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SOUND PRODUCING APPARATUS

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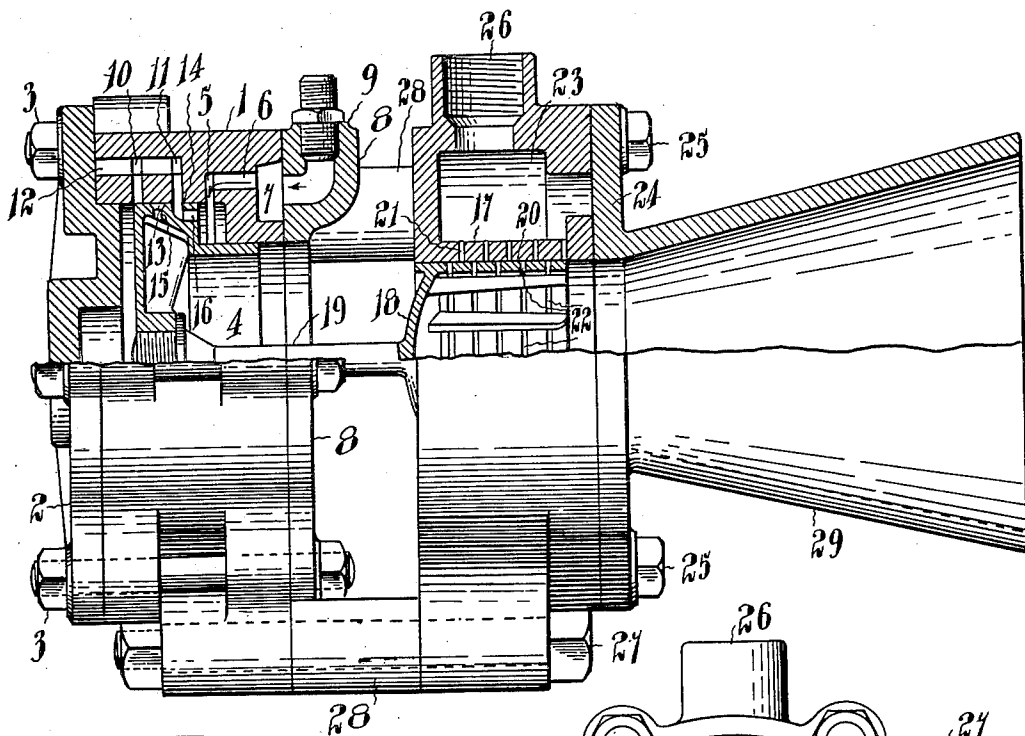


Fig. 1.

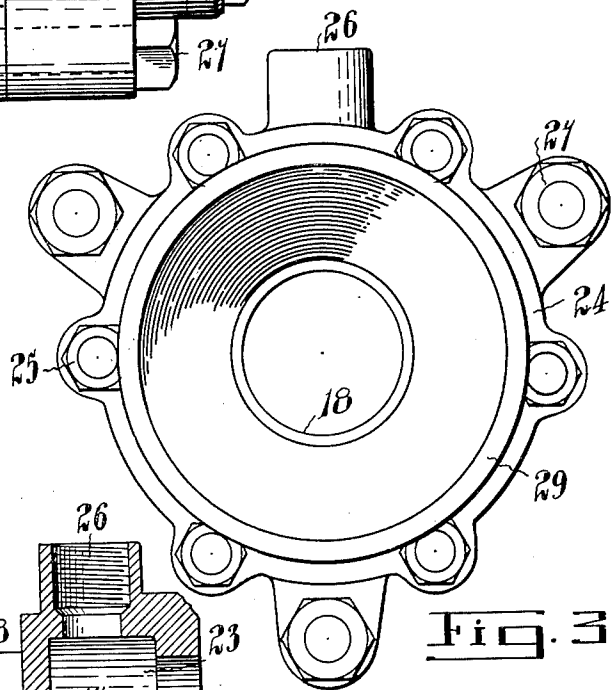


Fig. 3.

