Hyd lab Files

ARRANGEMENT OF THE ORLEANSVILLE-OUED FODDA IRRIGATION SYSTEM

WORKS FOR TAKING WATER FROM A PRESSURE CONDUIT AND REDUCING THE HEAD WHEN REGULATION IS FROM UPSTREAM

A Translation of Amenagement De Reseau D'Irrigation D'Orleansville - Oued Fodda

Ouvrage De Prise D'Eau Sur Conduite Forcee A Faible Chutes Reglee Par L'Amont

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TRANSLATOR'S PREFACE

This translation is neither complete nor final, but practically all the ideas expressed by the original author can be obtained from it in its present form. All illustrations have been duplicated from the original article without complete translation of the descriptive material or reduction of all values to English units.

The irrigation system of Orleansville-Ouad Fodda, characterized by the diversity of its elements, is, without doubt, one that necessitated the most research and permitted using or not using the most complete of new hydraulic equipment and is one of particularly pleasing conception.

The extreme complication resulted, above all, from the topography of the land irrigated and from the geographic location of the tributary networks of the rivers. The irrigable area, which is very well defined, is subdivided according to varying relief and utilizes the augmented contribution from a storage reservoir on the Ouad Fodda for one part and a diversion dam on the Ouad Ghelif for the other part. The project conveyance system and the distribution of water posed multiple complex problems, all arising from the existing state of affairs.

The first difficulty consisted of joining to an old section of existing canal, a system of large-pressure conduits designed to furnish for several years the increment required for temporary supply until changes become necessary because of the extension of irrigation and, at a definite future date, to serve as a framework for a general distribution system composed entirely of pressure conduits to permit distribution to an irrigated area of 24,000 hectares (approximately 60,000 acres).

Ateliers, Meyrat-Seylaz, charged with making the hydraulic studies for the project, presented and proposed for application, a plan for handling large discharges of water based upon the principle of head-reducing chambers able to function automatically, either in the line of or at the end of the main gravity conduit to provide regulation from downstream.

From 1938 to 1940 the lay-out progress was pursued very nearly normally, but during the year 1941, a difficult period in which the sources of supply from the mother country (France) were shut off, it became necessary to substitute a low-pressure conduit controlled from upstream, a take-off structure having the same automatic advantages of a rupture chamber and not containing any mechanism.

The problem posed is essentially the following: For a conduit 3.94 feet in diameter discharging in the order of 40 cubic feet per second, joining two sections of main canal, having a difference in elevation of 16.40 feet, and separated by an area (valley) approximately 3-1/2 miles long (Figure 1) to establish at the midpoint a turnout operating at a more constant head for supplying a secondary canal system capable of carrying about 19.4 second-feet operated by upstream controls, through an intermediate distribution system, Figure 2, and the end of the conduit discharging uncontrolled into the box structure joining the conduit and canal in which there is a slightly variable water surface (Figure 4).

The works conceived for this purpose and meeting the conditions pointed out above, have the outward appearance of a circular tower cut by facets, crowned at the top by a sloping cap that breaks the outline and adds a certain artistic distinction, Figure 3.

The tower constitutes a continuous extension of the conduit; it is formed of two concentric cylinders of unequal height and diameter, the larger being of 7.87 feet internal diameter and the other 3.94 feet internal diameter. The water enters the tower around the central column, fills the space between the two cylinders, and is discharged into the interior of the smaller where it continues on its way downstream. The elevation of the crest of the overflow was set to permit passing without risk of overflow of the tower, the maximum discharge of 46 cubic feet per second that might be demanded at the downstream extremity. Also, the tower is tapped to the exterior at the level of the secondary canal by an orifice equipped with a sliding gate, controlled by hand, that permits making deliveries under a quasi-constant head, as has been said above, and permits regulating discharges up to 19.4 cubic feet per second.

In an installation that has upstream control and is composed in general of sections of conduit functioning as a siphon, joined by basins, changes in discharge will produce oscillations of the fluid mass that are amplified by the volume of the water placed in motion which, in this case, is contained in the basins and in the line. These oscillations become extremely troublesome, especially at the extremities where it is impossible to obtain a regulation of discharge, a condition very important in irrigation.

In the works that have just been described, the phenomena of oscillation is greatly attenuated and presents only, one might say, a slight inconvenience. On the other hand, no matter what the diversions are from the conduit upstream and downstream from the structure, evidently limited by the entire supply, the piezometric line (hydraulic gradient) is tangent either to the weir crest or to the upper surface of the weir nappe. The variation of level, H, reaches a maximum of 0.012 feet for a gross head of 17.4 feet on the orifice. Since the discharge varies as the square root of H, it is easy to show that the differences are insignificant and that definitely the discharge diverted is practically constant.

