RESONANCE IN SONIC CIRCUITS

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ABSTRACT: *Agues a practical way in which the two springs with sonic capacities C_1 and C_2 can be obtained by cutting an spring that has the sonic capacity C.*

KEY WORDS: **Theory of Sonics, mechanical resonant circuit.**

1. INTRODUCTION

Theory of sonics has a mechanical resonant circuits design in witch material constants occur (tensile strength ...), whose values are difficult to control during thermal processes faced by springs. In this paper argues a practical way in which the two springs with sonic capacities C_1 and C_2 can be obtained by cutting an spring that has the sonic capacity C.

This method of calculating the basis for a patent, which proposed practical solving this problem [1].

Sonic hammer

In principle, a percussive sonic installation consists of the following parts in sketch below. (Sonic generator that is designed to generate mechanical energy in the liquid where large.

Operating the generator can be electric or hydraulic.

1) rigid pipe for transportation of the sonic energy by means of a hydraulic agent, up to sonic receiver. We have found experimentally that the use of high pressure flexible pipes, the hydraulic hose type improprie whereas all the mechanical energy is absorbed into the walls of rubber hose reinforced with visco-plasticity.

2) Sonic Receiver consisting of a piston inductance L sonic supported between two elastic springs with sonic capabilities C1 and C2.

3) One end of the piston is in contact with the agent hydraulic transmission line (2) of sonic energy and the other end into contact with percussive instrument that may be needed:

4) hammer, drill or auger.

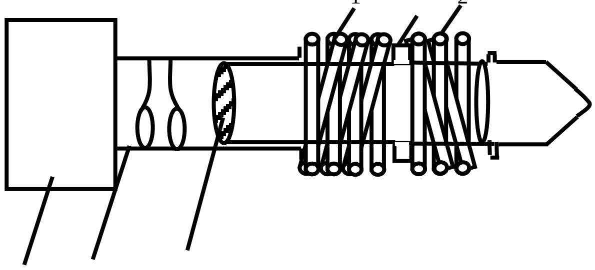
Sonic's task is to convey the sonic energy with maximum efficiency agent taken from hydraulic to hammer or drill.

Overcoming inertia piston due sonic inductance L leads to energy loss and therefore useful in lowering the yield per assembly plant.

For this reason sonic piston having inductance L is located between the resorts of sonic capacities C1 and C2.

For the receiver to act as a valve open and the whole energy of the wave mechanics of the transmission line to be so transferred through it to hammer or drill must value assembly parameters C1 - L - C2 belong to a circuit that functions in mode resonant frequency mechanical waves in transmission line.

Consider the circuit Sonic series L - C or a piston mass M, the sonic inductance L, supported between two resorts sonic capacities C1 and C2.



For the receiver to admit the whole amount of energy to body percussion in its design must take into account the resonance condition LCa2 = 1.

Translating electric formalism case of Sonic series LC circuit (in which energy dissipation insensitive), involves highlighting a form of differential equation own equivalent of this circuit.

Thus, the sonic pressure may be defined as:

$$h = L\frac{di}{dt} + \frac{1}{C}\int i dt = L\frac{di}{dt} + \frac{\Omega}{C}\cdot y$$

And in the end you should use group relations:

The two resorts sonic capacities C1 and C2 are arranged back and sides of the piston. Since the oscillation amplitude is reduced, we can write the relation:

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$$

equivalent to that of the series connection of the capacitance.

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} \text{ şi } \frac{1}{C_1} = \frac{2}{\pi} \cdot \frac{1}{C}$$

can determine the values C1 and C2 sonic capacity to the capacity of the sonic C: $\mathbf{C_1 = \frac{\pi}{2} C = 1{,}57C}$ **şi** $\mathbf{C_2 = \frac{\pi}{\pi - 2} C = 2{,}75\ C}$

2. METHOD OF CALCULATION

In order to design resonant circuit C_1-L-C_2 are neccessar further clarification: sonic resonance occurs if:

$$LC\omega^2 = 1,$$

L= sonic piston inductance calculated with the formula:

$$L = M/S_p^2$$

where M is the mass of the piston and piston Sp is the section relative to the spring.

C = equivalent sonic capacity, calculated using the formula:

$$C = fS_r^2/F$$

Where:

Sr is straight sectional area of the spring, and f is the distance that the spring is compressed under the action of F;

ω is angular wave transmitted through the spring.

In practice, weigh the mass M of the piston, to calculate inductance and sonic resonance formula to determine the value of sonic capacity C

Values of the two sonic capacities C_1 and C_2 are determined from the relations:

$$1/C = 1/C_1 + 1/C_2$$
$$1/C_1 = (2/\pi)C$$

from which we obtain:

$$C_1 = 1{,}57C, \quad C_2 = 2{,}75C$$

Major technical difficulty in the context of sonic hammers theory - which has stalled replication of these applications - is precisely that, technologically, is extremely difficult and inefficient to build arches that satisfies the conditions of the last two relations.

These difficulties can be avoided by calculating the point where the arc with length l and sonic capacity C can be cut, so as to obtain two arcs of lengths l_1 and l_2 with sonic capacities C_1 and C_2.

Sonic capacity of a spring is proportional to its length, according to the relation:

$C=Sl/E,\ C_1=Sl_1/E,\ C_2=SE/l_2$ (1)

S=sectionofspring

E = longitudinal modulus

Because springs are connected in series,

$l= l_1+l_2$ (2)

Were previously obtained relations:

$C_1=1,57C,\ \ C_2=2,75C$ (3)

From relations (1) and (3) we obtain:

$C_1/C_2=l_1/l_2=1,57/2,75=a$

Entering a value in (2), we obtain:

$l_1=al/(a+1),\ l_2=l/(a+1)$

Sonic capacity C will have the value

$C=C_1C_2/(C_1+C_2) =$

$=\omega l_1l_2/E(l_1+l_2) = \omega al/E(a+1)^2$ (4)

Knowing the values

$a=0,57;\ \ a/(a+1)^2=0,23$

are obtained

$C= \omega\ 0,23l/E$

and with values

$a/(a+1)=0,363;\ \ 1/(a+1)=0,636$

obtain

$l_1=0,363l;\ l_2=0,636\ l$ (5)

Verification:

$C= \omega l_1l_2/E(l_1+l_2)= \ldots= \omega l/E$

So long spring it will be cut according to ensuring mechanical resonant circuit design relation (5).

REFERENCES

[1] Patent no.149176(22), Percution Instalation, 16.01.1992.

[2] Constantinescu G., Teory of sonics, Editura Academia Republicii Socialiste România București 1985.

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