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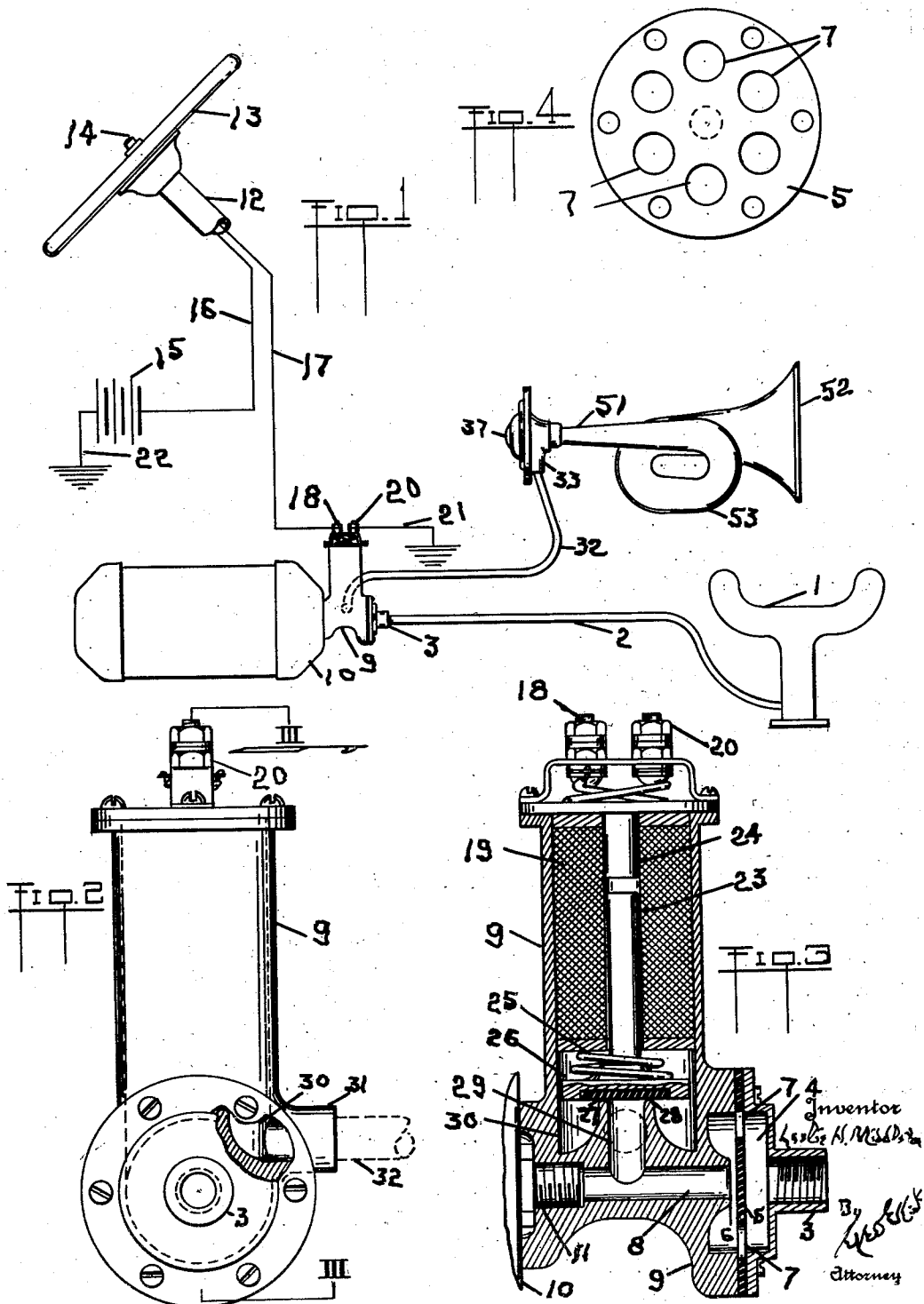
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SIGNALING

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SIGNALING

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This invention relates to wave selection and control in signaling.

This invention has utility when incorporated in pneumatic signals of the trumpet type having diaphragm sound generators therefor.

Referring to the drawings:

Fig. 1 is a fragmentary view of a layout of an embodiment of the invention, diagrammatically shown, for internal combustion propelled vehicles, whether for air, land or water;

Fig. 2 is a detail view, with parts broken away, of features of a control valve for the sound generating unit;

Fig. 3 is a section on the line III—III, Fig. 2;

Fig. 4 is a detail view of the check valve disk at the control valve; and

Fig. 5 is a view in longitudinal section, with parts broken away, of the sound generating unit, its mounting, and projecting trumpet.

