

April 19, 1938.

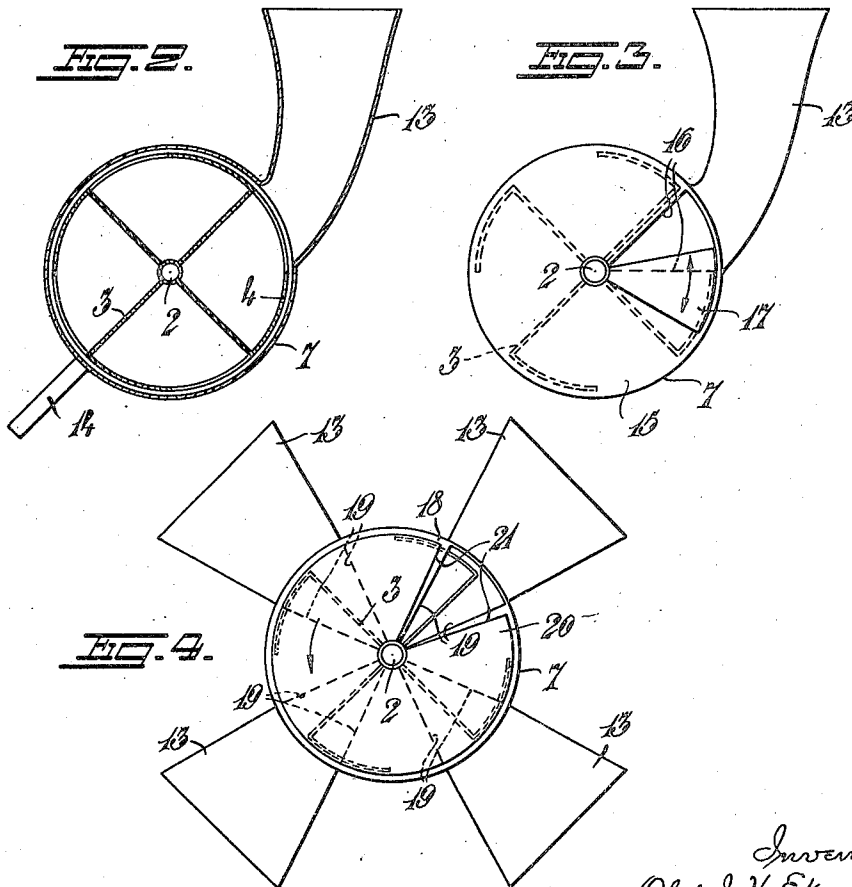
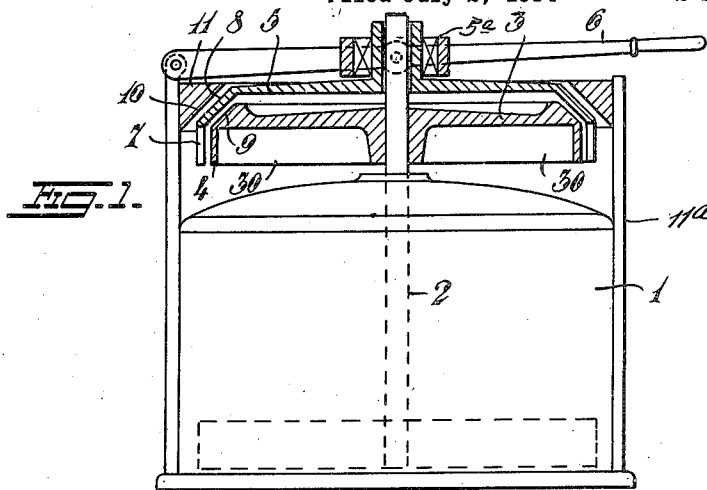
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2,114,654

SIREN

Filed July 2, 1934

2 Sheets-Sheet 1



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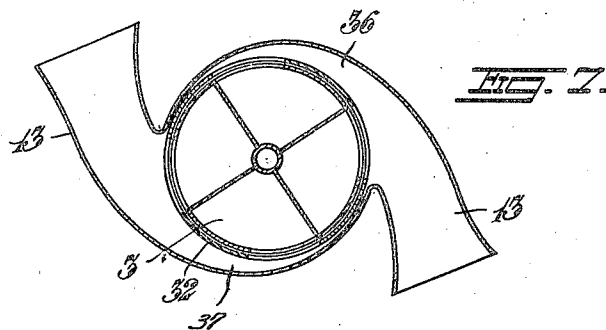
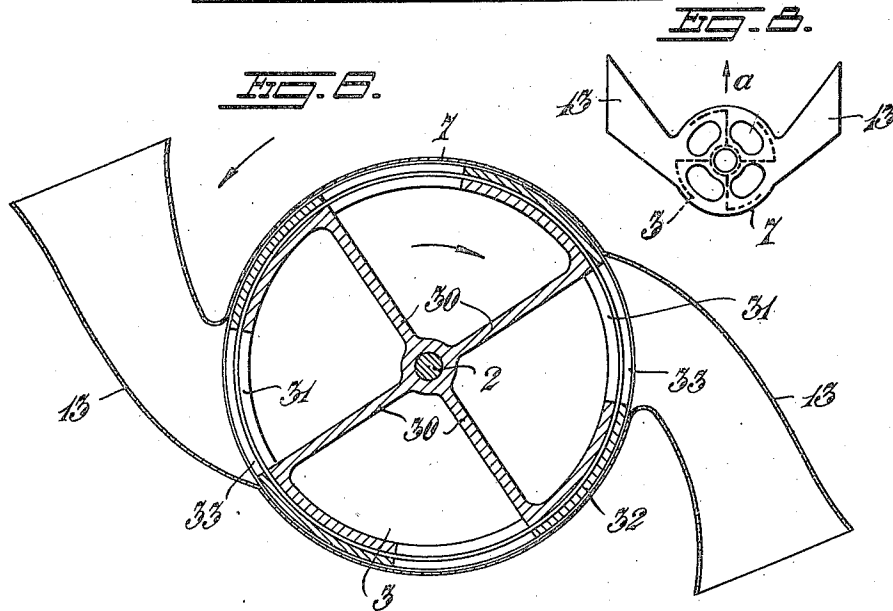
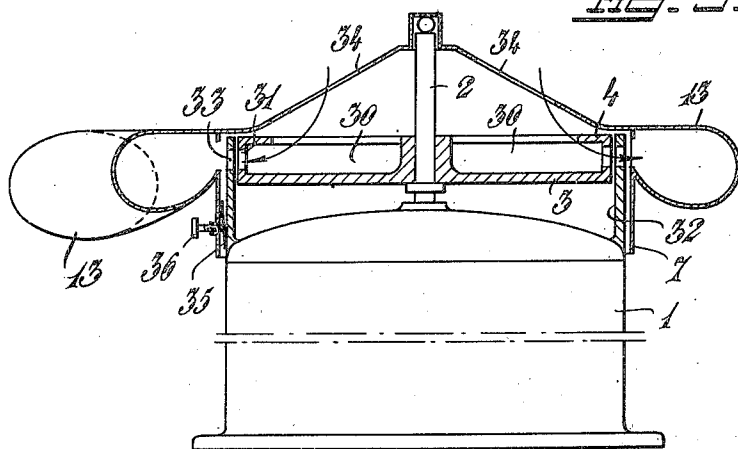
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UNITED STATES PATENT OFFICE

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SIREN

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6 Claims. (Cl. 116—147)

Devices for producing characteristic strong sounds, especially sirens for signalling purposes, comprise usually a blade wheel or rotor and a surrounding stator within which the blade wheel rotates at a high speed, thereby expelling air at certain definite intervals through a series of sound apertures in the stator.

The object of this invention is to provide a sound producing device of this type which is efficient in operation and simple in construction. The device according to the invention is characterized chiefly, by the fact that the stator is either replaced by a rotary wall directly surrounding the rotor or is itself surrounded by such a rotary wall. By this feature it will be possible to throw the sound in a definite direction or directions and to change the direction of the sound either continuously or at will, the rotary wall, if desired, being provided with a horn or horns in connection with the sound aperture or apertures. Furthermore, a slide valve device may be used in order to effect a concentrated emission of the sound in said definite direction or directions.