This type of structure is of limited application since it is applicable only to installations with upstream control discharging under a small head, but has the advantage of being very simple and cheap (about one-tenth that of the usual dissipation chamber). Its use is recommended in every case where mechanical equipment is outlawed either for economy or other reasons.

The present note is solely for information and is addressed to those that have practical hydraulic questions of interest.

At this time, large modern irrigation projects are about to be realized. It is useful to recall the solutions adopted under various circumstances, especially when the results obtained indicate successful operations.

The literature in this field is very meager and should be enriched by even modest contributions.

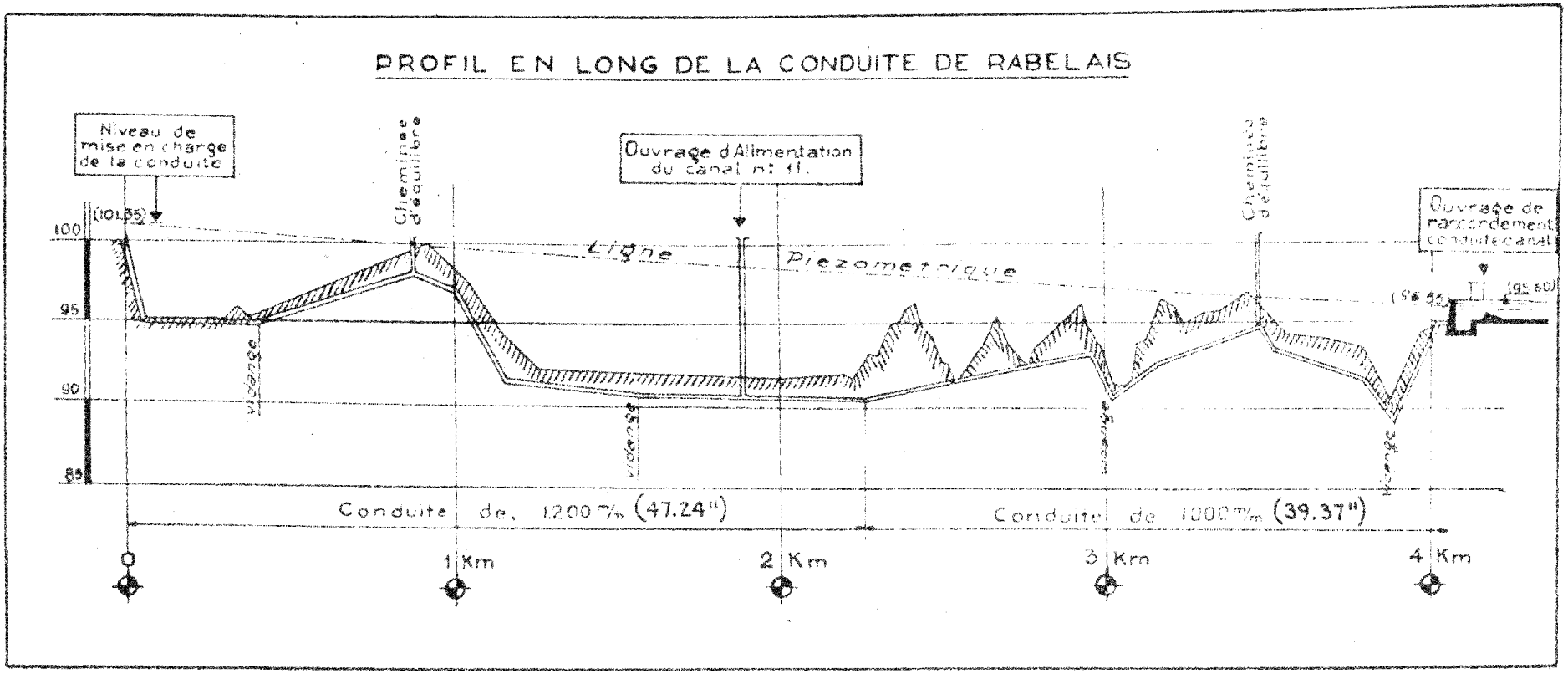
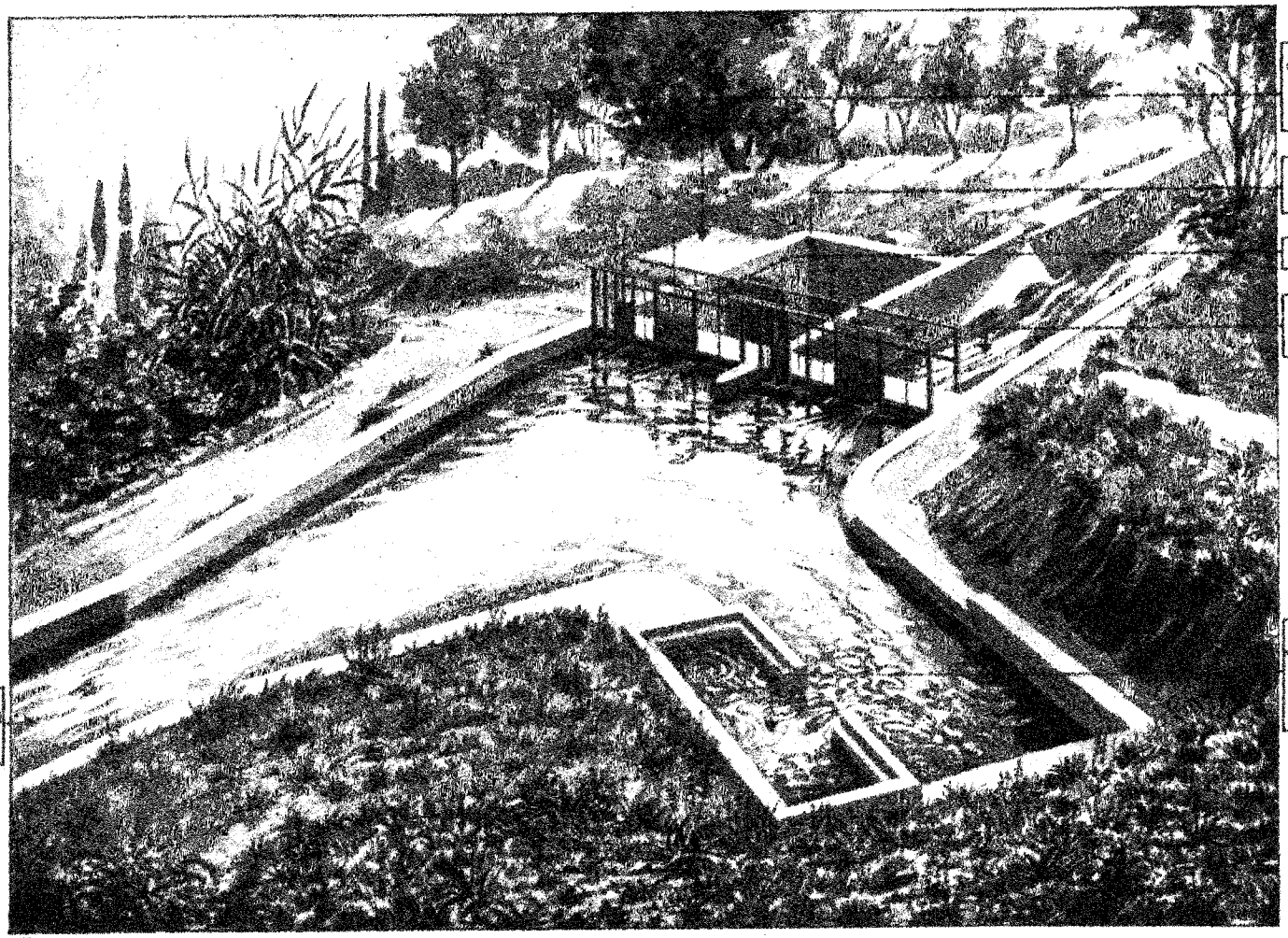

