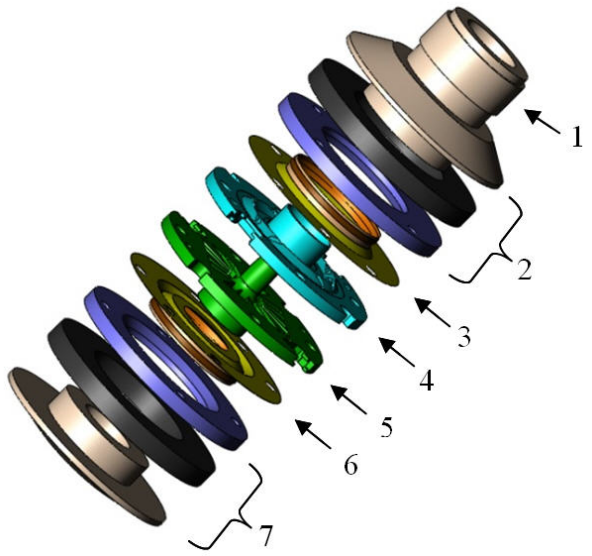

Figure 1: Exploded view of the dual driver based on 1.5" voice coils. 1. – front adapter, 2. – front motor, 3 – front diaphragm assembly, 4 – front phasing plug, 5 – rear phasing plug, 6 – rear diaphragm assembly, 7 – rear motor.

Two diaphragms (3 and 6) are vibrating in the "push-push" mode, which are loaded by the corresponding phasing plugs (4 and 5), and the sound pressure signal is summed on the adjacent openings in the phasing plugs and directed via radial channels to the central opening and further towards the exit of the driver.

Fig. 2 shows cutaway of the dual driver based on 1.5" voice coil and having 1" diameter exit.

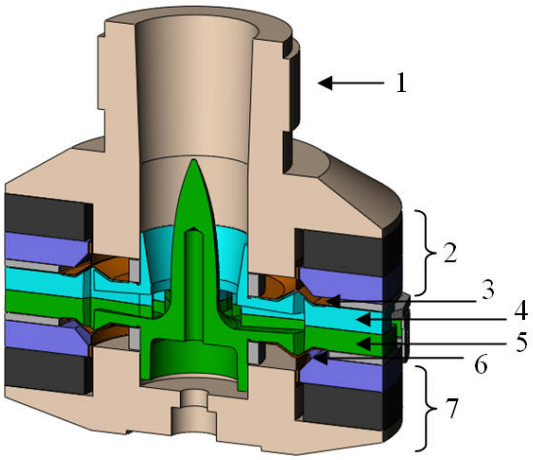

Figure 2: Cutaway of the dual driver based on the 1.5" voice coil. 1. – front adapter, 2. – front motor, 3 – front diaphragm assembly, 4 – front phasing plug, 5 – rear phasing plug, 6 – rear diaphragm assembly, 7 – rear motor.

Fig. 3 illustrates zoomed view of the central part of the driver. The arrows show the path of the acoustical signal. The sound pressure signal is directed through the slots in the phasing plug from the compression chambers to the radial channels and then to the central opening with the bullet and further through the central bore to the exit of the driver.

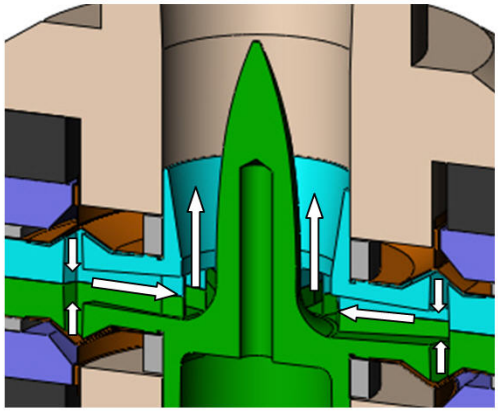

Figure 3: Zoomed view of the central part of the dual driver. Arrows show the paths of the acoustical signal.

Fig. 4 shows both sides of the front phasing plug. The rear phasing plug has a mirror image of the slots and radial channels. The only difference is the central bullet.

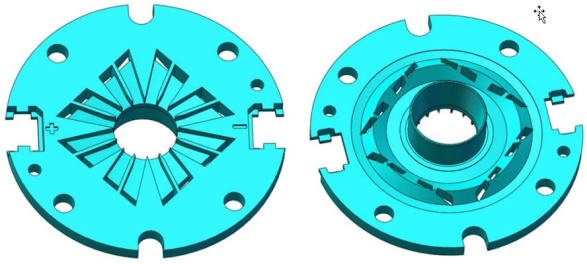

Figure 4: The front phasing plug. 1 – The side of the phasing plug adjacent to the rear phasing plug. 2 – The side of the diaphragm adjacent to the diaphragm.

