INSTITUTE OF HYDROLOGY

_____ SECTION

INTERNAL REPORT

NATURAL ENVIRONMENT RESEARCH COUNCIL

INSTITUTE OF HYDROLOGY

SUBSURFACE SECTION

REPORT NO 64

INSTALLATION OF AQUIFER COMPACTION RECORDER

K GILMAN

MAY 1975

NATURAL ENVIRONMENT RESEARCH COUNCIL

013576 500 6/70 XBD 2077

NATURAL ENVIRONMENT RESEARCH COUNCIL

INSTITUTE OF HYDROLOGY

SUBSURFACE SECTION

REPORT NO 64

INSTALLATION OF AQUIFER COMPACTION RECORDER

K GILMAN

MAY 1975

Institute of Hydrology
Maclean Building
Crowmarsh Gifford
Wallingford
Oxon
OX10 8BB

INSTALLATION OF AQUIFER COMPACTION RECORDER

1. INTRODUCTION

Compaction recorders are used to detect the subsidence of the land surface caused by intensive abstraction of groundwater from alluvial aquifers. The principal component of the instrument is a steel cable anchored to a large weight at the bottom of a borehole, and tensioned by a counterweight. A standard water level recorder is attached to a clamp near the top of the cable, and measures the relative movement of the ground surface and the anchor weight.

The compaction recorder described was designed and manufactured by Cotsworld Engineering to the specification of the Institute of Hydrology. The design was based on a paper by Lofgren (1969), and the mechanical calculations leading to the specification were performed by Gilman (1973).

2. A WARNING

Care is necessary in handling

(i) the main cable, to avoid kinking. Another danger is that the cable may be lost down the borehole, so it is essential that the surface end be securely anchored when the counterweight is not attached;

(ii) the beam and pulley assembly. The efficiency of the recorder depends on the pulley bearings and the knife edge;

(iii) the recorder clock. Do not overwind, do not carry the recorder with the drum attached;

(iv) the steel recorder wire. Avoid kinking.

3. INSTALLATION PROCEDURE

(i) An anchor weight will be required. This consists of a 100 kg concrete block sufficiently narrow to go down the borehole without fouling. This weight is fastened securely to the end of the main cable, and it is then winched down the borehole, taking care not to kink the cable. Do not attempt to use the recorder pulleys to carry the cable at this stage. Check that the anchor weight has reached the base of the hole.

(ii) Having lowered the anchor weight, cover the borehole with a slotted ply or cardboard lid to prevent the loss of tools, cable clamp etc. down the well.

(iii) Place the frame in approximate position and bolt on the knife-edge support (4). Grease the tops of the support screws (2) and screw them upwards so that the beam may be positioned above the knife-edge support

but with the knife-edge (3) about 1 mm clear of its support. The knife-edge should be in line with the scribed marks on the support. Adjust the position of the frame so that the pulley rim is vertically above the centre of the borehole. Lead the main cable (1) over both pulleys, cut off surplus cable and fix the large counterweight (5). Diagram 1 shows the method of fixing the cable to the weight. Compaction will cause the counterweight to move downwards a distance equal to the compaction, so ensure that there is a clear space of at least 0.5m. below the weight. Level the base using the adjustable feet and the circular spirit level (6).

(see Photographs 1, 2, 3 and Diagram 1).

(iv) Attach the cable clamp (7) to the steel wire (8). It is suggested that this should be brazed on to make a permanent fixing. Fix the clamp to the main cable as low as possible. Holding the outer scroll wheel (9) so that the hole in the rim is approximately 45^{o} above horizontal, lead the recorder wire into the helical groove and through the hole in the rim. Pass once around the wire securing screw (10) and out through the hole. Tighten the screw. Wind the wire into the helical groove and attach the small counterweight. Compaction will cause this counterweight to move downwards, so ensure that there is a clear space of at least 0.5 m. below the weight.

(see Photographs 4 and 5)

(v) Bolt the chart recorder to the frame in the position shown in Photograph 4. Three other holes are available should it be desired to mount a geared recorder to extend the range of the instrument. Clamp the chart drum (12) on to the clock spindle and insert the pen (11) into its holder. Adjust the pen height by means of the securing screw on the inner scroll wheel (13). It is suggested that a suitable starting position for the pen is a quarter of the chart height from the top. It may be necessary to prime the pen using a length of plastic tubing.

(see Photograph 4)

4. SERVICING

(i) At infrequent intervals it may be necessary to lubricate the recorder

bearing (16) with light machine oil. Do not oil the vertical recorder column (15) as this would cause dust to adhere.

(ii) Do not oil the pulley bearings. These are sealed units incorporating PTFE spacers.

(iii) The knife-edge and support are hardened steel and not stainless, so they should be protected by a film of light machine oil. The same treatment is recommended for the feet of the frame and the support screws.

5. OPERATION

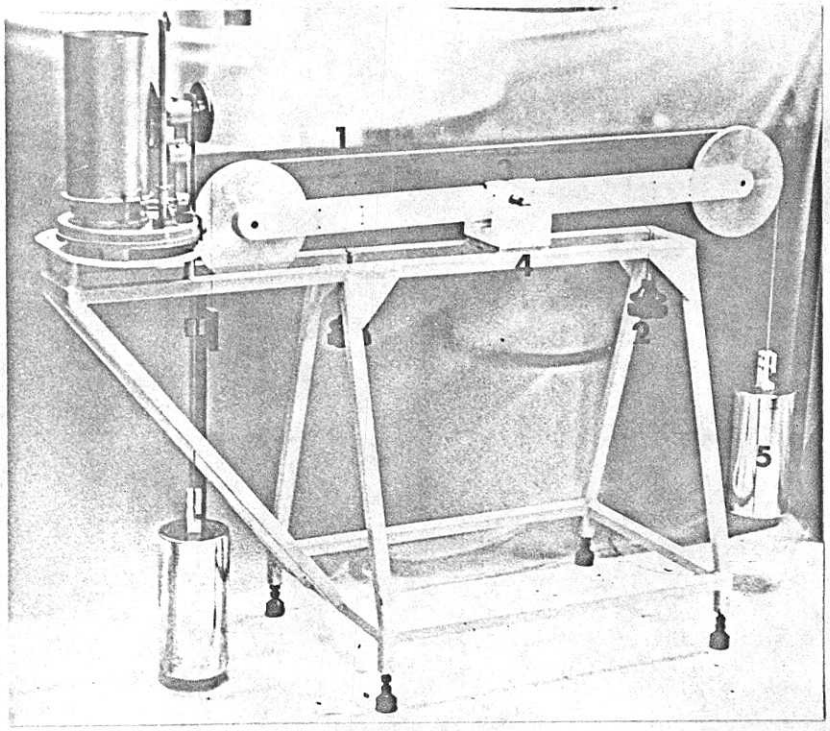
Charts should be changed monthly. Thepen should be tipped away from the chart and the drum removed from the recorder before removing the chart. At the same time the recorder clock should be wound and the beam reset to the horizontal, using the beam spirit level (14). The reason for resetting the beam is given by Gilman (1973) in para. 2.15.

The recorder clock is regulated to make one revolution in 28 days. However as a check, the chart should be time-marked, immediately after fitting and before removal, by making a small vertical movement of the pen. There is a small amount of play in the clock gearing, which should be taken up by rotating the drum anti-clockwise before replacing the pen.

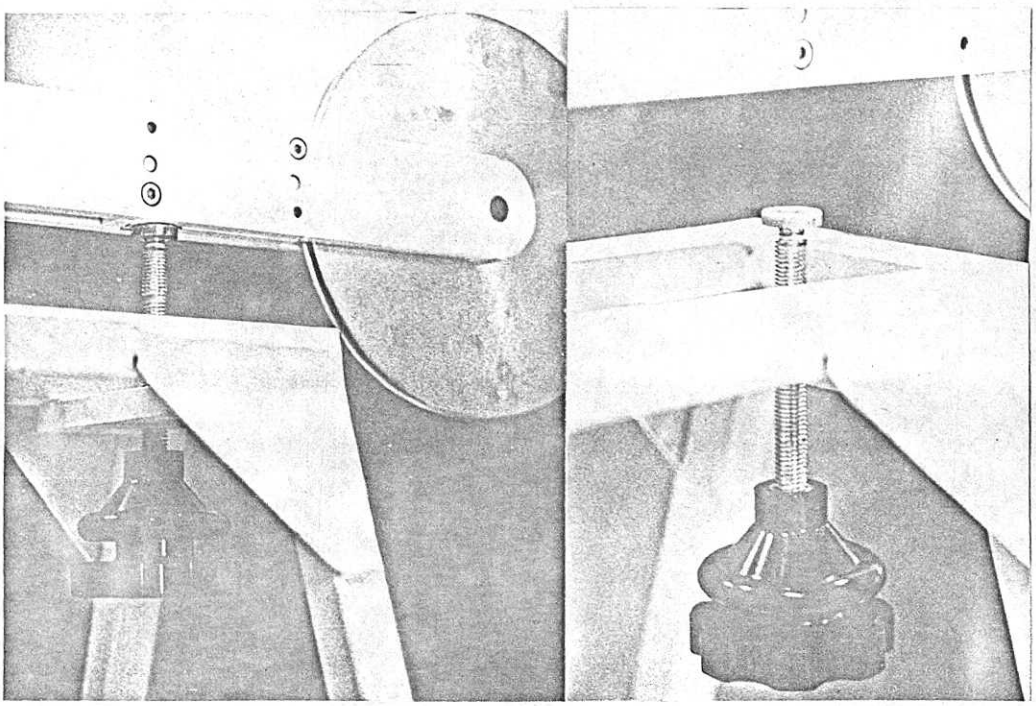
6. REFERENCES

Lofgren, B.E. Field measurement of aquifer-system compaction, San Joaquin Valley California USA, Int. Assn. Sci. Hydrol. Pub. 88, 1969.

