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Contribution COB N° 230

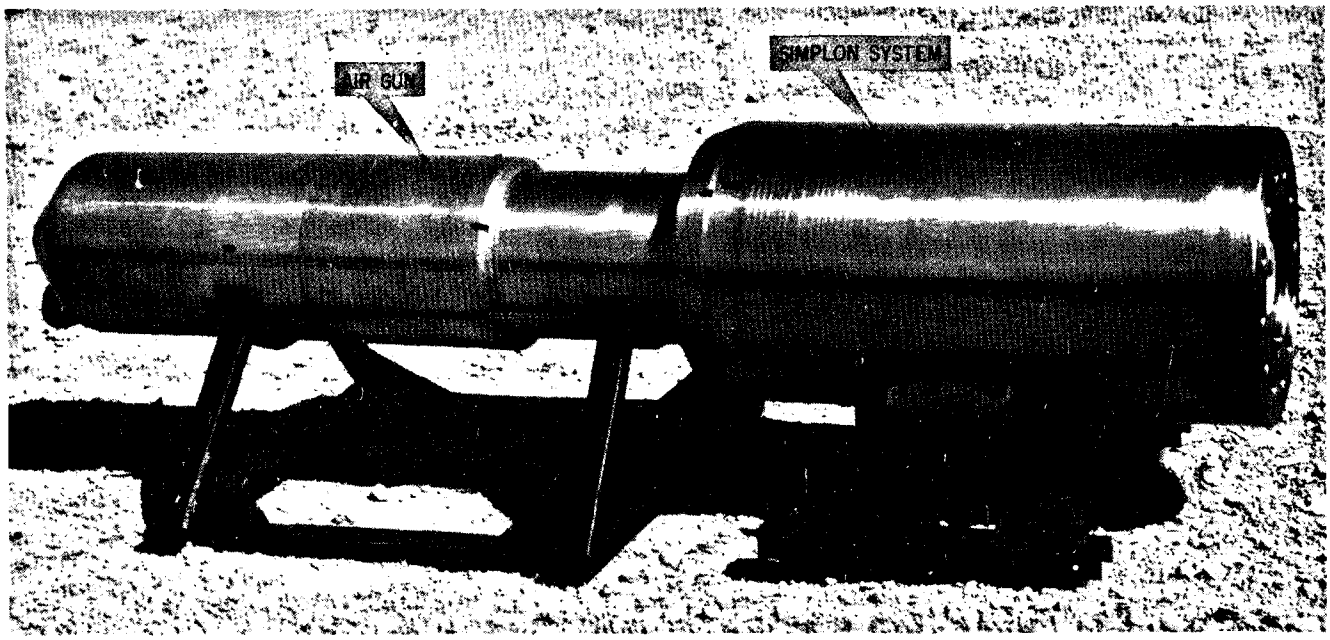

Fig. 1—Electrically triggered Casios-Simplon Water Gun ready for use.

New high-energy implosion seismic source

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Elimination of bubble pulses has been the main concern of air gun users for the past years. Until now, the proposed solutions: divided chambers, spheres, have resulted in an appreciable loss of acoustic energy.

The Casios-Simplon Water Gun, developed by CNEXO and SODERA, solved this problem using surprisingly simple means, which not only eliminate the disturbing secondary effects (bubbles) but greatly increase the acoustic efficiency of the air gun. The system uses the air gun as a pneumatic accelerator and creates the acoustic pulse by implosion.

Fig. 2—Illustration of Simplon system. A maximum firing rate of 15 seconds can be obtained with the latest models.

The emitted signal is free of disturbing secondary effects and its power spectrum closely approaches the spectrum of dynamite type sources.

The Casios-Simplon Water Gun consists of a Casios air gun and the Simplon System (Fig. 1).

The Casios air gun (axial emission), operates with chamber volumes from 370 to 915 cu. in. for the large models and from 125 cu. in. down for the small models. Operating air pressures range from 1,500 to 3,500 psi. The gun is electrically triggered (solenoid).

