Feb. 9, 1932. R. V. NORTHEY 1,844,226

SOUND PRODUCING DEVICE

Filed March 27, 1931 2 Sheets-Sheet 1

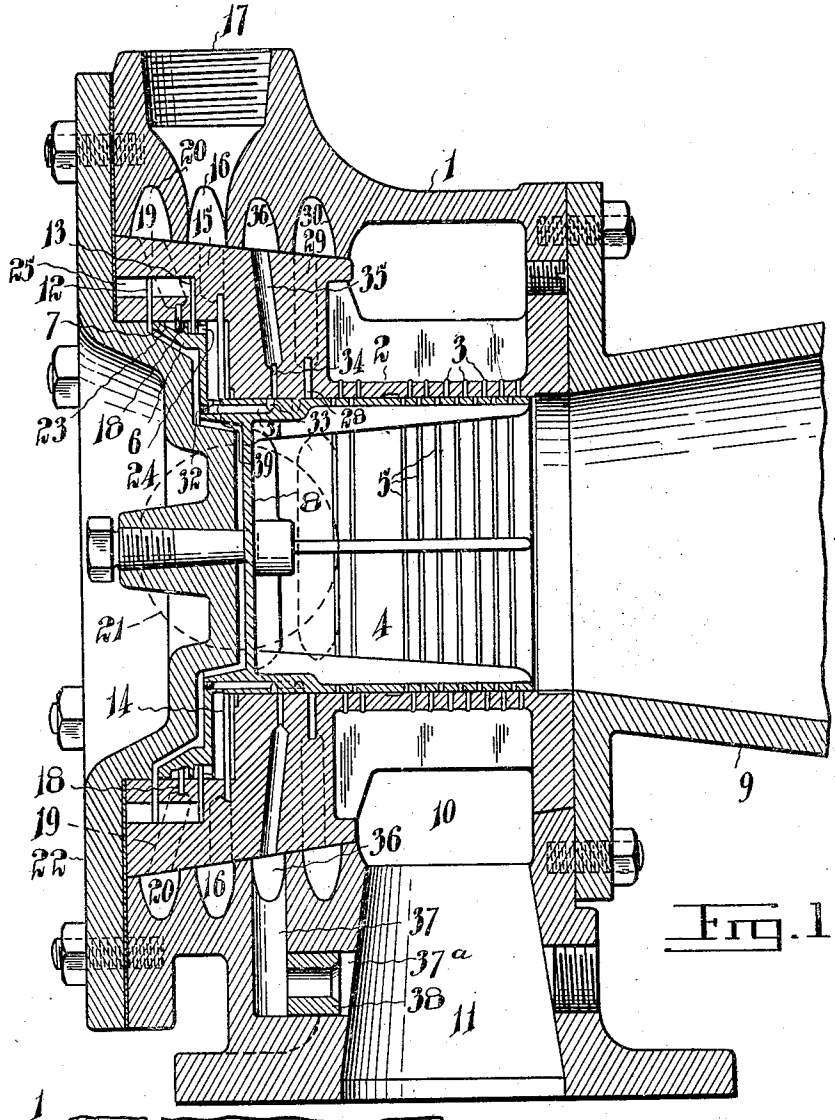

Fig. 1.

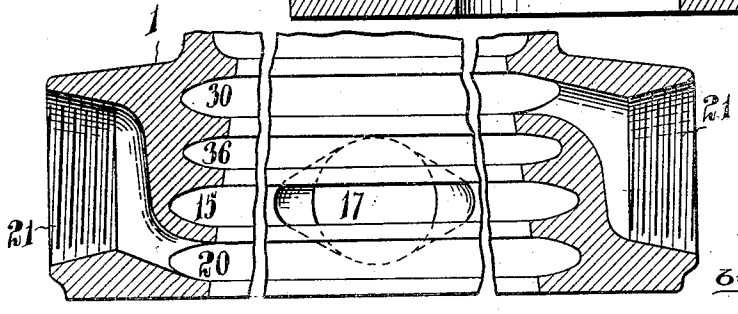

Fig. 4.