Another feature of the invention involves that the rotary wall may be coupled to the rotor by an adjustable coupling device. By this feature it is possible to arbitrarily vary the relative speed of the rotor and rotary wall and thus the sound frequency. Another advantage resulting from said feature is that the emission of the sound may take place for every frequency with practically maximum intensity within time limits which are under absolute control of the operator, so that the emission of the sound may be caused to start or to cease practically instantly, without swelling or sinking of the tone.

These and other features of the invention will appear from the following description with reference to the annexed drawings, which illustrate various embodiments of the invention.

Fig. 1 is an axial section of an embodiment of the invention having no stator;

Fig. 2 is a diagrammatic cross section of a second embodiment;

Fig. 3 is an end view of a third embodiment;

Fig. 4 is an end view of a fourth embodiment;

Fig. 5 is a side elevation, partly in section;

Fig. 6 is a cross section of an embodiment having a stator;

Fig. 7 is a diagrammatic cross section of a modified embodiment having a stator; and

Fig. 8 is an end view of an embodiment, especially adapted for use on cars.

With reference to Fig. 1, the numeral 1 indi-

cates a high speed motor, for instance, an electric motor. The shaft 2 of the motor carries a blade wheel 3 which is provided at its circumference with a flange 4 in which there are a number of, preferably, symmetrically distributed apertures. For instance, the wheel 3 may be provided with as many blades 30 as there are apertures in the flange 4. The shaft 2 projects above the blade wheel 3, where it carries a rotatably and slidably mounted disk 5 which may be displaced axially by means of a lever 6, without interfering with its rotation with relation to the shaft and the lever by reason of the fact that the disk and lever are connected through the bearing 5a which may be a ball bearing or other suitable type. At its circumference the disk 5 forms a wall 7 which surrounds the flange 4 of the blade wheel, and the disk includes a conical portion 8 selectively engageable with a conical surface 9 of the blade wheel 3 or a conical surface 10 of a surrounding stationary ring 11 carried on a skeleton frame 11a. By means of the lever 6 the conical portion 8 may be brought into engagement either with the rotary conical surface 9 or with the stationary conical surface 10.

The wall 7 is formed with sound apertures to cooperate with those of the blade wheel. By pressing the conical portion 8 against the stationary surface 10 with such a force as to prevent the disk 5 from rotation, the air expelled by the blade wheel through the sound apertures of flange 4 and wall 7 will produce a certain tone, the pitch of which depends on the relative speed of rotation between the blade wheel 3 and the disk 5. If, on the contrary, the conical portion 8 is released from the conical surface 10 and brought into engagement with the conical surface 9 of the blade wheel, then the disk 5 will be caused to rotate by friction at the same speed as the blade wheel. In the latter case, no tone may be produced, in the former case the pitch of the tone depends on the relative rotation of the blade wheel 3 and the disk 5. It will thus be evident that the sound frequency may be arbitrarily changed even with unchanged speed of the blade wheel. It will further be evident that the producing of the sound is always effected at the highest intensity, and the starting and ceasing of the sound may take place instantly owing to the small swinging mass of the disk 5 with relation to the blade wheel 3 and the armature of the motor connected thereto.

In Fig. 2 is shown an embodiment in which the rotary wall 7 surrounding the flange 4 of blade