PROFIL EN LONG DE LA CONDUITE DE RABELAIS
Niveau de mise en charge de la conduite
(101.35)
Cheminée d'équilibre
Ouvrage d'Alimentation du canal n° 11
Cheminée d'équilibre
Ouvrage de raccordement conduite canal
(96.55)
(95.60)
100
95
90
85
Ligne Piézométrique
Vidange
Vidange
Vidange
Conduite de 1.200 m/m (47.24")
Conduite de 1000 m/m (39.37")
0
1 Km
2 Km
3 Km
4 Km

FIGURE 1

OUVRAGE PARTITEUR DE LA CHUTE DE TENES



Origine
Conduite-canal
de RABELAIS
Artere inférieure
rive droite
du CHELIFF

Bassin
de mise en charge
de la conduite

2 Modules de 1500 l/s

Canal supérieur
rive droite
du CHELIFF

Aboutissement
de la Conduite forcée
à OUED-FODDA
déversement de la
Chambre "F"
d'extrémité

Arrivée
du Canal principal
rive droite
du CHELIFF

FIGURE 2

CONDUITE DE RABELAIS

OUVRAGE SPECIAL SUR CONDUITE FORCEE A FAIBLE PRESSION MAINTENANT UN NIVEAU DE CHARGE QUASI CONSTANT SUR L'ORIFICE DE PRISE ALIMENTANT LE CANAL SECONDAIRE N° 11

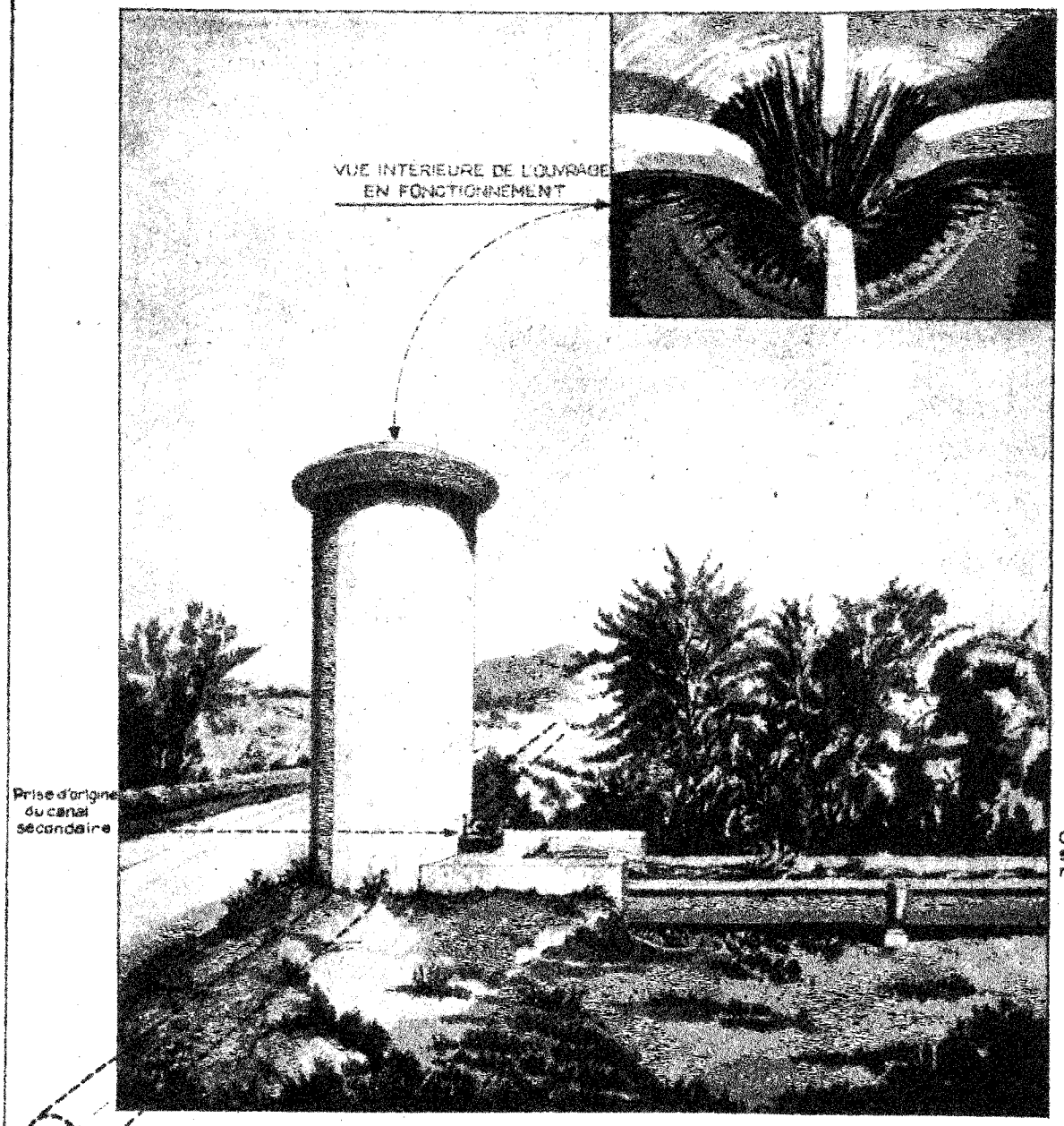
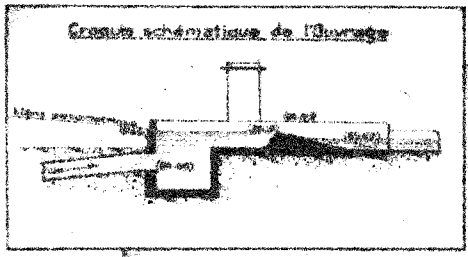


Schéma de fonctionnement

CONDUITE CANAL DE RABELAIS
ARTERE INFERIEURE RIVE DROITE DU CHELIFF

OUVRAGE DE JONCTION CONDUITE-CANAL



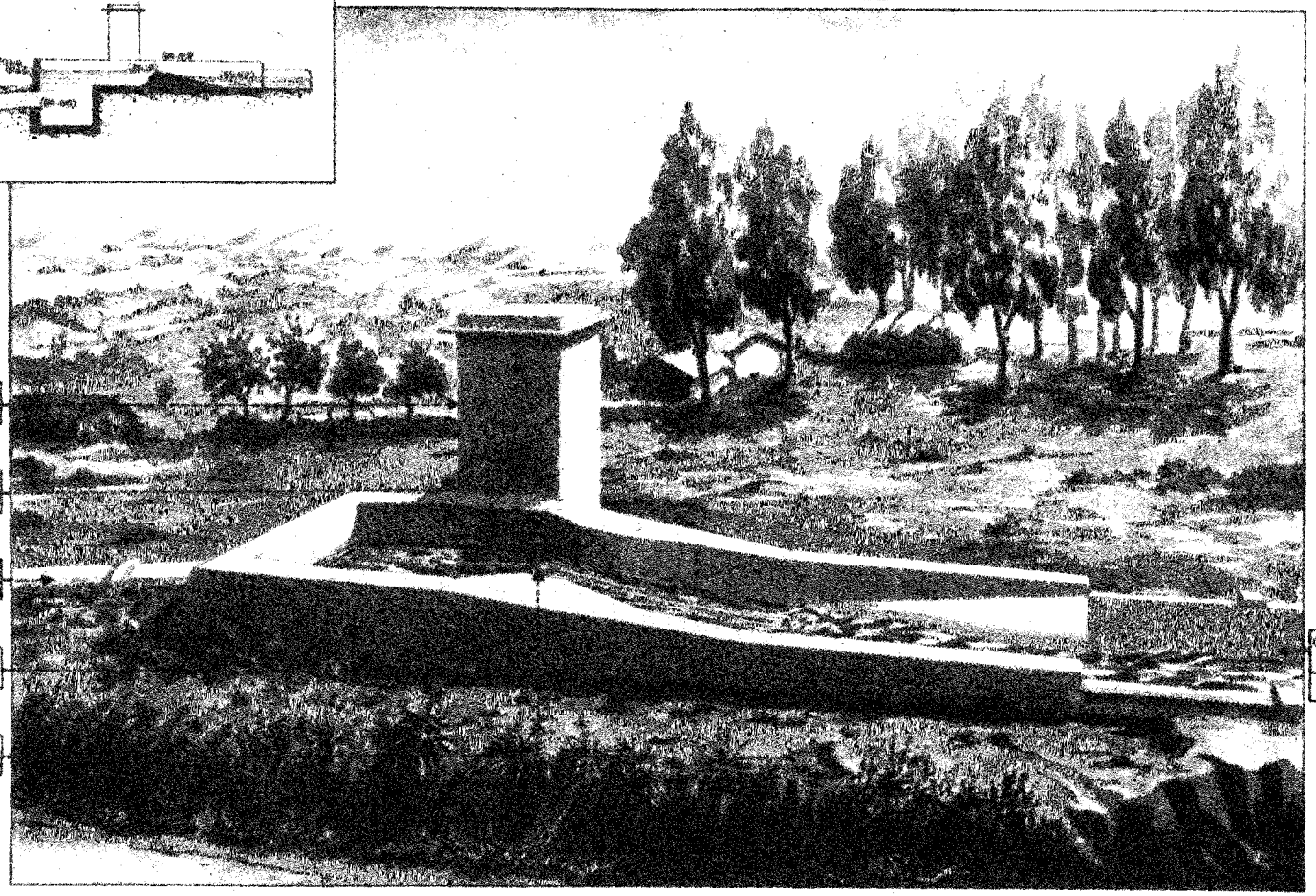


FIGURE 4