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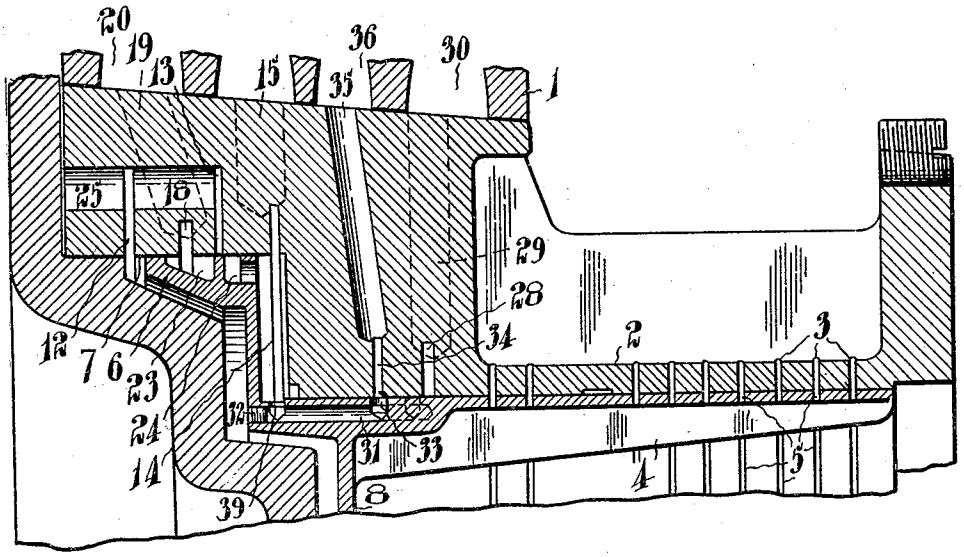

Fig. 2.

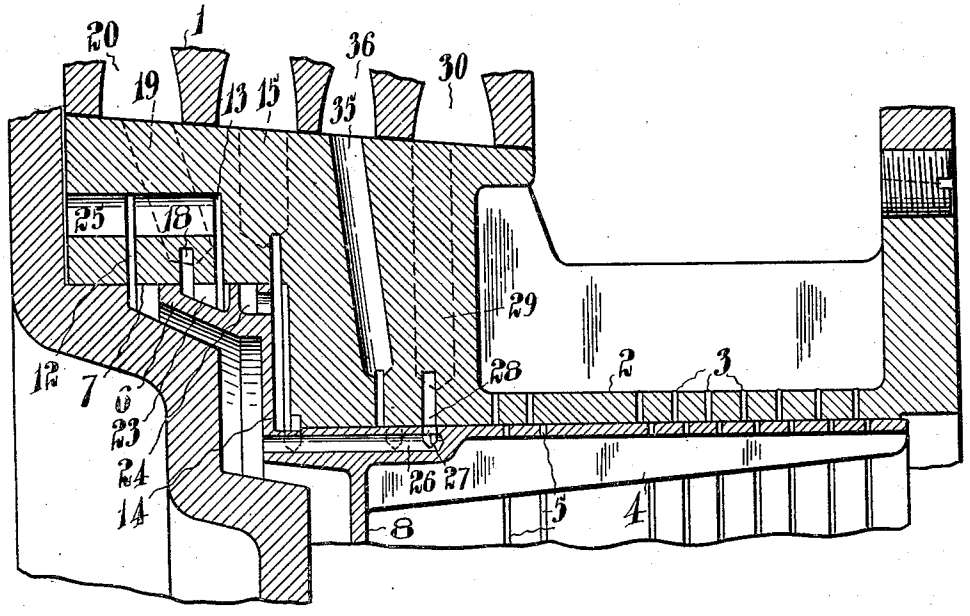

Fig. 3.

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1,844,226

UNITED STATES PATENT OFFICE

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SOUND PRODUCING DEVICE

Application filed March 27, 1931. Serial No. 528,449.

This invention relates to sound producing devices of the type shown in Patent No. 1,799,387 August 18, 1903, in which high pressure air was used to vibrate a hollow piston in a cylinder having orifices in its wall, the piston also having orifices which, by the vibration of the piston, are alternately brought into and out of alinement with the orifices of the cylinder, thus controlling the flow of low pressure air to cause a rapid succession of puffs of air to produce a musical note. In that patent means are disclosed, including a supplemental exhaust, which enabled the pressure of the driving air to be materially reduced resulting in marked economy of operation. In the present invention I aim to retain the advantages of the earlier construction, and also to so arrange the device that by the simple expedient of varying the relative pressures of the driving air and sound producing air the device may be caused to produce either its normal note or a note an octave lower.

