Paper No. 20

USE OF AN ORIGINAL PROCESS FOR WELL-DRILLING*

Since the second world war, an original process of well-drilling by wire-rope has been developed in France.

General description

This process meets the requirements of the drilling of wells, the diameter of which varies from 40 to 150 centimeters, through all kinds of ground up to a depth of 100 meters.

When the ground has a tendency to loosen, or if great depths should be reached, a metal pipe is set up as the drilling proceeds to ensure the holding of the ground and to make the sheeting of the well.

The average speed per hour which could be reached during the course of the last five years has been about one meter in length.

The main tool used in this process is the HAMMER-GRAB which:

— digs the ground
— scoops up and picks up the refuse to evacuate it
— drills by itself in every soil.

This special tool is specially designed to strike hard soils, such as chalky, gritty, stony or frozen ground.

It is water-tight too and can be used for drilling in very fine sand, even under great water depths.

It operates:

— without water in dry ground
— in the water in water-bearing soils
— under water in rivers and the sea.

Constitution of a drilling equipment

— 1 HAMMER-GRAB equipped with various kinds of bushing,
— 1 HAMMER-GRAB working apparatus together with laying-on and pulling-out equipment,
— 1 Pipe-Moulding machine with generating and bending apparatus,

Drilling thimble-joints with guiding-pipe and cutting outfit.

The working apparatus is completed with a single sheer, the arrow of which is equipped with members, and a winch is used to operate the HAMMER-GRAB, the latter being kept aside from the drilling axle with a swaying handle of the sheer which makes possible the emptying out of the bucket in a tip-truck or a gutter.

There are several types of HAMMER-GRAB with various capacities to ensure the fixing of the bushings from 300 to 1,400 mm wide.

The tubing used to keep the ground consists of segments laid out as the work proceeds. These are 2 or 3 meters long. The length varies with the arrow of the drilling machine.

The various parts are welded together by electric-welding. When pulling out the pipe, on the other hand, the sections are cut by blow-pipe according to the height of the crane.

The pipe is moved around in what is called "tacking". This moving in the axis is intended to do away with the lateral sticking to the ground. The motion is provided through a pipe-moulding machine.

This device makes the driving in of the pipe at high speed possible. The drilling can also follow or go ahead of the pipe driving according to the nature of the ground.

A specially-designed damping-device makes it possible to control the driving-in or the pulling-up of the pipe.

The pulling-out of the pipe is ensured through moving it around in tacking, as for the driving in, while the damping-device makes the operation flexible.

In the field of deep wells and water search, in 1951 two wells were constructed in Milan, each one-meter wide:

— the first one, 77-meter deep, in 86 hours.

The metal pipe was salvaged after a pause of 42 days needed for carrying out the filter and draining the installations.

— the second, 70-meter deep, right in the center of the city of Milan, was completed in 62 hours.

Many other wells have been constructed, particularly in African and south America.

Digging-out of water-research wells

Our forefathers dug wells close to their dwellings by hand through sumpmen; the revetment was made in masonry and they would stop when reaching the water level. In every European town one still finds the house well.

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At a later date, the exploitation of Artesian sheets brought along the catchment through small diameter drilling, from which hand or mechanical pumps would raise water to the ground level.

In several big towns, some large-diameter wells were dug down to very great depths into which under-water pumps were laid for driving the water into tanks.

In recent years, the FELDMAN processes consisted in catching the water sheets through very wide diameter wells (minimum 3-meters wide) into horizontal horns from which the water was driven into smaller wells and then drawn out by pumping up to the ground level.

Eventually, in the Near-East, in Africa, in Asia, the implementation of sounding by percussion or rotating machines made the reaching of very great depths possible.

All these processes were both very long and very costly. The use of this new original process has revolutionized water-research techniques.

Our forefathers' wells, which would only reach very shallow depths and required months of work, had been replaced with drilled wells, through this new process, down to depths of upto 100 meters and at speeds averaging a meter length per hour.

The construction of the wells of Crescenzaco and Milan, Place Brera, provides an example of this.

Wells up to 1.5 meters in diameter can also be drilled, but the most usual and convenient ones are one-meter wide. Besides the advantages of speed, this makes the use of very great output laid-in pumps possible. The Milan well drilled in 62 hours was installed in less than a month and gives an output of 180 liters per second.

The catchment of water through the new original processes can be carried out, as in the case of Milan, through the use of vertical metallic strainers together with gravel filters or by substituting a concrete pipe coated with a horizontal filter for drilling.

In the first case (stage 1) the drilling is carried out to its depth through a tacking movement for driving in.

When the pipe has reached its depth, a catchment pipe perforated in its lower part is driven in to replace the strainers and extended by a filled pipe upto the ground level.

When the pipe is set up, gravel is brought in afterwards by self-centring layers to be used as a filter; the size of the gravel gets smaller from the strainers to the ground in order that one layer will not be invaded by the grains of the surrounding layer.

In short, the granulometry of the gravel filters is in proportion to the difference of diameter between the filter and the drilling pipe, once the gravel has been laid-in, the pipe is levelled with the water sheet (stage III).

Next comes (stage IV) the setting of a concrete lock to isolate the water sheet from the superior layers or the polluted soils.

The room between the filled pipe of the strainers and the drilling pipe is then filled up.

When that work is finished, the pumping installation is set up and, according to the depth, the required equipment is used, either level pumps or laid-in ones.

Another process is as follows: after having reached the bottom of the well with this new process pipe, the latter is replaced by a concrete pipe perforated in its lower part. That concrete pipe filled with gravel is filtered through the basket at the bottom of the well.

The pumping is carried out, as in former instances, with the difference that the well remains at its maximum diameter.

This process is very convenient when the water sheets are under pressure or profuse, for the well remains stable and it is then possible to clean it when the filter is full.

It is beyond discussion that such equipment has completely revolutionized the techniques of drilling, bringing about new economical and speedy conditions. Such are the main features of a process which has only recently been realized.

THE DEVELOPMENT OF GROUNDWATER RESOURCES WITH SPECIAL REFERENCE TO DELTAIC AREAS

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