wheel 3 is formed with a single sound emitting opening to which a horn 13 is connected. The wall 7 can be rotated either by a power transmitted from the blade wheel, for instance, by a device similar to that shown in Fig. 1 or by power imparted thereto from the driving shaft 2, or by appropriately shaping the horn 13 so as to rotate the wall 7 as result of the reaction appearing at the emission of the compressed air. In order to balance the rotary wall 7 with respect to the air resistance and to the action of the gravity, the wall 7 may carry a blade-shaped projection 14 situated diametrically opposite to the horn 13, the area of said projection being equal to the effective area of the horn and the weight of said projection corresponding to the weight of the horn. It is to be noted that, at each time that an emission of air through the horn takes place, one sector-shaped portion only of the blade wheel is in action at a time. In the remaining sectors a compression of air is taking place under the action of the centrifugal force. It is thus evident that a considerable reduction of the compression work to be produced by the blade wheel may be obtained by preventing any supply of air to the sectors during the time, during which they are not in communication with the horn, and allowing them to receive air only immediately before they shall expel the air through the horn, because by this arrangement the compression work may be concentrated to a single sector at a time. The necessary control of the supply of air to the blade wheel sectors may be realized, for instance, by providing the rotary wall 7 with an end wall at that side of the blade wheel which is otherwise completely open to receive the air, and forming said end wall with a sector-shaped opening in front of the base of the horn.

An embodiment of this type is illustrated in Fig. 3. The wall 7 is provided with an end wall 15 at that side where the sector-shaped portions of the blade wheel 3 are open for receiving the air. In the end wall is a sector-shaped opening 16 adjacent the horn 13. Said opening 16 may, preferably, be controlled by means of a shield 17 rotatable about the shaft 2 of the blade wheel.

A similar result, as far as the effect of emission through the horn is concerned, may be obtained by using a wall having a plurality of horns, provided one horn only is in operation at a time. Such an embodiment is shown in Fig. 4. The blade wheel 3 carried by the shaft 2 is surrounded by a wall 7 having a plurality of horns 13 in different directions. At the open side of the blade wheel the wall 7, which may be held against rotation, is provided with an end wall 18 having a sector-shaped opening 19 for each horn 13. Above said end wall the shaft 2 carries a rotatable shield 20 having a sector-shaped opening 21 of equal or substantially equal size as that of one of the openings 19. By rotation of said shield 20 the openings 19 may be uncovered one at a time, so that the effect of each horn will be the same as that described in connection with Fig. 3.

The principle of this invention will not be departed from, if compressed air is used in substitution of atmospheric air. In such case, the blade wheel, if desired, may act as a slide valve only, provided the pressure of the air supplied is sufficiently high. The compressed air may be produced in any desired way, for instance, by a vane compressor of axial flow type carried by the shaft of the blade wheel or slide valve.

In all of the embodiments hereinbefore described, the siren comprises, essentially, a blade wheel or rotor and a rotary wall directly surrounding the rotor. It is to be noted, however, that a stator may be inserted between the rotor and the rotary wall so as to directly surround the rotor and to be, in turn, directly surrounded by the rotary wall. Embodiments of this type are illustrated in Figs. 5-7.

With reference to Figs. 5 and 6, the numeral 1 indicates the driving motor, the shaft of which 2 carries the blade wheel which comprises a circular disk 3 having on its upper side a number of radial blades 30 situated between the hub of the disk and a peripheral flange 4 thereof. The flange 4 is formed with a series of uniformly distributed sound apertures 31, for instance, one for each blade. The surrounding stator 32 is, likewise, formed with a series of similar apertures 33. The stator is surrounded by a rotary wall 7 closely fitting around the apertured portion of the stator. Said rotary wall carries two horns 13 situated at diametrically opposite points of the wall. The wall 7 comprises the peripheral wall of a housing rotatably mounted on the shaft 2 and having air inlet openings 34 in its top wall. Said housing may either be rotated by hand in order to set the horns to desired positions, or provisions may be made in order to continuously rotate the housing, causing the horns to always change their position. To this end, a mechanical or electrical driving device may be used, or the housing may be driven automatically. In the last-mentioned case, the horns, as shown in the drawings, may be shaped so as to act as turbine blades, thereby causing the housing to rotate under the action of the air emerging through the horns. In order to permit control of the rotation of the housing, the wall 7 may be provided with adjustable braking means, comprising, for instance, a slip spring 35 bearing against the stator and a screw 36 to control the pressure exerted by the spring upon the stator.