I attain my object by providing means whereby, at the half stroke of the piston, sound producing air is admitted in front of the piston to check the forward stroke of the piston and return it to the initial position. Thus if the relative pressures of the driving air and sound producing air are suitably adjusted, usually to the extent of wholly or almost wholly cutting off the driving air, the piston will move to uncover the sound producing orifices of the cylinder and then return to its initial position, thus giving one puff of air for each double stroke.

With higher air pressure behind the piston the latter makes a full stroke and moves sufficiently far to uncover the orifices of the piston on the forward stroke and then close them again, the same occurring again on the return stroke. Thus two puffs of air are given for each double stroke of the piston which produces a note an octave higher than in the first case when the piston makes only a half stroke.

The invention is hereinafter more fully described and is illustrated in the accompanying drawings in which

Fig. 1 is a longitudinal section of the apparatus showing the piston at the rearward end of its stroke;

Fig. 2 an enlarged sectional detail of parts of the apparatus showing the piston on the half stroke;

Fig. 3 a similar view showing the piston in the exhaust position; and

Fig. 4 a cross section of the casing showing particularly the exhaust passages.

In the drawings like numerals of reference indicate corresponding parts in the different figures.

1 is the casing in which is mounted a cylindrical sleeve 2. The wall of this cylinder has a series of sound producing orifices 3 formed therein, which will usually be spaced at equal distances apart. Within the cylinder a hollow piston 4 is adapted to reciprocate, this piston being also provided with sound producing orifices 5 adapted to be brought into alinement with the orifices in the cylinder by the reciprocation of the piston.

The piston is provided with an enlarged head 6 adapted to reciprocate in the cylinder enlargement 7. The apertured part of the piston is separated from the remainder of the piston by the diaphragm 8. The open end of the piston communicates with the horn 8, which is suitably secured to the end of the casing.

Within the casing is formed the chamber 10 communicating with the air inlet 11. The sound is produced by the reciprocation of the piston, which causes its sound producing orifices to coincide at regular intervals with the orifices of the cylinder 2, thus producing a series of puffs of air which occur at such intervals as to form a musical note.

The piston and casing are constructed in the following manner to effect reciprocation of the piston. The cylinder enlargement is provided with the annular ports 12 and 13, which are connected by a plurality of longitudinal passages 25. In the wall of the cylinder enlargement is also formed an annular port 14 with which communicate a plurality of radial passages 15 which communicate with an annular chamber 16 formed in the casing 1. With this chamber communicates the air inlet 17. Intermediate of the ports 12 and 13 is an annular exhaust port 18 with which communicate a plurality of radial passages 19 which communicate with an annular chamber 20 formed between the casing and the cylinder enlargement and communicating with the exhaust passages 21. The head 22 closes the outer end of the cylinder enlargement. The piston head has an annular groove 23 formed in its exterior surface which is so positioned that, when it forms a communication between the exhaust port 18 and the port 13, the port 12 is uncovered. Also through the head of the piston are formed a plurality of passages 24 opening through the forward face of the piston head and through its periphery. Preferably the inner parts of these passages are formed by an annular groove in the exterior surface of the piston head.

From this construction it follows that, when the parts are in the position shown in Fig. 3, air from behind the piston head is exhausted through the port 12, the longitudinal passages 25, the port 13, the groove 23, the exhaust port 18, the passages 19, the chamber 20 and the passages 21. The momentum of the piston then carries it a little further to the right. There is then the condition that air under pressure is acting on the front of the piston while the pressure has been exhausted from behind. The piston is then forced to the position shown in Fig. 1 in which the groove 23 no longer forms a communication between the port 13 and the exhaust port 18. In this position the port 12 is still open to the space behind the piston head while the passages 24 provide a passage for air from the space in front of the piston head through the port 13, passages 25 and port 12 to the space behind the piston head. The same air pressure then exists both in front of and behind the piston head, but, owing to the greater surface of the piston head exposed to air pressure at the back than at the front, the excess pressure drives the piston forward to and beyond the exhaust position previously described. The piston is thus reciprocated to effect sound production as hereinbefore described.

The parts previously described are old in the art the present invention lying in the features hereinafter described.

