

PENGUKUR VOLUME AKTUAL TANAH.

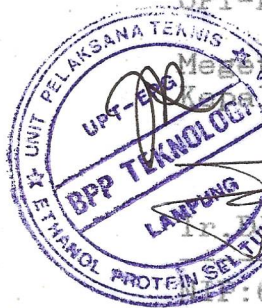
Judul Asli : SOIL ACTUAL VOLUMENOMETER.

Alih bahasa

Oleh : M. CHAERUDIN TRI ATMODOJO.

Sulusuban, April 1993.

Dapat dipergunakan dilingkungan  
UPT-EPG BPP TEKNOLOGI



Mengetahui:

Kepala UPT-EPG BPP TEKNOLOGI

M. ALI

680000134.

PERPUSTAKAAN

No. Induk  
Klasifikasi  
Subjek

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Harga / Asal  
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## K A T A   P E N G A N T A R

Dalam Keterbatasan berbahasa asing aktif maupun pasif, maka dirasa - kan perlu untuk menterjemahkan INTRUCTIONS dari beberapa peralatan Laboratorium yang pada umumnya berbahasa asing ( Inggris, Jepang , Jerman dan sebagainya ).

Terjemahan ini bertujuan untuk mempermudah pengertian dasar operasi yang besar kaitannya dengan kualitas hasil pengamatan ataupun penelitian sebab para pelaksana pada umumnya belum mendalami bahasa asing secara aktif dan terpadu.

Alat pengukur volume aktual tanah ( Soil Actual Volumenometer ) adalah alat untuk mengetahui volume Real tanah yang berupa fase padatan saja. Dengan peralatan ini diharapkan para laboran dapat mengetahui secara lebih mudah mengenai volume actual tanah tanpa mengalami kesulitan intepretasi bahasa.

Demikian semoga dapat dimanfaatkan seperlunya oleh yang berkepentingan dan saran - saran terhadap terjemahan ini kami nantikan. Terima kasih.

Sulusuban,    April 1993

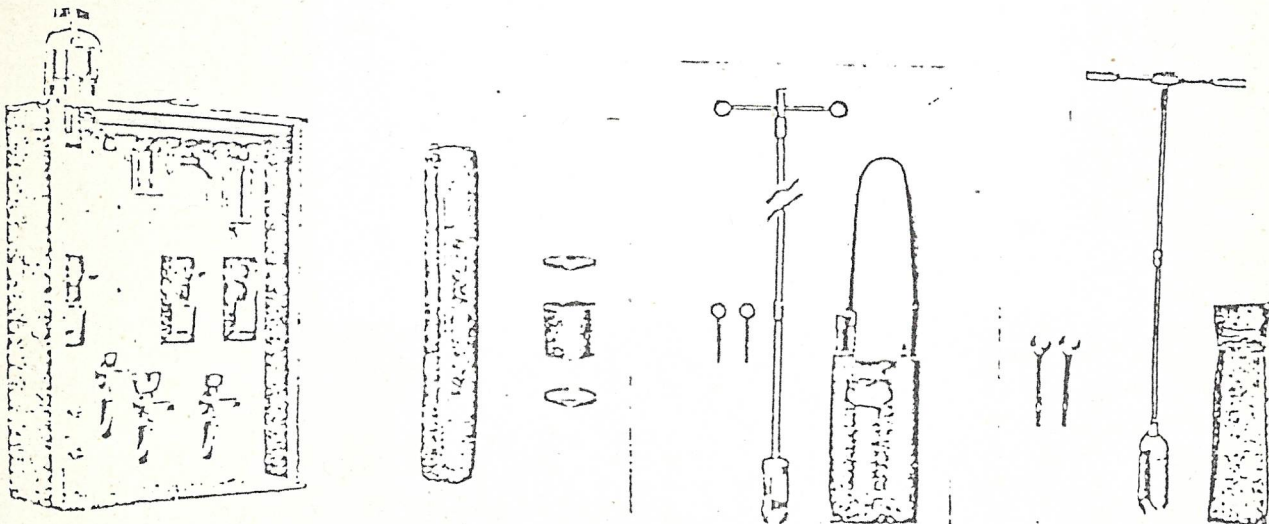
Penyusun,

PENGUKUR VOLUME AKTUAL TANAH Model 100 S

Alat ini berupa 1 set yang meliputi perlengkapan untuk survey tanah yang menggunakan pengukur volume aktual.