In the rotation of the blade wheel, the air contained between the blades thereof will be subjected to the action of the centrifugal force and thus compressed, allowing more air to enter at the centre of the wheel. As soon as an aperture 31 of the flange 4 of the blade wheel comes into register with an aperture 33 of the stator, the compressed air tends to escape, but will be prevented therefrom by the rotary wall 7 which only allows emission through the horns. By the horns the emerging air and thus also the sound waves are thrown in definite directions. If the wall 7 is held against rotation, the wall 7 should be in a position in which each horn 13 is situated right opposite one opening 33, as shown in Fig. 6. If the wall 7 is rotated or allowed to rotate, the horns will successively change the direction of the sound, so that the sound will be directed around a complete circle during half a revolution of the wall 7 in case of two horns.

In Fig. 7 I have shown, how the wall 7, instead of closely fitting around the stator 32, may be formed with heliciform channels 37 like those of a centrifugal pump. By this feature, all sector-shaped portions and all openings of the blade wheel 3 will be caused to cooperate, as far as the horns are concerned, during each pressure phase.

In using an apparatus according to this invention in connection with a motor car, a considerable resistance against the emission of the sound will appear when the horns open for-

ward in the direction of movement of the car. In order to overcome this drawback I may use a stationary wall 7, as shown in Fig. 8, having one or two horns directed obliquely forward and outward which are cut at their open ends along, preferably, vertical planes parallel to the direction of movement of the car (which is indicated by the arrow *a*). As a result, any air resistance due to the movement of the car cannot counteract the producing of the sound waves within the horns. Any essential reduction of the reach of the apparatus is not to be feared by this arrangement, because the sound will be emitted from the horns in an oblique forward direction toward the walls of the buildings along the sides of the road, to be then reflected further forward by said walls.

What I claim is:—

1. A siren comprising a rotor, a stationary cylindrical wall surrounding the rotor and having a plurality of sound openings formed therein, a rotatably mounted cylindrical wall surrounding said stationary wall and having a sound opening formed therein, and a horn projecting laterally from the rotatable cylindrical wall, said horn being curved rearwardly so as to act as a turbine blade to rotate the rotatable wall, said horn leading directly from said last-mentioned sound opening.

2. A siren having a rotor, a rotatable cylindrical wall surrounding said rotor and having a sound opening and a laterally projecting horn leading from said opening for directing the sound, said horn being curved backwardly with respect to the desired direction of rotation of said wall, so as to act as a turbine blade, to rotate the wall under the influence of the air emerging through the horn.

3. A siren having a rotor provided with peripheral sound openings, a stator surrounding said rotor and having sound openings corresponding in number and relative location to those of

the rotor, a rotatable cylindrical wall surrounding said stator, said wall being provided with sound openings less in number than the number of openings in the rotor and stator, laterally projecting horns leading from the sound openings of said wall for directing the sound, said horns being so curved backwardly with respect to the direction of rotation of said wall, as to act as turbine blades to rotate the wall under the influence of the air emerging through the horns.

4. A siren having a rotor, a stator surrounding said rotor and having sound openings formed in it, a rotatable wall surrounding said stator and having sound openings, horns leading from the openings of said wall, said wall being formed with heliciform channels leading to the horns.

5. A siren comprising a rotor having a circumferential cylindrical flange provided with a plurality of sound openings, a rotatably mounted cylindrical wall surrounding said flange and having a number of sound openings which is less than the number of sound openings of the rotor flange, and a laterally projecting horn leading directly from an opening of said wall, said horn being curved so as to act as a turbine blade to rotate said wall.

6. A siren comprising a rotor having a circumferential cylindrical flange, a stationary cylindrical wall surrounding said flange of the rotor, said flange and said stationary wall having a plurality of sound openings, a rotatably mounted wall immediately surrounding said stationary wall and having a number of sound openings which is less than the number of openings of either the rotor or stationary wall, and a laterally projecting horn leading directly from a sound opening of said rotatable wall, said horn being curved to act as a turbine blade to rotate the rotatably mounted wall under the influence of air passing therethrough.

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