of larger dimensions and of coarser pitch—say thirty-three to the inch—than a valve of the same class suitable for a phonograph. In this class of valve when used for a phonograph I have found by experiment that up to a fineness of pitch of sixty-six per inch and a width of slot of about .008 of an inch there is a steady increase of loudness and clearness of the sound produced. Such a valve for phonograph-records may have twenty slots and twenty-one tongues, each slot three-sixteenths of an inch long, thus giving a total length of lip-opening of two by twenty by three-sixteenths equals seven and one-half inches. Such a valve is very small in dimensions. The thickness of the tongue may be .015 of an inch at the roots, tapering to .003 of an inch at the tips; and the back may stand out from the weigh-bar one-sixteenth of an inch. When made of nine-carat gold, (the metal I sometimes prefer in order to obviate oxidation,) its weight will be about one and one-fourth grains. If made of aluminium, which produces louder sounds, the weight may be reduced to three-fourths of a grain. The amplitude of oscillation of the center of the valve-grating for the gramophone may be about equal to that of the style-point. For the phonograph and ordinary wax records it may be from equal to double that of the style-knob. These ratios depend chiefly on the dimensions and fineness and weight of the gratings. The air-pressure may be from two to five pounds per square inch or even higher; but with three pounds the reproduction from the wax record is louder than the original voice speaking into an Edison Bell recording-phonograph when making the record. Though I have mentioned a fineness of grating of sixty-six-to-the-inch pitch, I have not as yet observed any marked limitation with fineness up to this degree. The gratings do not become stuck or choked, provided an air-filter of cotton or toweling is placed in the supply-pipe. The cutting of such gratings is easily accomplished by fine watch-making tools, including a lathe and thin and fine saws of a thick-

ness equal to the slots to be cut. Such gratings may be formed of two perforated plates or membranes instead of gridirons. Though I have described and illustrated this valve as a single comb, I may form it as a double or a circular or a segmental or other form of comb, the general guiding principle being that it is desirable to reduce the lengths of the tongues to secure their rigidity with a minimum aggregate weight of tongue, and it is therefore desirable to increase the number of tongues as much as possible and to reduce their length and thickness, the limiting thickness of any tongue of given length being determined by this that the frequency of oscillation of the tongue shall be above some given and very high note. If the tongues are too thin, they may set up an audible vibration of their own independently of the controlled oscillation of the valve as a whole. Though I have described the moving member as attached to a weigh-bar actuated by an arm, I may prefer to apply the moving force directly to any part of the valve and to place the fulcrum outside such force relatively to the valve. This disposition I prefer in the case of a circular comb; but in all cases suitable arrangements must be provided to maintain constant proportional displacement of all parts of the valve relatively to the fixed valve-face during oscillation. Although I have described the valve as worked by compressed air and in conjunction with a pressure-chamber, the reproducer may be worked by rarefied air and a suction-chamber. In all cases the moving part of the valve should be placed on the side of less pressure. If placed on the side of greater pressure, it is liable to be in unstable equilibrium and to sound like a reed as a whole on its own account, or the individual tongues of the valve may similarly vibrate.

For use with gramophone-records the volume of the compressed-air chamber must usually exceed one cubic inch and is generally made equal to about three cubic inches. I also slightly throttle the inlet to the compressed-air chamber to increase the steadiness.

In combination with the valve described in this specification I have found by experiment that if the trumpet is lined with velvet, felt, or similar substance for a short distance from the small end sounds of very short wave length, such as scratching and very high harmonics, are much reduced. Also I have found that a piece of tubing with one or more sharp bends introduced between the reproducer and the trumpet is of great assistance in reducing such sounds. The very short waves proceed in radial directions from the valve and impinge on the sides, especially at the bends, and are thereby reduced, while the waves of moderate length travel easily round the bends and are less af-

fectcd. A convenient method of carrying this into effect is to attach a piece of metal tubing *7* bent twice at right angles to the tube *t*, Fig. 3, and to the trumpet by means of short pieces of rubber tubing, as illustrated in Fig. 7.

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

10 1. An apparatus for reproducing sounds, comprising in combination, a valve-face; short flexible springs fixed at one side of said valve-face; an oscillating valve-cover mounted on said springs and adapted to control a
15 current of elastic fluid; and means for actuating said valve-cover in accordance with the sounds to be reproduced; substantially as described.

2. An apparatus for reproducing sound, comprising in combination, a valve-face; short flexible springs fixed at one side of said valve-face; an oscillating valve-cover mounted on said springs and adapted to control a current of elastic fluid; means for adjusting
25 the position of said valve-cover relatively to said valve-face; and means for actuating said movable grating in accordance with the sounds to be reproduced; substantially as described.

30 3. In a sound-reproducing apparatus, in combination; an elastic-fluid chamber; a fixed grating forming part of the boundary of said chamber; a connection adapted for supplying compressed or rarefied elastic fluid to said chamber; short flexible springs fixed
35 to said chamber; an oscillating grating mounted on said springs and adapted to control the flow of elastic fluid through the openings in said fixed grating; and means for actuating said oscillating grating in accordance with the sounds to be reproduced, substantially as described.

4. In a sound-reproducing apparatus, in combination; an elastic-fluid chamber; a
45 fixed grating forming part of the boundary of said chamber; an axially-oscillating bar mounted on said chamber; a grating fixed to said bar and adapted to control the flow of elastic fluid through said fixed grating; means for adjusting the position of said oscillating grating relatively to said fixed grating, and means for actuating said bar in accordance with the sounds to be reproduced, substantially as described.

55 5. In a sound-reproducing apparatus, in combination; an elastic-fluid chamber; a hollow arm carrying said chamber, a fixed grating forming part of the boundary of said chamber; said hollow arm being movably
60 supported; a connection to said hollow arm adapted for supplying compressed or rarefied

elastic fluid to said chamber; a movable grating adapted to control the flow of elastic fluid through the openings in said fixed grating; and means for actuating said movable grating in accordance with the sounds to be reproduced, substantially as described. 65

6. In a sound-reproducing apparatus, in combination; an elastic-fluid chamber; a fixed grating forming part of the boundary
70 of said chamber; an axially-oscillating bar mounted on said chamber; a grating fixed to said bar and adapted to control the flow of elastic fluid through said fixed grating; a style-socket-forming arm fixed to said bar; and means for fixing a gramophone or phonograph style in said socket; substantially as described. 75

7. In a sound-reproducing instrument in combination; a compressed-air chamber; wire-gauze dividing said chamber into two parts; an air-filter on one side of said wire-gauze; a fixed grating forming part of the boundary of said air-chamber; a grating
80 movable in a substantially normal direction so disposed as to cover the openings in said fixed grating; and means for actuating said movable grating in accordance with the sounds to be reproduced; as set forth. 85

8. In a sound-reproducing apparatus, in combination; an elastic-fluid chamber; a fixed grating forming part of the boundary of said chamber; an axially-oscillating bar mounted on said chamber; a grating fixed to said bar and adapted to control the flow of elastic fluid through said fixed grating; a style-socket-forming arm fixed to said bar; a style fixed in said arm; and means for actuating said style in accordance with the sounds to be reproduced; substantially as described. 90 95 100

9. In a sound-reproducing instrument in combination; an elastic-fluid chamber; a connection adapted for supplying elastic fluid to said chamber; a fixed grating forming part of the boundary of said chamber; a grating movable in a substantially normal direction adapted to control the flow of elastic fluid through said fixed grating; a tube fixed to said chamber leading from said grating; a short connecting-tube having two or more sharp bends between said tube and the trumpet; and means for actuating said movable grating in accordance with the sounds to be reproduced, substantially as described. 110 115

In witness whereof I have hereunto set my hand in presence of two witnesses.

CHARLES ALGERNON PARSONS.

Witnesses:

HERVEY GRAHAM DAKYNS, JR.
WILLIAM DAGGETT.