Internal combustion engine intake manifold 1 is shown with suction duct 2 therefrom to fitting 3 having therein check valve chamber 4. In this chamber 4 is located check valve disk or diaphragm 5 normally just clear of port 6. Suction action of the engine intake is thus effective to generate a pull thru the port 6 and by way of ports 7 thru the diaphragm, draw such air into the duct 2 for delivery to the engine with the fuel for carburetion. The drawings for this check valve are exaggerated to stand reduction. In preferred practice the diaphragm 5 position of rest approximates a clearance of .020" from the port 6, and the diaphragm 5 itself is also of about .020" thickness, and resistant to attack by heat, oil, and motor fuel. To this end the diaphragm is an impregnated cambric for ready flexing in a short range.

The port 6 is a terminus for duct 8 thru housing 9. The duct 8 in passing thru the housing 9 is in direct communication with reservoir 10 with which reservoir 10 the housing 9 is assembled by fitting 11.

On column 12 is steering wheel 13 for the automobile, or motor boat, or other vehicle. In convenient location relatively thereto is

push button switch 14 for closing an electric circuit from battery 15 having line 16 to the switch 14 and line 17 therefrom to terminal 18 at the housing 9. The terminal 18 is connected to solenoid coil 19 in the housing 9, from which coil the circuit is completed thru terminal 20 and line 21 to ground, thereby permitting conductor communication by ground line 22 with the battery 15.

Energizing of the coil 19 causes pulling of plunger or core 23 against stop 24, and such action is opposed by helical compression spring 25 about the plunger 23. This spring 25 acts upon disk 26 fixed with the plunger 23 for normally holding valve pad 27 to close port 28 from which extends branch duct 29 to the duct 8. The below atmospheric pressure condition of storage as the normal operating condition for the reservoir 10 further establishes a closed holding tendency for the pad 27 at the port 28. There will be no fluttering of the check valve diaphragm 5 for air withdrawal when the vacuum established is in a range above the motor suction then effective, or if the motor be stopped. Under these lowered pressure conditions for the reservoir 10, the valve 5 will be closed. Push button switch control for opening the valve 27 permits suction effectiveness in chamber 30 of the housing 9, into branch 31 therefrom connected by line 32 with horn housing 33.

In the housing 33 is chamber 34 having flexible side wall or diaphragm 35 isolating the chamber 34 from chamber 36 which is normally closed by plug 37.

Opposite to the flexible wall 35, the chamber 34 has port 38 with surrounding seat 39 facing away from the disk diaphragm wall 35. Thin flexible disk 40 is mounted by stem 41 extending thru washers 42 and the wall 35. A loading disk 43 is also provided in parallelism to the wall 35 and the disk 40, located in this instance in the chamber 36, altho practical operation may be had by locating this disk 43 in the chamber 34. Threaded portion 44 of the stem 41 extends thru nut 45. Removal of the plug 37 permits access to notched terminus 46 for use of a screw driver in rotating the stem 41 in determining the nicety of normal clearance for

the disk 40 from the seat 39. This unit may be designed for a definite frequency of vibration as the sound generation source. The wall 35 is assembled between sections of the housing 33 and spaced therefrom by washers 47. Screws 48 complete the assembly. The wall 35 desirably is selected of thin sheet metal, such as Swedish steel, for ready flexing and of long life as against resiliency fatigue. A loading to reduce the normal vibration rate for the diaphragm or wall 35 is had by disk 43, which may be relatively more rigid. This brings about a primary damping effect. The adjustment of the stem 41 is not to flex the wall 35, nor to bring such wall into any position for rest or movement. The adjustment is in practice contemplated to be solely for determining the clearance of the thin valve closing disk 40 as to the seat 39. This is a maintained clearance for rest. Furthermore this disk 40 has such a degree of flexibility that its movements may supplement the actual shifting from the wall 35 for over or under flutterings in effective port areas. Further damping or retarding of the movement for the wall 35 is brought about by the closed maintained capacity chamber 36. The air volume in this chamber 36 may be trapped at atmospheric pressure. Flexing of the wall 35 to close the valve 40 is resisted by air compression in the chamber 36, while opening of the valve 40 beyond the normal is also resisted by air expansion in the chamber 36.