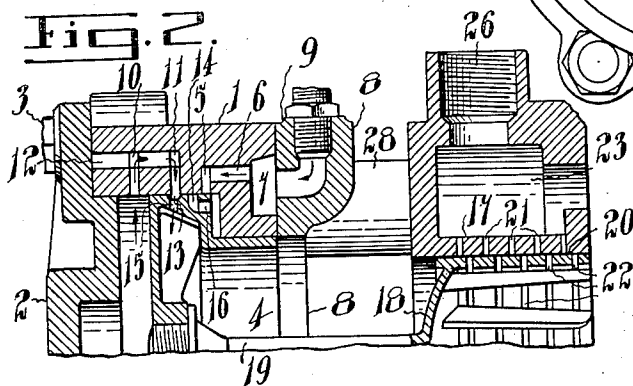


Fig. 2.

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SOUND PRODUCING APPARATUS

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13 Claims. (Cl. 116—147)

This invention relates to sound producing apparatus of the diaphone type in which a hollow piston is vibrated 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 a gaseous fluid to cause a rapid succession of puffs to produce a musical note.

10 In the present invention the problem is to produce a sound producing device particularly adapted for use on railway locomotives on which, for certain reasons, it is desirable to use compressed air to vibrate the piston and steam from the locomotive boiler to produce the sound.

15 In such installations, if apparatus of the type shown in United States Patent 1,789,387 were employed, the very considerable difference in temperature between the air and steam would result in unequal expansion of the different parts of the apparatus which would materially and adversely affect the operation.

My object therefore is to devise apparatus which will overcome the difficulty referred to, 25 which may be cheaply produced and which is economical in operation.

I attain my object by means of a construction which may be briefly described as follows. The driving air cylinder is spaced from the steam cylinder and their only connection is by means of tie bolts and spacers of relatively small cross sectional area, and therefore of small conductive capacity.

Further the air piston and steam piston are 35 connected only by a piston rod which is also of relatively small cross sectional area. As a further protection against the transfer of heat from the steam end to the air end, the exhaust air from the air cylinder is exhausted into the air piston, which is hollow and open at the end adjacent the steam cylinder. The exhaust from the hollow steam piston passes into the horn, which is directed away from the air cylinder.

The device is also simplified, cheapened and 45 improved in operation by casting in the cylinder an annular distributing chamber for the sound producing fluid, which is open at its outer end, and by providing an annular closure with which the horn may be connected. A similar arrangement is also provided for the distribution of the gaseous fluid used in the motive part of the apparatus.

The invention is hereinafter more fully described and is illustrated in the accompanying 55 drawing in which

Fig. 1 is a longitudinal section, partly in elevation, of the apparatus showing the air piston at the rearward end of its stroke;

Fig. 2 a similar view of part of the device showing the air piston at the forward end of its stroke; and

Fig. 3 a front elevation.

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

Referring to the drawing 1 is the cylinder of the motive part of the apparatus. This cylinder has its bore formed of two different diameters. The outer end of the cylinder is closed by the cover 2 secured in place by the bolts 3. In the cylinder is fitted the hollow piston 4, which is also of two different diameters. There is thus a chamber of cylindrical form behind the piston and a chamber of annular form and lesser cross sectional area in front of the piston. With the annular chamber communicates the annular port 5 communicating by means of passages 6 with the annular chamber 7 formed in the face of the cylinder remote from the cover 2.

An annular cover 8 is secured to this face and closes the chamber 7. A pipe fitting 9 is formed on this cover which serves as a connection between the chamber 7 and a pipe supplying air or other gaseous working fluid.

Also in the wall of the cylinder having the larger internal diameter are formed the annular ports 10 and 11. The former is opened by the piston head or enlargement when the piston is at the forward end of its stroke and the latter is opened at the rearward end of the piston stroke. Passages 12 connect the ports. In the piston head are formed the annular ports 13 and 14, the former communicating with the interior of the hollow piston through the holes 15 and the latter with the annular chamber in front of the piston through the holes 16.

When the piston is at or near the forward end of its stroke the exhaust port 13 is in communication with the port 11 and exhaust from behind the piston to its interior takes place through the port 10, passages 12, port 11, port 13 and holes 15. See Fig. 2.

