TINKER & RASOR

METHOD AND EQUIPMENT USED IN LOCATING PIPELINES THAT ARE BURIED OR SUBMERGED AT EXCESSIVE DEPTHS

By
Darrel D. Byerley

Tinker & Rasor
P.O. Box 281
San Gabriel, CA 91778 USA

www.tinker-rasor.com
Info@tinker-rasor.com

LOCATING SUBMERGED PIPELINES

This paper describes an improved method and apparatus used in accurately locating buried pipelines that lie below the practical depth range of standard type locators.

The usual method in locating underground pipelines is with the use of a locator which develops radio frequency energy of very low power. This type of locator applies a radio frequency signal to the pipeline under study by radiation from the radio transmitter through both air and soil or less frequently by direct coupling to the pipe. The practical depth range of a radio frequency type locator is 15 to 20 feet, depending upon the size of pipe and the soil conditions.

Where a pipeline lies below the depth range of the standard locators, it has been a practice to expose the pipeline at various points in order to map the true course. On offshore pipelines, the practice has been to employ marine survey personnel to probe for their true location. Where offshore pipelines have an overburden greater than 6 to 8 feet, the usual method has been to jet off the overburden and attach buoys to the pipelines so final plotting could be noted on a site map. These methods are both time consuming and expensive, particularly where divers must be employed for underwater locating surveys.

The apparatus used in the pipe locating method to be described consists of an audio oscillator and receiver.

OSCILLATOR:

The transistorized oscillator converts low voltage (12 volts) d.c. to stable audio frequency a.c. directly by a highly efficient method. The input current to the oscillator is only 1.7 amperes for a full output of 15 watts. In order that a maximum of the audio energy can be transferred from the oscillator to the pipe, the output circuit is provided with a selector switch so that voltages of 2.5 - 5.0 - 7.5 - 15 - 50 and 100 volts are available to match the impedance load of the pipe. An interrupter makes the 750 cycle signal more easily recognized.

RECEIVER:

The receiver employs a high gain, five transistor amplifier and a sharply tuned 750 cycle filter. Silicon transistors and modern circuit design insure maximum circuit stability even when operated at ambient temperature extremes. The filter attenuates a.c. and d.c. interference. The search coil is contained within the receiver and has low impedance of 2,000 ohms. Although earphones are furnished for operator's optional use, the loudspeaker offers advantages related to safety, convenience and comfort. Built-in battery test and signal intensity meter of modern full-face design for ease of observation. Multi-directional depth level gauge for accurate (within 1 inch) depth determination.

APPLICATION and METHOD

When alternating current of audio frequency is caused to flow in a conductor, such as a pipeline, an electrical field exists around the pipeline in a plane at right angles to the pipeline (See Fig. 1).

The intensity of the electrical field depends upon the amount of audio current flowing in the pipeline. This electrical field can be intercepted and measured by placing an inductance coil in the same plane as the pipeline. As the coil is moved back and forth at right angles to the pipeline, the electrical field is cancelled directly over the pipeline and a null will be noted as long as a relatively large amount of audio current is flowing in the pipeline. Using this null method, it is possible to follow the pipeline while a large amount of audio current is flowing in it. When rather large amounts of audio signal can be applied to a pipeline, and a suitable receiver is used, the practical depth of pipe locating can be extended to much greater depths. Pipelines

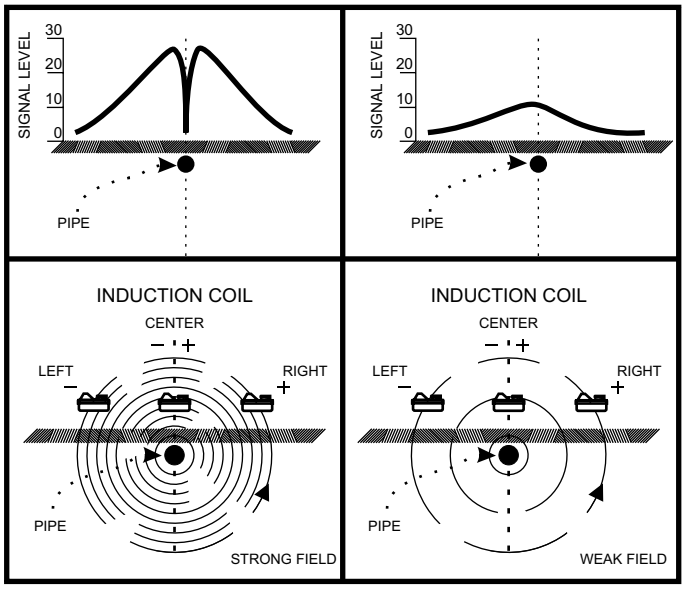

FIGURE 1

at depths exceeding 35 feet have been accurately located by this equipment and method, and depths greatly exceeding this may be possible, depending on the condition of the protective coating.

To locate deeply buried or submerged pipelines, the audio oscillator is electrically connected to the pipeline at a convenient location at either end of the line, but preferably at a terminus so the audio

current will flow in one direction only. If the pipeline is well coated, the audio oscillator ground may be made through the water in the immediate vicinity of the pipeline terminus. If the pipeline is poorly coated or has no protective coating, the audio oscillator ground should be made through a well insulated cable to a point several hundred feet away from the oscillator and at right angles to the pipeline.

After the audio frequency current is properly applied to the pipeline, the locating survey is conducted from a boat. The operator places the inductance coil in a horizontal position with reference to the pipeline and as the boat makes oblique traverses over the pipeline, a sharp null effect will be noted. By audible observation the operator will notice a gradual rise in tone as he approaches the location of the pipeline and the null effect occurs when directly over the pipeline (See Fig. 1). As the exact null occurs, the operator gives a visual signal, or an audible signal if two-way radio is used, to two survey units with transits (Fee Fig. 2). The transits are located on shore and several hundred feet to each side of the pipeline. The surveyors take fixes at the signal command of the operator and these fixes are then plotted on a site map. It is recommended that a thorough investigation be made by making several oblique traverses over short distances. This can be accomplished in a very reasonable period of time and will better substantiate the true course of the pipeline.

This method and equipment can be used on the locating of most all pipelines. The fact that on well coated pipelines the operator can advance away from the audio oscillator for several miles is worthy of mention. Another aspect is the tracing of an

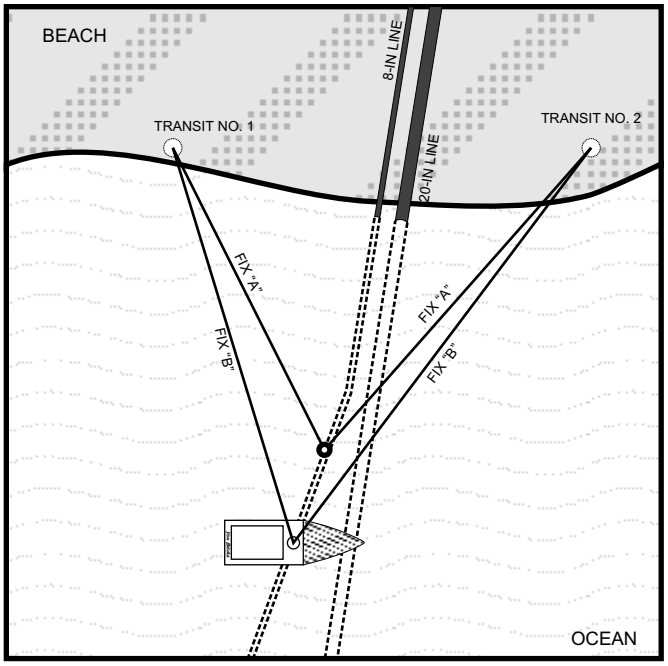

FIGURE 2