The Simplon System, consisting of the cylinder, floating piston and exhaust hose, is attached to the mouthpiece of the air gun. The heaviest assembly weighs about 1,000 lbs, and measures 5 ft 5 in. long. Minimum immersion required is about 6 ft.

The operating principle is as follows (Fig. 2):

(A) Air gun closed, pressure chamber filled with compressed air. Simplon piston closed up to the port of air gun. The cylinder, in front of piston is filled with water.

(B) Air gun is triggered; opens and compressed air pushes Simplon piston forward ejecting the water from cylinder into the surrounding seawater. The motion of the ejected "water plug" in the sea water causes a cavitation, which implodes. The implosion releases the acoustic signal, its energy being proportional to the kinetic energy of the water plug.

(C) At the end of stroke, the Simplon piston stops; the air is vented to the surface through an air exhaust hose.

(D) The air gun then closes, refilling with air starts. As the

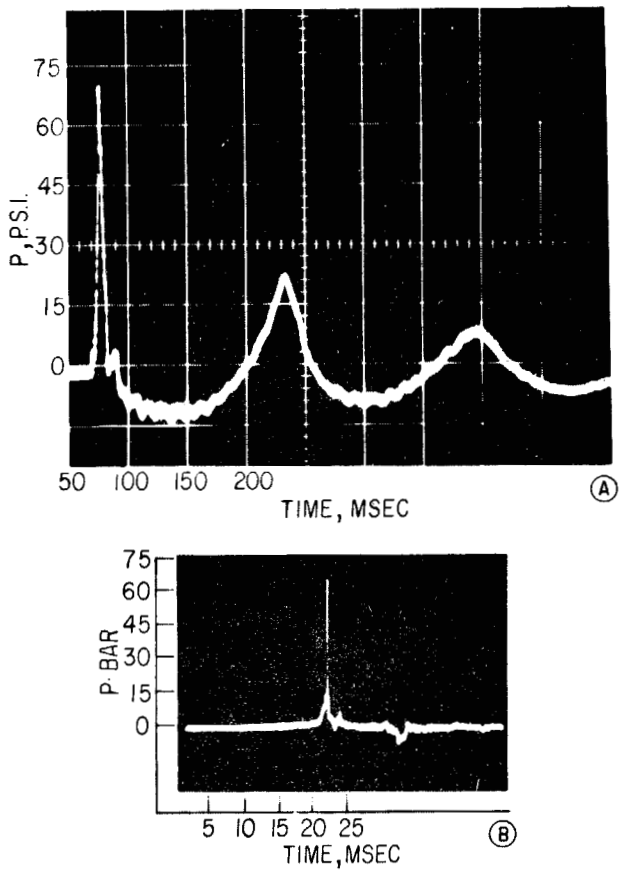
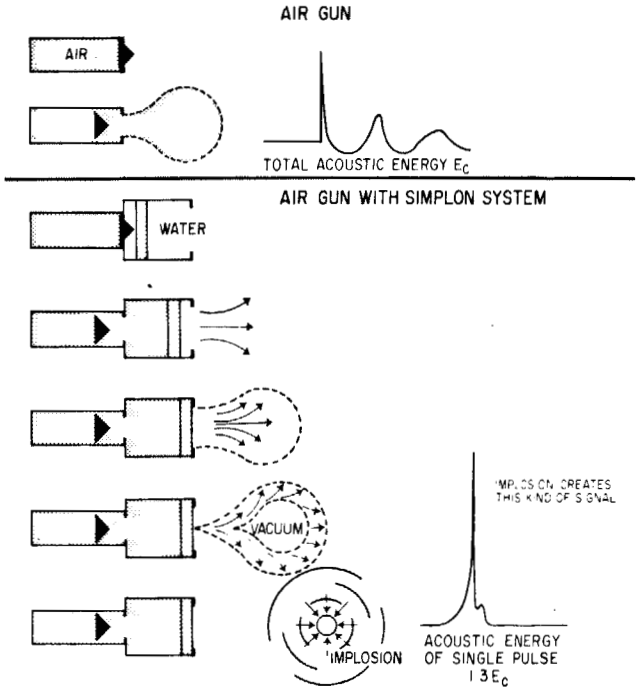


Fig. 3—Signature of the air gun (A) and signature of Simplon system (B).



How the system works—at top is the conventional air gun. At bottom is Simplon system.

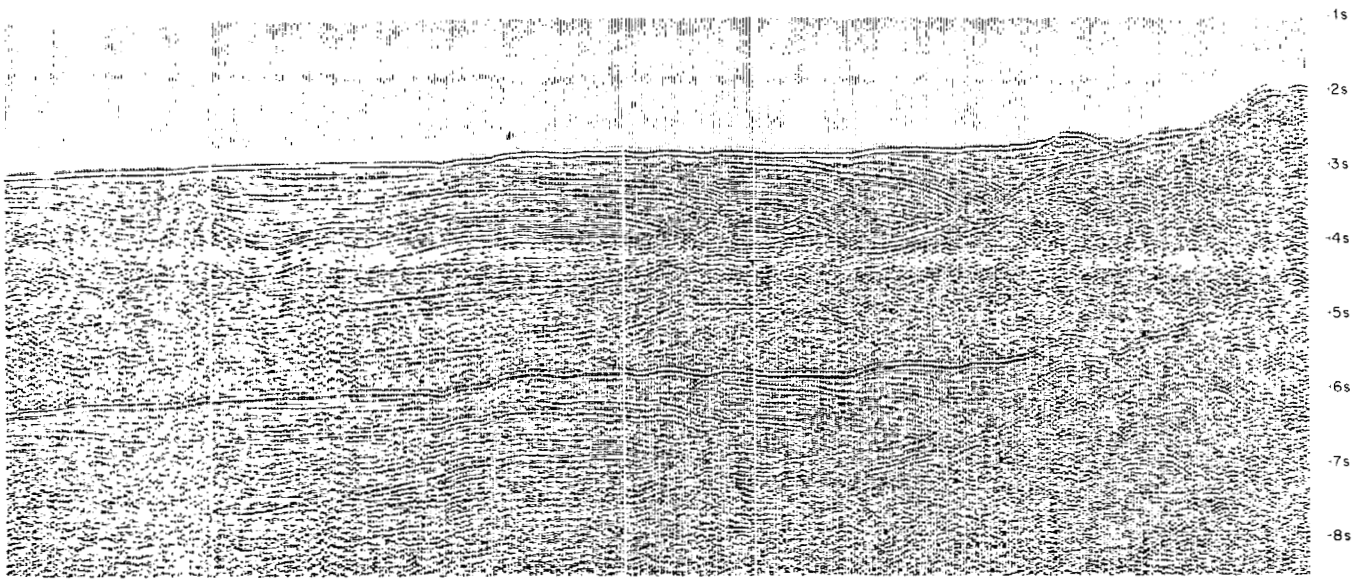


Fig. 4—Profile run in Mediterranean Sea with the Casios-Simplon Water Gun.

air pressure behind the Simplon piston drops, the hydrostatic pressure replaces the piston to its initial position. The gun is then ready for the next shot.

At the present, a maximum firing rate of 15 seconds can be obtained with the largest models. If higher firing rates are required, two assemblies with alternate firings can be used.

A typical signature is shown on Fig. 3 (A-B) (Repetitivity: ±3 milli-seconds).

As the released acoustic energy is proportional to the kinetic energy ($E = m.v^2$) of the ejected water plug, thus the acoustic output of the gun is proportional to its velocity, hence easily monitored with the air gun's operating pressure.

The power spectrum of the emitted signal reaches from a few cycles to about 3.5 kc, having its peak in the seismic frequency range, insuring great penetration powers. But a still considerable energy is present at 2-2.5 kc, so very high resolution records of the shallow layers can be simultaneously obtained.

A profile run in the Mediterranean Sea (Fig. 4) demonstrates the high resolution and penetration powers (see deep reflections from below the salt layers) of the Casios-Simplon Water Gun.