Air compressed in the annular chamber by the moving piston then drives back the piston till the port 14 in the piston communicates with the port 11, when air enters the annular chamber through the port 5 and from the annular chamber flows through the holes 16, port 14, port 11, passages 12 and port 10 to the cylindrical chamber behind the piston. The pressure before and

behind the piston is thus equalized and the piston is shot forward again to the exhaust position, since the area of the rear end of the piston, exposed to pressure is much greater than that of the annulus at its forward end exposed to pressure. Thus the piston is rapidly vibrated as long as a driving fluid, which will usually be air at a pressure of about 100 lbs. to the square inch, is supplied to the chamber 7.

The actual sound producing apparatus comprises a cylinder 17 and a hollow open ended piston 18. The pistons 4 and 18 are connected by the piston rod 19.

The inner wall 20 of the cylinder 17 has the sound producing orifices 21 formed therein. The wall of the piston is also provided with orifices 22. 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, thus producing a series of puffs of air or other gaseous fluid at such intervals as to form a musical note.

The gaseous fluid in the present case will usually be high pressure superheated steam. This fluid is supplied to the orifices 21 from the chamber 23 which surrounds the wall 20 and opens through the outer face of the cylinder 17. A cover 24 secured to the cylinder 17 by the bolts 25 closes the chamber, and also has the horn 29 formed on or secured thereto. The chamber is provided with an inlet 26 for connection with a steam supply pipe.

The cylinders 1 and 17 are secured together by the bolts 27 and their spacing maintained by the spacing sleeves 28 through which the bolts pass.

From the above description it will be seen that the actual heat conductive connection between the driving and sound producing ends of the apparatus is reduced to a minimum, while air may pass freely between them to carry away the heat from the sound producing end. Further the cool exhaust air from the driving end is discharged into this space, adding to the cooling effect, while the hot exhaust from the sound producing end is directed away from the device.

Owing to the entire separation of the driving piston and the driven piston exhausting the driving air into the interior of the hollow driving piston cannot prejudicially affect the sound production as was the case in earlier forms of diaphone in which the air exhausted into the hollow piston passed into and through the hollow sound producing piston.

The general construction is also very simple comprising simple, easily machined and assembled parts.

In operation the device is found to be very economical compared with the ordinary steam whistle.

What I claim as my invention is:

1. A sound producing device comprising a cylinder having sound producing orifices in its wall; a hollow driven piston adapted to reciprocate in said cylinder, open at one end and having sound producing orifices in its wall adapted to be brought into alignment with the orifices in the cylinder by the reciprocation of the piston; a chamber for a sound-producing gaseous fluid formed about the cylinder; a driving piston; a piston rod connecting the two pistons; a cylinder for the driving piston spaced from the cylinder of the driven piston; means connecting the cylinders in spaced relationship; and ports in the driving piston and the walls of its cylinder controlling the admission and exhaust of a gaseous driving fluid.

2. A sound producing device according to claim 1 in which the driving piston is hollow and open at one end to the atmosphere and the cylinder therefor open at the same end and in which the exhaust of the driving fluid takes place into and through the interior of the piston and through the open end of the first-mentioned cylinder.

3. A sound producing device according to claim 1 in which the driving piston is hollow and has an open end and the cylinder thereof has also an open end facing the cylinder of the driven piston and in which the exhaust of the driving fluid takes place into and through the interior of the driving piston and through the open end of the first-mentioned cylinder.

4. A sound producing device comprising a hollow driving piston having an enlarged head and being open at the smaller end; a cylinder having parts of different diameter to receive the parts of the piston of corresponding diameter, the cylinder being closed at its larger end whereby a cylindrical chamber is formed behind the piston and an annular chamber in front of the head; a supply port in the cylinder wall for the driving fluid, opening into the said annular chamber when the piston is at or near the rearward end of its stroke; a port in the cylinder wall open when the piston is at the forward end of its stroke; an intermediate port in the cylinder wall; a passage in the cylinder wall connecting the two last mentioned ports; an exhaust port in the piston wall towards its rear end opening into the interior of the piston; an inlet port in the wall of the piston in constant communication with the annular chamber, the ports being positioned and proportioned so that the reciprocation of the piston alternately brings the exhaust port and inlet port into communication with the intermediate port in the cylinder wall; sound producing apparatus of the reciprocating diaphone type spaced from but connected with the cylinder aforesaid; and a connection between the piston aforesaid and the reciprocating part of the sound producing apparatus.