Fig. 5 shows the exploded view of the JBL production model D2430K having 3" voice coil and 1.5" exit.

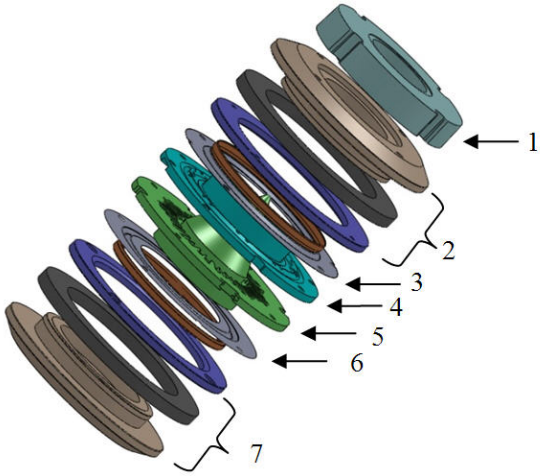

Figure 5: Exploded view of the JBL dual driver D2430K based on 3" voice coil and having 1.5" exit. 1. – front adapter, 2 – front motor, 3 – front diaphragm assembly, 4 - front phasing plug, 5 – rear phasing plug, 6 – rear diaphragm assembly, 7 – rear motor

Fig. 6 shows both sides of the front phasing plug of this driver.

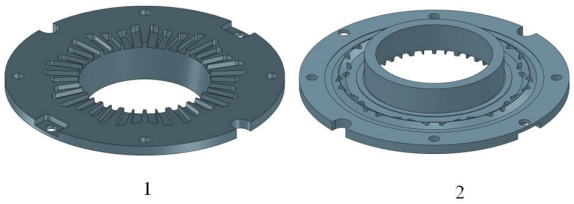

Figure 6: The front phasing plug of D2430K dual driver. 1 – The side of the phasing plug adjacent to the rear phasing plug. 2 – The side of the diaphragm adjacent to the diaphragm.

This phasing plug and the smaller one (shown on Fig. 4) have similarities with exception for the fact that the larger one has more slots, more radial channels and more complex pattern of the slots. The slots' orientation in the phasing plugs is neither radial nor circular, which is typical for the regular compression drivers. The slots are positioned diagonally with respect to the circular pattern of the phasing plug's profile, i.e. the slots are going "across" the compression chamber at certain angle. This provides averaging of the acoustical signal "picked up" at different points across and around the compression chamber. The diagonal position of the slots mitigates influence of both radial and circumferential air resonances in compression chamber whose behavior at high frequency is very complex due to the partial vibration of the diaphragm and it does not obey theories developed on assumption of vibration of infinitely rigid diaphragms [2, 3].

3. THE DUAL COMPRESSION DRIVER PRINCIPLES OF OPERATION AND METHODS OF ANALYSIS

The principles of operation of the dual driver are explained using matrix analysis. Matrix method is a powerful tool that makes it possible to simulate electro-mechanical-acoustical systems based on lumped and on one-dimensional distributed parameters. The matrix analysis of transducers stands between the classical Thiele-Small approach and the coupled finite elements analysis [4] – [6]. Simplified block diagram of the dual driver is shown on Fig. 7. This diagram corresponds to parallel electrical connection of the drivers' inputs. Each one of the two symmetric parts of the dual driver consists of the electrical, mechanical, and acoustical components.

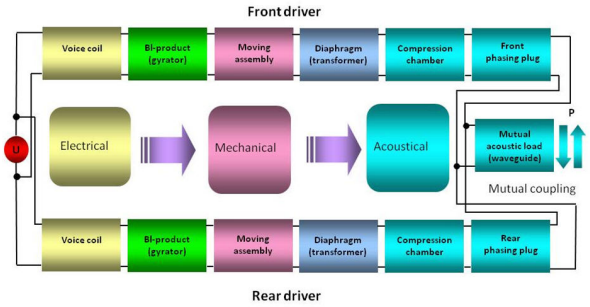

Figure 7: Block diagram of the dual driver. Electrical inputs of single drivers are connected in parallel.

The acoustical outputs of the single drivers are connected to the mutual acoustic load which includes radial channels in the phasing plugs followed by the waveguide connecting the exits of the phasing plugs to the exit of the driver, see Fig. 3.

Due to the symmetric nature of the dual driver, one half may be considered first. Each cascaded component in a single "half" shown in the block diagram Fig. 7 can be presented by the square transfer matrix describing corresponding two-port circuits.

In the electrical domain the transfer matrix relates the input voltage and current and the output voltage and current: