D O U B L E W A L L S C R E E N S

FIELD EXPERIENCE
OF
UNICEF CAIRO

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ATTACHMENTS

I. INTRODUCTION

The purpose pf this paper is to consolidate at one place and make available the double wall screens experience of the UNICEF Cairo Office and share it with any other office that may have interest in the subject

We firmly believe that the success of our India Mark-II deep hand pumps project component can be attributed mainly to the use of the double wall screens.

In order to introduce our experience with the double wall screens in Egypt, the background and how it started, it is worth outlining the past local techniques and experience in this regard as the logical introduction to the subject

II. TRADITIONAL TECHNIQUES FOR SCREENING WATER WELLS IN EGYPT

A. Perforated Pipes

This is one of the oldest and simplest techniques used in Egypt for water wells'screening, and was known and used technique by the ancient Egyptians few thousand years ago. Today, farmers and non technical personnel are knowledgeable enough to install and use such type of screens without any need for external advice The perforation is usually performed manually, or by any semimechanical way, depending on material used and the size of pipe to be perforated Material used vary greatly, from black steel to galvanised pipes and at some old wells in the oasis a wooden screens were used

successfully The perforation sizes are normally not small, with holes dia. 0 5 - 1.0 cm. Number of holes in the pipe is usually limited by the strength of the material and the pipe wall thickness.

B Manually Slotted Pipes

This is a similar technique to the above one, the difference is that the openings are shaped as horizontal or vertical slots, instead of rounded holes These slots are made either manually or by any semimechanical way The openings of these slots are again usually large in size and the number of slots in the pipe is limited by the material strength

C Wiremesh covered pipes

This technique represents a step forward, compared with the previously mentioned ones. The production of such screens has two stages. First, the pipes are perforated or slotted as described before, second, a sheet of wire-mesh, of copper or aluminium, is tailor - made to cover all the opened areas of the pipe, and firmly fixed by welding It is assumed, that by this way the well is protected against sand particles, but on the other hand it creates some other problems to be discussed in the paragraphs to follow.

D. Bridge Slotted Screens

This is the most common technique used today in Egypt Few decades back all bridge slotted pipes were imported from abroad. Later on, after a strong and a steady demand of the local market, the local production started. Primarily with a poor quality, but steadily developing to cover presently 90% of the market needs The screen holes are covered with a bridge of the same material as the pipe, enabling the water to flow through the space between the pipe wall and the bridge, see fig. 1. The height of the bridge is normally between 1 -- 3 mm. To get the best results from those screens, a layer of gravel pack should be placed perfectly around the screens from the outside of the liner in the bore hole annulus The efficiency of the screens usually depends on the efficiency of the gravel packing process and the proper size of gravels used, which is not easy to guarantee

III. PRESENT TECHNIQUES - PROBLEMS

Before surveying the advantages and the disadvantages of each type of screens mentioned before, it is worth to explain a function of the screens in general, and what are the expected features of the best quality screens in this respect

A. Why Water Well Screening

1 The borehole walls need a shield or protection against collapse pressure, particularly during water pumping out of water bearing layers It is a must, that this protection should not act as an obstacle against the waterflow into the well

2 Water produced from any water well, should be free from any strange material, such as sand particles, etc; to protect the pumping unit from the damage.

3 Important screens' quality is the corrosion resistance

B. Brief Screen Analysis

1 Required Screen Qualities

The above first two points represent the two main functions of a screen, and consequently the following features are expected to be found in any good screening technique

1.1 The screen material selected should have the proper specification to withstand and overcome the collapse pressure for a long life of a well.

1.2 The percentage of the opening area in the screens should be high, permitting a maximum quantity of water to pass through, with minimum friction losses

1.3. The screen openings (water passages) should be finer and smaller than that of the surrounding particles to prevent their flow into the well

1.4. Screens should be made of the material that should be highly corrosive resistant, to ensure a long life of the water well

2. Main shortcomings of traditional screening techniques

Bearing in mind the above desired qualities of the screens, one can summarise the most common shortcomings of all traditional techniques as follows:

2.1 Material used for screens almost regularly is of a low quality, due to the cost factor, traditionally, black mild steel sheets spirally welded pipes are used as screens material. This type of material when exposed to ground water, without any protection or coating, has a strong tendency to chemically react with water resulting sooner or later in corrosion. That in turn results in pipe collapse. If, galvanised steel pipes or pipes of well known intentional standards are used as screens, the performance improves considerably. Final results expected from steel pipes always depend on coating efficiency and wall thickness

2.2 Size of openings as described before is a major problem in most of the screens Due to the fact that perforations are performed manually or semimechanically, the sizes produced are usually bigger than desired. This directly results in a well being filled up with sand within a very short period of time
Any pump installed in such a well is exposed to the high chances of damage or failure, due to the wear of the mobile or soft parts.

2.3 Opening area, expressed in percentage of openings against the blank area of a specific pipe, is usually very low. The common percentage of local screens is 10% That causes a bad well performance, yield against drawdown, and need to lengthen the screens string in each well.

C. GRAVEL PACK PROBLEM

The bridge slotted or wireroped screens available now on the market, have almost solved the above problems, by offering the best techniques in manufacturing, coating, slotting and high opening areas However, there is still one factor affecting the best well performance, "The Gravel Pack" It is an outside layer of artificial porous media surrounding the screens, aiming to provide an optimum media for the water flow from the aquifer into the wells without

sudden change in permeability factor, which may result (if occured) in high losses in the hydrodynamic head called "head loss". Moreover, Gravel Pack protects well from the invasion of the fine sand particles existing in most of sandy aquifers, which causes serious well troubles, as well as the pump damages

Gravel pack has obviously an ultimate importance in guaranteeing a good well performance. This brings up the real problem facing any drilling crew, how to place the gravel pack correctly around the screens, and how to ensure its homogenity and prevent entrance of small sandy particles

To sum up the possible risks and precautions that can be encountered during this job, one can mention the following

1. To ensure that gravel is positioned in the right place, the designer of the well should enlarge the drilling diameter to get enough annular space around the screens This implies an additional drilling cost
2. Casing and screens should be positioned at the center of the hole, by means of centeralizers, to guarantee the homogenity of gravel thickness around the screens. Again an additional cost
3. The sizes of the gravel particles should be chosen against the characteristics of the aquifer sands. Usually it should be a mixture of two or three sizes (1 - 3 mm), sometimes difficult to be found at each locality

4. Many precautions should be made during the process of gravel packing, to prevent the sorting of gravel particles, falling down through drilling fluid inside the annular space, i e. the setting of each particular size together, causing unhomogenity.
5. The gravel particles should be rounded in shape, that may be not available at each locality

IV. DOUBLE WALL SCREENS

The latest innovation that gives the satisfactory solutions to the above problems is the introduction of the double wall screens, i.e. screens prepacked with gravel that can be assembled conveniently on the ground surface Different types of prepacking techniques were tried, but the most successful on the market now is the P V C double wall screens, that brought excellent results to the UNICEF WSS project of Egypt.

Description

Briefly, double wall screens consist of inside screens and outside screens, fixed together by means of special joint tool with two threadings for the two screen sizes. In between the two screens, the most appropriate gravel particles for the water bearing formation encountered are placed. If required, an artificial material can be used, such as plastic balls, instead of the natural gravel see figure 2

It is clear that the innovation lies in the fact that the gravel pack is installed within the annular space of the two screens of different sizes on the surface before running-in the screens in the hole In this manner, one can guarantee that all technical requirements of a good screen installed will be met, especially if the openning areas of screens and the size of its slots are as desired

It should be outlined that the use of this type of screens is a completely new approach in water wells construction's because·

1. The gravel packing process and its risks are eliminated completely
2. The size of a borehole is minimized to a great extent for the same productivity
3. It is in the long term a low cost approach, with a very high quality product
4. Use of a P V C materials tremendously extends the well productive life.

V USE OF DOUBLE WALL SCREENS - EGYPTIAN EXPERIENCE

A. Background

When preparation were being made for launching the hand pumps' component of our programme, information collection was undertaken in order to learn more about different types of pumps and its performances In 1982 a visit was made to a certain UNICEF Country Programme, where India Mark II pumps were chosen as an appropriate technology in deep hand pumps' approach.

In spite of a good performance of the pump itself, the project was facing a serious problems with the leather cups of the pump's valves that were constantly worn out in 30 days - 40 days, as a result of the sand presence in the pumped water This in turn resulted in water wells being silted up, in unexpectedly short time

By spot observations and analyses of the situation there in details, it was found that the problem was caused by the gravel pack. Either by not installing it at all, or by completion of packing procedures of a very poor quality. Similar indications collected from other countries reinforced the belief here that, the most crucial part in the successful installation of these pumps is the proper design of the well itself

From the experiences gained in this regard, and by surveying the latest developments in technology, the following decisions were made up:

1. India Mark-II deep hand pump was selected to be introduced in Egypt as an appropriate of deep hand pumps technology.
2. To guarantee the long life of the water wells to be drilled, P V C. casing and screens were selected, due to its numerous advantages against conventional steel pipes.
3. To guarantee the successful gravel packing process, the pre-packed screens were analysed, and consequently the double wall screens, as the best type of prepacked pipes were selected to be used in our project as the most appropriate.

B Project Implementation

1. Introduction to project start-up

Egypt is a rather sophisticated developing country with comparatively large number of skilled professionals working in the water related sectors. The start of UNICEF assistance in the area of water supply and sanitation coincided with the country's receipt of large USAID funds in early years of this decade Combination of hundreds millions of U.S $ made available for water works, with the presence of local skilful water staff and experts made any type of a cheap appropriate technology such as deep hand pumps unatractive There was an air of attitude, that only the highly sophisticated approaches to improving country water sources are welcomed, such as Water treatment plants, desalination units, and a top quality systems with a large booster pumps, use of stainless steel, etc. This approach was not limited to the urban areas but to the rural as well, i.e. to the areas assigned for the UNICEF assistance Through the long negotiations with the Government, in which the UNICEF fought for supporting only the cost effective and appropriate technology two mainlines of drinking water support were selected: Self - Contained Systems (SCS) and Deep Hand Pumps - India Mark-II. While the first component-SCS has been financially strongly supported by the Government throughout the implementation period, UNICEF decided to support the second component (India - Mark-II) on a turnkey basis, to prove its reliability and need in the rural areas as the best approriate technology for the small sattelite villages

2. Project results up to November 1987

In a view of the limited funds, it has been decided to support in the first project phase the installation of 300 deep hand pumps The estimated was that some 150 - 200 persons would use one hand pump installed Once the procurement action was finished, importing double wall screens and all the components of the India Mark-II for the first 100 pumps, the project implementation started In January 1984 the first ten (10) pumps were successfully installed at one locality in the Aswan Governorate. Till the end of 1984 another 75 pumps were installed making the total number of pumps installed 85.

After the installation of these first 85 deep hand pumps, the implementation of this component has been stopped for some logistic problems and due to the heavy work concentration in the other project areas The revival of this component started in December 1986 bringing the total number of pumps installed till November 1987 to 165

Conclusions

The implementation stoppage of some two years provided an unplanned advantage, an easy monitoring of the installed pumps' performance.

1 In a continious pumping performance during the last three years it has been found that all the 65 pumps were continously working in an excellent order

2. In average, two (2) pumps out of ten (10) were repaired for a mechanical failure at some stage, but not a simple leather cup change was required

3. The above fact, under item 2, is the practical proof of the efficiency of the double wall screens installed, since the water bearing formation contains fine agrressive sands, as the rule

inally, we do hope that our positive experience with the of the double wall screens in formations containing ssive sands might help some other UNICEF offices in the l work.

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UPPER EGYPT
PROJECT

INDIA MARK II
DEEP HAND PUMPS INSTALLED

TAGE A

O N T R A C T O.	REG	FILE NO	PCS INSTALLED	LOCATION GOVERNORATE	COMPLETED MONTH/YEAR
.		4	10	ASWAN	Feb 1984
I	WSS/2/84	9	25	ASSIUT	Nov. 1984
II.	WSS/4/84	10	25	ASSIUT	Nov 1984
V	WSS/6/84	11	15	ASSIUT	Jan. 1985
	TOTAL		75 PCS in January 1985		

TAGE B

O.	REG.	NO	INSTALLED	GOVERNORATE	MONTH/YEAR
.	WSS/2/86	18	10	ASWAN	March 1987
I	WSS/1/87	19	25	ASWAN/ASSIUT	June 1987
II.	WSS/2/87	20	25	ASSIUT/SOHAG	August 1987
II	WSS/3/87	21	50	U E. - ALL	(29 PCS) Nov 1987
X.	WSS/ /				
.	WSS/ /				

November 1987 Total STAGE A = 75
STAGE B = 89

Grand Total A & B = 164

ATTACHMENTS

FIGURE 1

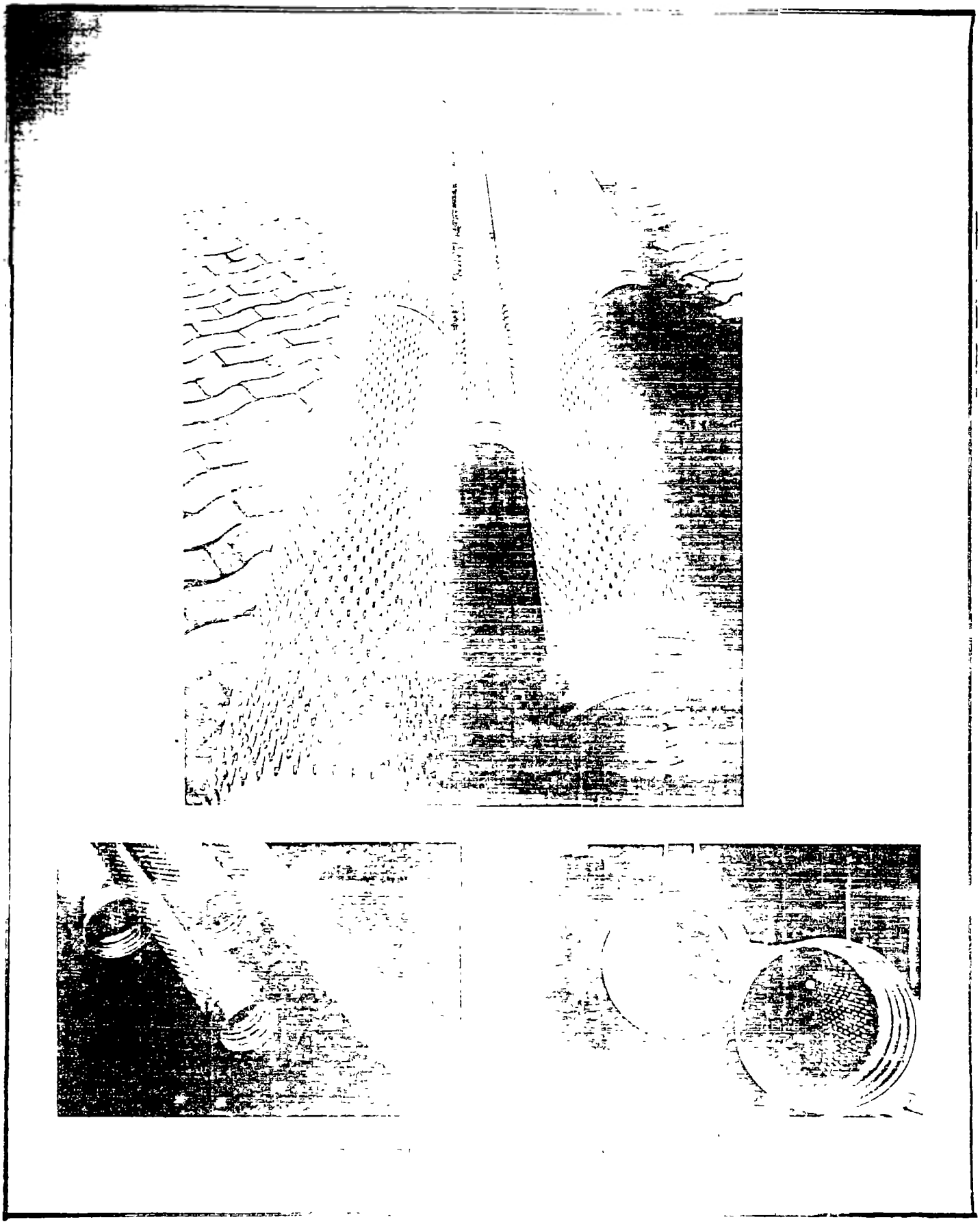
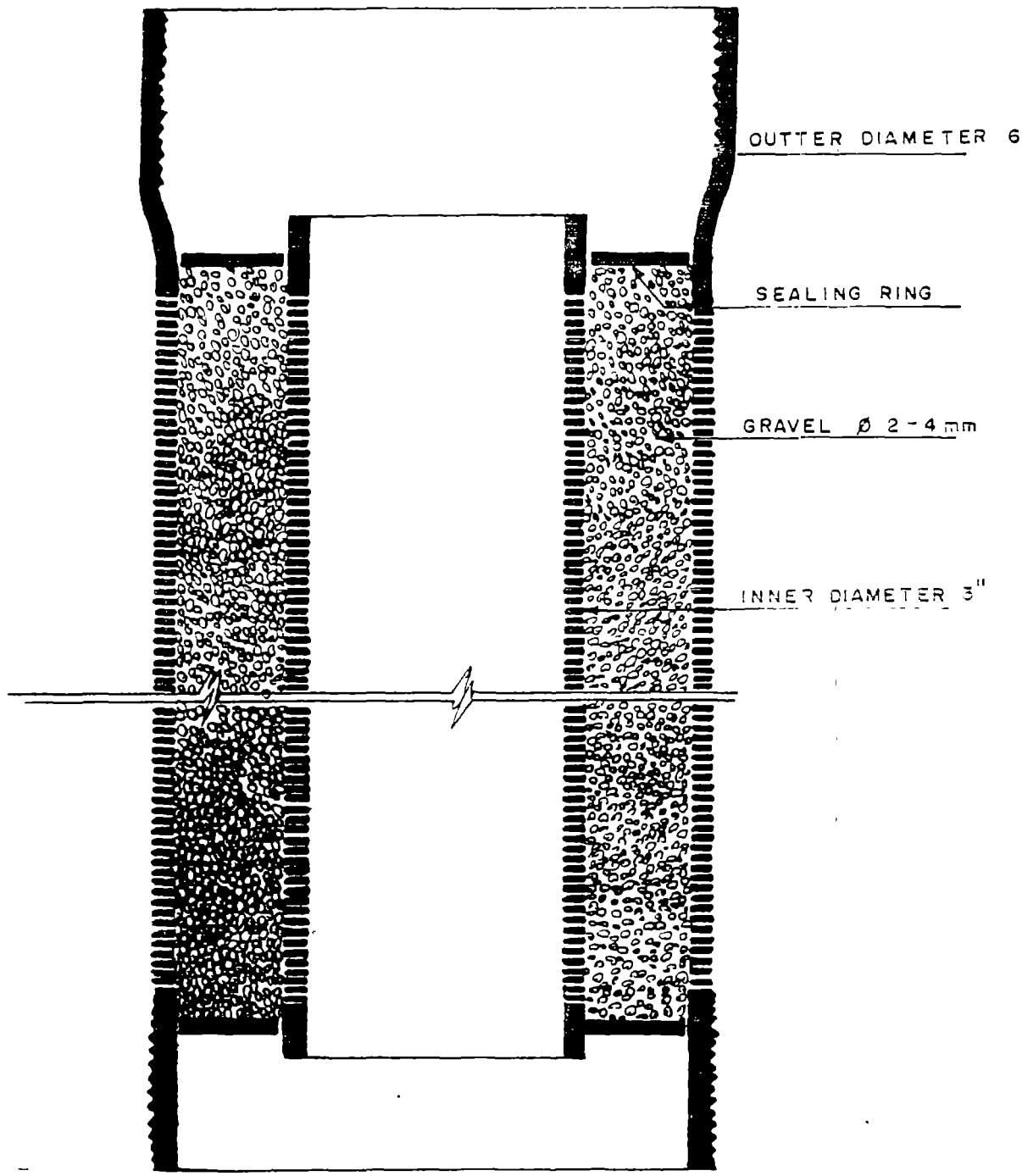


FIGURE 2



CROSS SECTION OF DOUBLE WALL SCREEN

UNICEF

UNITED NATIONS CHILDREN'S FUND
FONDS DES NATIONS UNIES POUR L'ENFANCE

INTEROFFICE MEMORANDUM

TO: See Below

DATE 23 December 1987

FILE NO F/33

FROM: Magdi Zaki M Zaki
Water Supply Officer

SUBJECT: Double Wall Screens

During the last MENA Regional meeting at Khartoum - Sudan, the use of double wall screens in water wells was an important issue for discussions. Since UNICEF Cairo Office has a good experience in using this new type of technology, particularly within the deep hand pumps project, we feel that this experience should be shared with you and other offices.

The attached document include a complete description for screening water wells in general and highlight our experience in using D.S.W. in hand pumps project. Cairo Office is ready to provide more information on the subject if it is needed.

Best regards.

Distribution: Mr. R. Jolly Deputy Executive Director Programmes
Dr. Nyi Nyi Director of Programme Development and Planning
Mr. R. Reid UNICEF Regional Director- MENA - Amman
Mr. M. Beyer Senior Policy Specialist

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MZ/nt

FROM THE UNICEF WATERFRONT

A note from the Adviser, Drinking Water Programmes, UNICEF, New York, N.Y. 10017

To: UNICEF WET and Supply Colleagues
World Bank: Shaul Arlosoroff and David Grey
WHO: Mike Acheson
IRC: Hans van Damme and Jan Teun Visscher
USAID/WASH: Dr. Dennis Warne

From: Martin G. Beyer, Senior Policy Specialist (Drinking Water and Sanitation)

Date: 5 January 1988

Dear Friends,

Subject: Double Wall Filter Screens for Wells

Years ago our late colleague Dr. Bozidar Kojićić developed the double wall screen for use with handpumps out of his original idea for oil wells. Some prototypes were than manufactured some six-seven years ago and sent to Ethiopia and Egypt for field testing.

Attachmt. Only now we have received the attached report from Egypt, which looks highly encouraging. There seems to be good possibilities to manufacture such screens even for very small diameters as used for sludged wells of the type of Bangladesh.

Any comments and questions are most welcome.

Happy New Year 1988.

Due to a momentary heavy workload on the WET Section in New York, we much regret any delays and the very brevity of our reply or response. However, your letters/telexes/messages/concerns/requests/prayers are heard and not neglected. Bear with us.

Please also note our new address and telephone:
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