Operation of the push button switch 14 brings about a pressure drop in the chamber 34. The slight clearance at the valve 40 is of less capacity than the duct 32. The relatively greater area of the wall 35 with pressure drop in the chamber 34, overcomes the lag below atmospheric pressure in the chamber 36 in effecting opening of the valve 40. The in rush at atmospheric pressure supplies air to the chamber 34 to act upon the wall 35 to shift the valve 40 toward port closing position. The approximately steady suction, or in effect continuous withdrawal of air by the line 32, is in practice of but slight actual volume, for the diaphragm wall 35 as loaded and dampened, at once gets to its periodicity rate for pump action.

The valve 40 is in minor chamber 49 in which is bushing 50 mounting trumpet 51 the terminus of which is provided with bell 52. Niceties of construction and design here further materially contribute to signal efficiency. The lowered frequency obtained for the generation unit provides a source for a note in audibility range of great attention-attracting value. The horn 51, 52, herein is primarily disclosed as more than a mere director and more than a projector, or even than an amplifier. The end sought herein in addition to directing-projecting-amplifying, is tone clarification, which it has been found means

carrying power for distance much increased as well as with note or notes of less objectionable attributes in signal uses.

In the selection of material, such may be of sheet metal. The trumpet portion is of such rigidity as to defeat resonance. The purpose is thus that the trumpet 51 is a conduit thru which the pulsations from the pumping by the sound generating unit may be definitely controlled, at least as to certain limits. The bell 52 provides a slightly terminus, should not be resonant, and should defeat any edge singing action.

There may be hereunder a loop type of horn 53. By the adoption of a predetermined increment for cross-sectional area increase in the trumpet from the chamber 49, the pumping action has its pulsations controlled for quite definite frequency cut-off. The physical structure is made to lend itself to this control by designing the trumpet for a definite taper increase from its throat adjacent the chamber 49. It has been found that k , a constant for cross-sectional area increase may have quite a range as the expansion constant; A , the large area of the trumpet; a , the throat or small area of the trumpet; n , the number of units of length for such definitely tapered portion of the trumpet, with formula:

$$k = \frac{A}{an}$$

Substituting in the above 3.1416 diameter squared, there results:

$$k = \frac{D^2}{d^2n},$$

with D , diameter at larger area region and d , diameter at throat or smaller area region. With L , overall length for the definitely tapered portion of the trumpet, and l , a unit length, or the distance between cross-sections, then

$$n = \frac{L}{l}$$

With N unity

$$k = \frac{D^2}{d^2L}$$

Solving for D , there is had

$$D_1 = d\sqrt{kN}$$

This formula may be used with D_1 a diameter to be found at N units of length from the throat. By taking k from under the radical and designating it c , the formula takes the form

$$D_1 = cd\sqrt{N}.$$

With the foregoing basis for design, practical considerations demand dimensional limitations enter. Diaphragm unit volume in practice has been found effective as a sound generator thru a $\frac{5}{8}$ " throat. An overall

length for a horn of 15" for the definite taper and 3" more for the larger cross-sectional area increment of the bell, does not produce an unwieldy or unsightly signal device for automobiles, or even factory code signals.

Instead of taking $\frac{5}{8}$ " as the throat diameter, there may be taken 3.1" as the taper large diameter terminus before the bell, or at the 15" length region. Together it is seen these give an expansion ratio of about five to one, which is a slightly taper for a trumpet, as well as hereunder involving acoustic valuable properties. The constant is thus located as $\sqrt{1.65}$ or 1.283, and the dimensions solve:

Point No.	Distance from throat	cd	$\sqrt{N}$	D_1
N				.625"
1	1"	.802	1.	.802"
2	2"	.802	1.414	1.120"
3	3"	.802	1.732	1.389"
4	4"	.802	2.	1.604"
14	14"	.802	3.740	2.959"
15	15"	.802	3.870	3.100"

Were the constant taken for a definite cut-off of all frequencies below 256 vibrations per second, such constant would be 6.4 instead of 1.65 found above. Were there solving for the increment to develop an approximation of bell terminus, the length would be something like six feet. It is thus seen that the practical dimensions have introduced marked departures, for fraction of the overall length, and in a greatly stepped down extent from fundamental tone, say of lower C in treble clef. Notwithstanding these arbitrary departures to meet the realm of practice, there is produced a structure of definite value as to frequency cut-off effectiveness. Under the formula, the definite taper is spaced a number of notes down from the note of the sound generating unit. However, the frequency cut-off has real value in tone clarification, prompting the conclusion that there is efficient selectivity in the audible range, and that while according to computations the frequency cut-off is in a low range, it is truly in a range promoting clarity of tone and contributing to distance for audibility.

The bushing 50 is shown with its threaded outer portion protruding from the housing 33. Nut 53 thereon holds eye 54 of mounting bracket 55 having clamp terminus 56 opposed by clamp element 57, which may embrace headlight spacing rod 58 or other vehicle structure, and be there demountably anchored by bolts 59.

In practice, value is to be attributed to the reservoir or chamber 10 and additionally to the control connection therefor. The reserve means that there is available use of the signals when the motor is not running as in the instance of stalling. Furthermore, there is retained use for this signal throughout entire

range of speeds for the motors. The diaphragm 5 as a flexible valve is responsive for evacuating effectiveness in the chamber 10 not only at idling of the motor, but at running speed, even at excessive speed. In fact this diaphragm is so sensitive that at .3" of water as a measure of the lower pressure in the intake 1, this diaphragm 5 is operative for creating lowered pressure in the chamber 10 which pressure is controllable from the push button 14 for operating the horn or signal.

What is claimed and it is desired to secure by Letters Patent is:

1. A signal comprising a chamber having a port, a valve for the port, said chamber having a flexible wall opposing the port, means mounting the valve on said wall, control means for varying the pneumatic pressure in said chamber, and a damping control for the flexible wall including an approximate volume retaining chamber.

2. A signal comprising a chamber having a port, a valve for the port, said chamber having a flexible wall opposing the port, there being means mounting the valve on said wall, control means for varying the pneumatic pressure in said chamber, and an additional normally closed chamber opposing the flexible wall and having a pressure maintained condition therein for affecting said signal by controlling said wall.

3. A signal comprising a trumpet terminating in a restriction, a chamber having a valve seat adjacent said restriction, a valve for the seat and movable toward the trumpet in opening, said chamber having a flexible wall on the side thereof opposite said valve, connecting means for mounting the valve to be shifted by said wall, pressure control means for effecting wall operation, and a damping control for the wall including an additional chamber, and a closure for the additional chamber effective for trapping a controlled volume therein.

4. A signal comprising a trumpet terminating in a restriction at one end and a bell at the other, there being a taper enlargement therebetween on an increment constant of cut-off vibration selectivity, a chamber having a flexible wall opposing said restriction and a valve at the restriction connected to be shifted by wall flexing, and fluid dampened pneumatic actuating means for effecting wall flexing in signal producing frequency.

5. A signal having a reciprocable wall, a control for the wall, and a projector therefor provided with a dimension constant of lower audibility tone cut-off effectiveness.

6. A signal having a reciprocable wall, a control for the wall, and a projector therefor provided with an increment constant cross-sectional area, and a terminus of greater increment, said projector increment area

being of capacity for selective tone elimination.

7. A signal having a reciprocable wall, a dampening control for the wall, and a projector therefor within ten to one ratio of diameters in a dimension extent thereof having a tone frequency effective cut-off constant.

8. A signal having a reciprocable wall, a dampening control for the wall, and a projector therefor of increasing diameter dimension portion for tone frequency cut-off in a range below 256 vibrations per second, said dimension portion having an increment constant and of fractional lineal extent thereunder.

9. A signal device having a reciprocable wall, a dampening control for the wall, and a projector therefor of a diameter ratio in excess of three to one in a dimension extent range having frequency cut-off effectiveness, said dimension being a fractional lineal extent on a constant for a cut-off in frequency below 256 vibrations per second.

10. The method of signaling comprising generating vibrations of a determined frequency, projecting said vibrations, and during said projecting, cutting off lower frequency vibrations.

11. The method of lowering the effective tone of a vibrating diaphragm having a plane of rest, comprising pneumatically resisting flexing of the diaphragm out of said plane.

12. The method of generating lowered tone diaphragm vibrations for a diaphragm having a position of rest, comprising pneumatically actuating the diaphragm on one side thereof by varying the pneumatic pressure, and resisting said actuating by maintaining pneumatic pull toward the position of rest at the other side of the diaphragm.

13. A signal having a sound generating source, a control for the signal, a pneumatic supply for the source and a diaphragm device to conserve the supply for the sound control source.

14. A pneumatic signal, a reserve chamber therefor connected to the signal, means for creating a departure from atmospheric pressure in the chamber, and a diaphragm check valve between the means and chamber.

15. A pneumatic signal, a reserve chamber connected to the signal, suction means for evacuating the chamber, and a diaphragm check valve between the means and chamber.

In witness whereof I affix my signature.
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