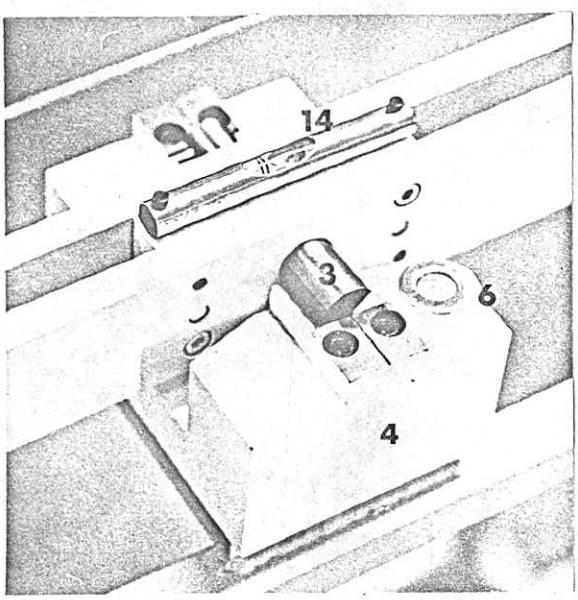
Gilman, K. Mechanics of aquifer compaction recorder, Inst. Hydrol. Subsurface Sect. Rept. 56, 1973.



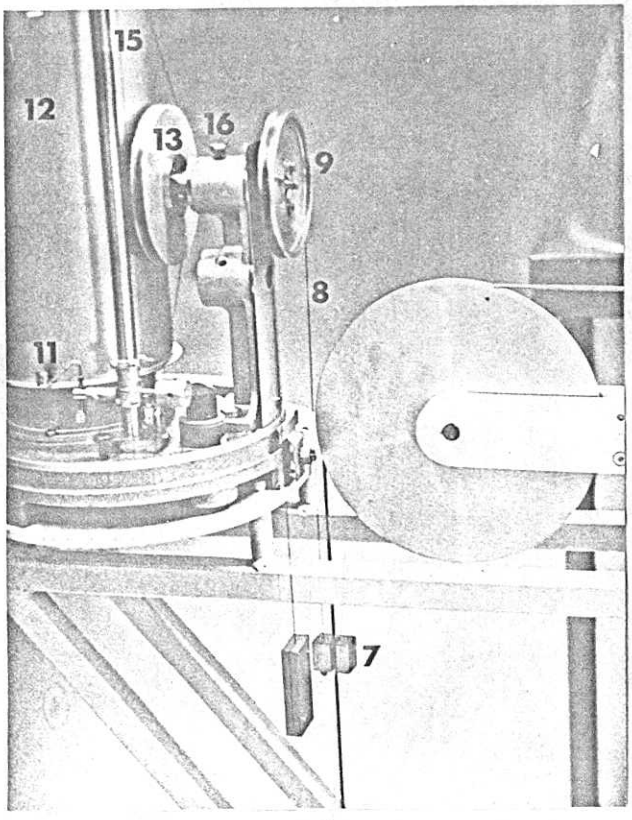
1



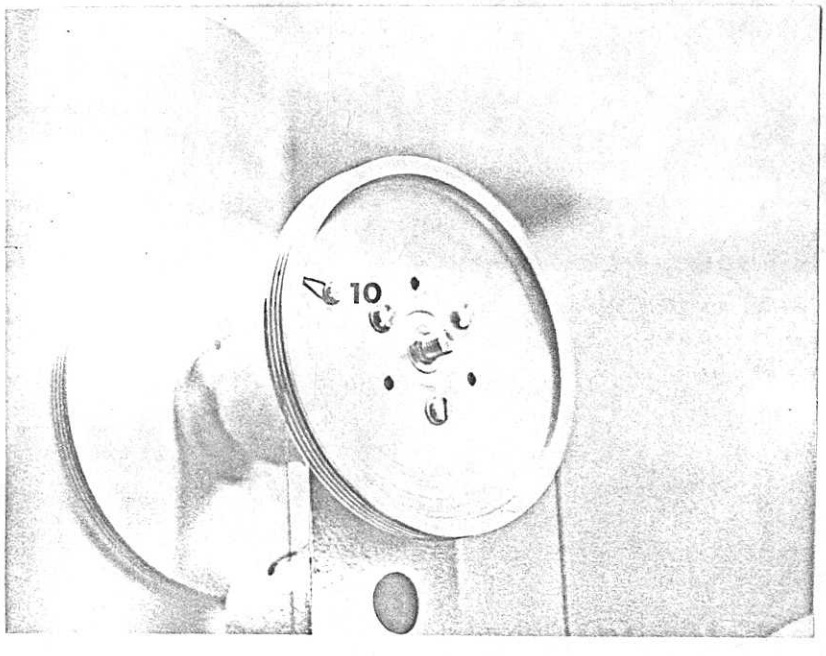
2



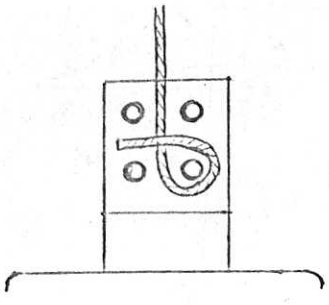
3



4



5



Diag. 1