КРИМІНАЛІСТИЧНА ТЕХНІКА ТА МЕТОДИКА

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POSITION LOCATION OF THE ILLEGAL CUT-INS TO OIL AND GAS PIPELINES

Nowadays the thefts of oil products and gas by the use of unauthorized jointings with pipelines are on a scale of an acute state problem. The considerable length of pipelines complicates the continuous control of their condition. Several domestic devices of the search of places of illegal cut-ins to oil and gas pipelines are considered.

Keywords: *illegal cut-ins to oil and gas pipelines (pipelines), identification of places of illegal jointings with oil and gas pipelines.*

The problem of illegal (unauthorized) jointings with the pipelines and the theft of the transported products has been actual in our country since early 1990s. Nowadays the theft of oil and gas is the State problem. As it is noted by the staff of the Department of Management of Gas Mains' Safety "Ukrtransnafta", today Ukraine has got a well organized criminal business on the illegal jointings with oil and gas pipelines [1]. Such thefts are committed by carefully prepared and technically competent people, equipped with a variety of tools and devices for illegal jointings, cars and means of communication. Illegal jointings are the jointings of the locking device with the flows of the length from tens of meters to several kilometres, used for the selection of transported products, with the purpose of its sale. As a rule, it is carried out by a group of persons. For unauthorized jointing with the pipeline and the subsequent theft one needs to perform certain actions. An organized system of theft is conventionally divided into three groups. The first group is doing an illegal jointing with oil and gas pipelines that set the various adaptations for a further selection of raw materials. The second group includes those who actually carry refills of raw materials and accompanying persons. To this group you can also classify the observers and guards. The third group are the direct organizers who sell stolen petroleum products and gas.

For the companies the criminal business, that has already begun to mass produce, became a genuine adversity as they carry a significant economic loss. Repeated illegal jointings with the pipings indicate their inadequate defence. Some experts believe the problem of illegal jointings to be one that is hardly solved without the increasing of the criminal liability for these actions. Position location of the illegal jointings is a complex system of search works involving different services and units. Time for installing and removing the illegal cut-in is usually relegated to a minimum. It is easy to calculate that the errors when installing just one place to connect is a few thousands, and sometimes tens of thousands of hryvnas of damages, because the quality and continuity of public services and enterprises is a matter of honour and image of companies.

Nowadays for the detection of leaks and illegal cut-ins to the piping a large number of methods have been designed [2, 3, 4], based on different physical laws and phenomena. In particular, such as: method of lowering the pressure; method of negative shock waves; method of comparing the costs; ultrasonic method (probe); method of acoustic emission; laser gas-analysis method; visual method; method of eddy currents; combined magnetic control method; method of shock waves by M. Zhukovsky; other methods as well as their combinations. None of the listed methods of leak detection does not satisfies completely all the requirements for them.

Due to the existing methods of controlling the leaks it is difficult to find illegal cut-ins because of their short length and small amounts of leakage, the requirement of a promptness is not fulfilled as well. Systems for the detection of illegal cut-ins are rather expensive due to the use of a high-precision equipment and devices. Position locations of illegal jointings with the oil and gas pipelines with the devices used since 1990s, in many cases aren't possible due to the low sensitivity and weak jamming protection of receivers, a small power generator, instability of parameters when changing temperature environment leads to an erroneous determination of the place of jointing. The State Research Institute MIA Ukraine carried out the research work to study the possibilities of the development of the device for detecting illegal cut-ins to the oil and gas pipelines. According to the results of the study it is found that on the Ukrainian market have been already represented modern domestic appliances, series "Universal 911", produced by the company "Quartz-Elektronik"(Mykolaiv), which are equal in quality and abilities with foreign standards. In Fig. 1 it is presented the unit "Universal-911 M-4".