5. A sound producing device comprising a hollow driving piston having an enlarged head and being open at the smaller end; a cylinder having parts of different diameter to receive the parts of the piston of corresponding diameter, a removable closure closing the larger end of the cylinder; an annular inlet chamber for driving fluid formed in the cylinder and opening through the face of the smaller end thereof; a removable cover closing said chamber; ports in the piston and cylinder walls controlling the admission and exhaust of the driving fluid; sound producing apparatus of the reciprocating diaphone type spaced from but connected with the cylinder aforesaid; and a connection between the piston aforesaid and the reciprocating part of the sound producing apparatus.

6. A sound producing device comprising a hollow driving piston having an enlarged head and being open at the smaller end; a cylinder having parts of different diameter to receive the parts of the piston of corresponding diameter, a removable closure closing the larger end of the cylinder; an annular inlet chamber for driving fluid formed in the cylinder and opening through the face of the smaller end thereof; a removable cover closing said chamber; a pipe fitting integral with the said cover for forming a connection between the chamber and a supply pipe; ports in the piston and cylinder walls controlling the admission and exhaust of the driving fluid; sound

- producing apparatus of the reciprocating diaphragm type spaced from but connected with the cylinder aforesaid; and a connection between the piston aforesaid and the reciprocating part of the sound producing apparatus. 80
7. A sound producing device comprising a cylinder having sound producing orifices in its wall; a hollow driven 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; a chamber for a sound-producing gaseous fluid formed about the cylinder communicating with the orifices in the cylinder wall and opening through the end face of the cylinder wall; and an annular closure for said chamber secured to the said wall. 85
8. A sound producing device comprising sound producing apparatus of the reciprocating diaphragm type including a stationary and a reciprocating part; a reciprocating motor operating with a gaseous driving fluid and including a stationary and a reciprocating part, the motor and sound producing apparatus being entirely independent units; a direct connection between the two reciprocating parts; and means detachably holding the stationary parts in spaced relationship. 90
9. A sound producing device comprising a cylinder having sound producing orifices in its wall; a hollow driven 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; a chamber for a sound-producing gaseous fluid formed about the cylinder communicating with the orifices in the cylinder wall and opening through the end face of the cylinder wall; an annular closure for said chamber removably secured to the said wall; and a horn carried by said closure. 95
10. A sound producing device comprising sound producing apparatus of the reciprocating diaphragm type including a stationary and a reciprocating part; a reciprocating motor operating with a gaseous driving fluid and including a stationary and a reciprocating part, the motor and sound producing apparatus being entirely independent units; means connecting the reciprocating parts; and means connecting the stationary parts in spaced relationship. 100
11. A sound producing device comprising sound producing apparatus including a stationary and a reciprocating part; a reciprocating motor operating with a gaseous driving fluid and including a stationary and a reciprocating part and an exhaust outlet from the motor directed towards the sound producing apparatus, the motor and sound producing means being entirely independent units; means connecting the reciprocating parts; and means connecting the stationary parts in spaced relationship. 105
12. A sound producing device comprising sound producing apparatus including a stationary and a reciprocating part; a reciprocating motor operating with a gaseous fluid and including a stationary and a reciprocating part; an exhaust outlet for the sound producing mechanism directed away from the driving apparatus, the motor and sound producing apparatus being entirely independent units; means connecting the reciprocating parts; and means connecting the stationary parts in spaced relationship. 110
13. A sound producing device comprising sound producing apparatus including a stationary and a reciprocating part; a reciprocating motor operating with a gaseous fluid and including a stationary and a reciprocating part; an exhaust outlet from the motor directed towards the sound producing apparatus; an exhaust outlet for the sound producing mechanism directed away from the driving apparatus, the motor and sound producing apparatus being entirely independent units; means connecting the reciprocating parts; and means connecting the stationary parts in spaced relationship. 115
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