In the end of the piston are formed a plurality of longitudinal passages 26. These passages open through the piston head. Ports 27 are formed in the piston wall communicating with these passages 26. In the cylinder wall I form an annular supplemental exhaust port 28 with which communicate a series of radial passageways 29 which communicate with the annular chamber 30 which communicates with the exhaust passages 21. There is thus provided a supplemental exhaust through the piston and cylinder wall at the end of the forward stroke of the piston as in the prior application hereinbefore referred to, the specific construction, however, being different. Also formed in the piston are a series of longitudinal passages 31, these being drilled through the metal and having their outer ends closed by the plugs 32. With these passages communicate the ports 33 formed in the piston wall. In the cylinder wall is formed an annular port 34 with which communicate a series of radial passages 35 communicating with the annular chamber 36. With this annular chamber communicates a radial passage 37, which in turn communicates with the passage 37^a communicating with the air inlet 11 for the sound producing air. A plug 38 is positioned in this passage having a central opening therethrough. By employing a plug having a suitable size bore the flow of air from the inlet 11 into the annular air chamber 36 may be controlled as desired. The ports 33 are so positioned that they come into alinement with the port 34 when the piston has completed substantially half its forward stroke. At this point ports 39 extending through the piston wall from the passages 31 are in communication with the space in front of the piston.

From the construction described it follows that if a suitable pressure is maintained at the inlet 17 for the driving air the piston will make a full stroke in either direction from the position shown in Fig. 1 to the position shown in Fig. 3. The supplemental exhaust provided enables the exhaust from behind the piston head to take place so fully and rapidly that the return movement is effected with a minimum air pressure so that economies in operation are effected and also in the expense of installation. If, however, the pressure of the driving air be reduced sufficiently as soon as the piston on its forward stroke reaches the position shown in Fig. 2, sound producing air is admitted through the passages 31, ports 38, 33, 34 from the annular chamber 36 and the pressure in front of the piston is augmented by the pressure of the sound producing air. The piston is then driven back as the pressure in front of the piston exceeds that behind it. Thus a low note is sounded as the piston only uncovers the sound producing orifices of the cylinder once for each double stroke of the piston instead of twice as is the case when the

piston travels the full length of its stroke in either direction.

I have found that by choosing a horn designed to resonate to the frequency of the low note produced the vibrations of the piston are to an extent controlled by the resonance of the horn and that the piston will vibrate when the pressure of the driving air is sufficiently reduced in substantial synchronism with the horn and the range of sound transmission is materially increased.

In practice I find that with the driving air entirely cut off the device will operate in the manner described.

What I claim as my invention is:

1. A sound producing device comprising a cylinder having sound producing orifices in its wall; a hollow piston adapted to reciprocate in said cylinder, open at one end and having sound producing orifices in its wall adapted to be brought into alinement with the orifices in the cylinder by the reciprocation of the piston; an enlarged head at the end of the piston remote from its open end; an enlargement of the cylinder in which the piston head reciprocates; ports in the piston head and the wall of the cylinder enlargement controlling the admission and exhaust of the piston driving air; a chamber for sound-producing air surrounding the cylinder; and in the cylinder and piston walls co-operating at the half stroke to form a communication between the interior of the cylinder enlargement in front of the piston head and the sound-producing air chamber to check the piston substantially at the middle of its stroke.

2. Apparatus as set forth in claim 1 provided with co-operating ports in the cylinder and ports piston walls forming an exhaust supplemental to that of the piston head and the cylinder engagement.

3. In apparatus as set forth in claim 1 a specific construction of the means for admitting sound producing air in front of the piston head comprising longitudinal passages in the piston wall opening into the cylinder enlargement; ports in the piston wall communicating with these passages; ports in the cylinder wall with which the piston ports register at the half stroke; radial passages in the cylinder wall extending from said ports; an annular passage with which said radial passages communicate; and a passage between said annular passage and the chamber for the sound producing air.

4. A sound producing device comprising a cylinder having sound producing orifices in its wall; a hollow piston adapted to reciprocate in said cylinder open at one end and having sound producing orifices in its wall adapted to be brought into alinement with the orifices in the cylinder by the reciprocation of the piston; an enlarged head at the end of the piston remote from its open end; an enlargement of the cylinder in which the piston head reciprocates; means for continuously admitting driving air in front of the piston head; means for alternately admitting air to and exhausting it from the cylinder enlargement behind the piston; means for supplying sound producing air to the exterior of the cylinder; and means for admitting sound-producing air to the interior of the cylinder enlargement in front of the piston head at the half stroke of the piston.

Signed at Toronto, Canada, this 20th day of March, 1931.

RODNEY V. NORTHEY.