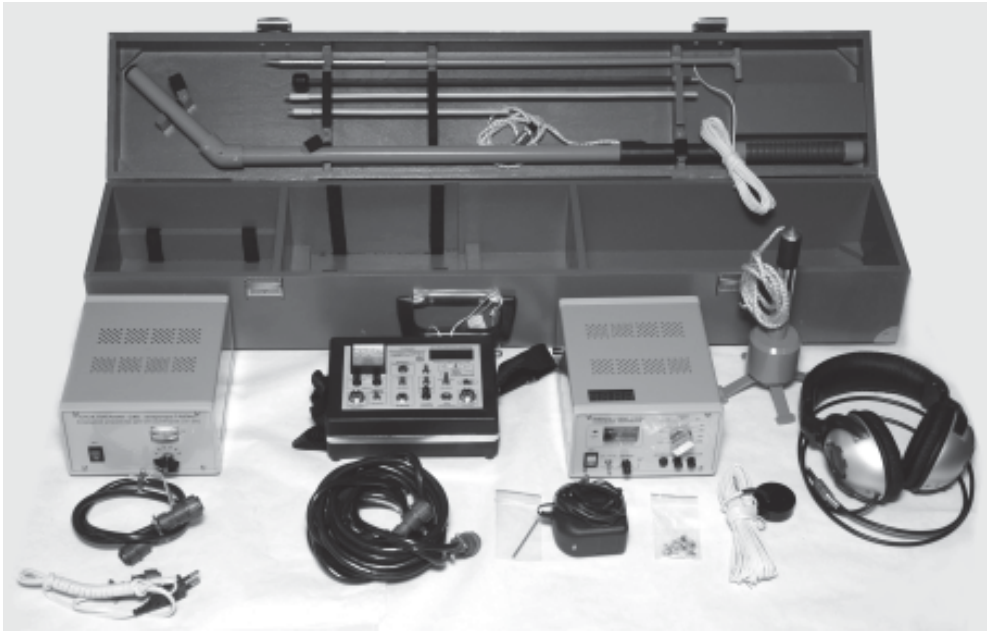

Fig.1. Exterior view of the device "Universal-911 M-4"

A jointing is a length ranging (from 10 to several tens of centimetres) diversion from the main pipe. As a rule, it is performed in a vertical or lateral manner and doesn't have the full insulation to Earth. Breaking of the isolation the receiver device

registers with the contact or non-contact methods. Contact (or the pin) method is based on the measuring of the currents flow generator on the surface of the Earth using two pins separated at the same distance (from a few centimeters to several meters). Pins are placed lengthwise or across the line of the route of the pipeline. If the pins are placed alongside and above the line of the route, the signal generator increases when approaching the places of insulation damage, decreases over this place and again increases it, ie, max – min – max. If they are placed across the pipeline, i.e. at an angle of 90 degrees, the signal of a generator, which is accepted by the receiver, increases when approaching the place of damage, has a maximum over this place and then decreases.

Noncontact method solves the same problems, but by using the electric antennas above the surface of the Earth. In this case, breaking isolation is defined by the device for the electrical component of the electromagnetic signal. Noncontact method has the following advantages before the contact one:

– the definition of isolated cut-ins of the small length – 10–15 cm;

– exploitation of the receiver on any type of cover or soil: asphalt, concrete and other dense mediums;

– doesn't not depend on the moisture on the surface of the soil;

– allows to carry out search work more operatively.

An important condition for a contactless method is the presence of a powerful signal generator over the studied site. In other words, reducing of the signal approximately half requires frequent reinstalling the generator or use a more powerfull generator. Practical application of the devices series "Wagon-911 m" for the detection of unauthorized jointings revealed that power generator should be not less than 100 Watts in the receiver with sensitivity of 0.2 MV. However, if the location of the missing station cathodic protection, the purpose of which is to weaken the corrosion or to protect the pipeline, then as a consequence of this pipeline has a very bad isolation. A large number of places of damage causes the loss of a signal generator on each of them. This factor makes the reinstall of a generator, usually 500–1000 m, which causes certain inconveniences, because control taps technologically are 2 km away.

In this case it is convenient to use the powerful generators, such as 500 Watts. Such power is provided with the device modification "Universal-911 M-7". Power generator with a capacity of 500 Watts provides mobile gasoline power plant, and the generator is permanently mounted on the chassis of the car. Analyzing test protocols and reviews [5] of the "Naftogaz of Ukraine", the Institute of Oil Transportation (Kyiv), "Ukrnaftogazekspert" (Kharkiv), "Kievgaz", "Zhytomyrgaz", "SFI Vnipitransgaz" (Kyiv), "Alfa-Se" (Poltava), "Lenoblgaz" (St.-Petersburg), "Antikor" (St.-Petersburg), "Saratovgaz" (Saratov), "GazRegionZashchita" (Saratov), etc. we can state that the devices "Universal-911 M" lurch the similar models of this type, namely:

– are performed by 2-channel diagram (channel definition of route and channel search damage in terms of protecting pipelines, defining places of unauthorized cut-ins), its constructive solution allows you to optimize the work of carrying out of search works and to break short the execution of works in 2–3 times; – have a high sensitivity for the jamming protection; – allow you to carry out a search operation on different pavements etc.

Studies have shown that the the device registers the presence of even the shortest isolated 7-10 inch pipeline joinings as an increase of a signal strength over this place in three or four times, that is quite enough for their detection. Works with the device must be carried out by the technicians and require an understanding of the processes of transmission and reception of electromagnetic signals.

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