\* Perincian alat dan Spesifikasi

- 1) Pengukur Volume Aktual ..... 1 unit
  - Kapasitas sampel : 100 ml
  - Batas ukur : 25 - 100 ml
  - Ketelitian : sampai 0,1 ml
  - Ukuran : 40 x 17 x 55 Cm
  - Berat : 12 kg
  
- 2) Silinder sampel tanah ..... 10 set
  - Kapasitas : 100 ml
  - Bahan: Plat nikel (vernikel)
  - Jumlah per set : 6 buah
  - Tas (case) : Kanvas
  
- 3) Penyampling tanah ..... 1 set
  - Kapasitas sampel : 100 ml
  - Kedalaman sampel : 100 cm  
(dilengkapi batang/tongkat, 2 buah @ 50 cm)
  - Tas : Canvas
  - Perlengkapan : Sikat dan pisau
  
- 4) Bor tanah ..... 1 set
  - Diameter luar : 10 cm
  - Kedalaman bor : 100 cm  
(dilengkapi batang/tongkat, 2 buah @ 50 cm)
  - Tas : Canvas
  - Perlengkapan : 2 buah konci pas



## PENGUKUR VOLUME AKTUAL TANAH (Soil Aktual Volumenometer) Model 100

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Alat ini mengukur volume aktual (jumlah volume padat dan volume cair) sampel tanah yang diperoleh dari pengumpulan sampel pada sampel silinder bervolume 100 ml. Ketiga fase dalam tanah misalnya kadar air, porositas dan jumlah padatan dapat diketahui dari hubungan antara volume (V), berat (W) dan berat spesifik (d). Dengan alat ini dapat diketahui dengan cepat dalam 1 atau 2 menit beserta ketepatan yang tinggi tanpa menggunakan pemanasan.

### Spesifikasi

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Kapasitas sampel	:	100 ml
Jarak pengukuran	:	25 - 100 ml
Ketepatan	:	+ 0,1 ml
Ukuran alat	:	40 cm x 17 cm x 55 cm
Berat	:	12 kg
Perlengkapan	:	sampel silinder (6 buah dengan tas)

### Prinsip

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- 1) Tanah adalah media atau benda yang mengandung butiran-butiran dan terdiri atas 3 fase yakni fase padat, fase cair dan fase gas sebagai tercantum pada gambar 1. Volume aktual adalah volume padat dan volume cair. Alat ini mengukur secara langsung aktual volume.
- 2) Bila volume aktual telah diketahui, maka penyusun-penyusun dasar fisik dari tanah dapat diperoleh sangat mudah dan sistimatis satu persatu sebagai tercantum pada gambar 3., sehingga metoda ini dinamakan metoda volume aktual.
- 3) Skema peralatan disajikan pada gambar 2., tabung pengukur dan pipa U terbuat dari "acrylic resin" dan logam terbuat dari baja atau "brass" dan semuanya berhubungan. Jarak pengukuran adalah dari 25 ml sampai 100 ml dan ketepatan + 0,1 ml.

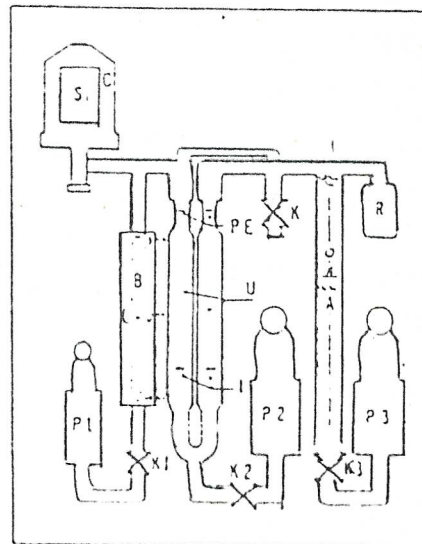
## CARA KERJA

### I. STANDARDISASI ALAT (Silinder 60 ml)

1. Buka kran K
2. Buka kran K1 dan atur cairan nol
3. Buka kran K3 atur cairan 60.
4. Buka kran K2 atur cairan pada skala dibawah.
5. Pasang sampel silinder standar 60 ml.
6. Tutup kran K.
7. Buka kran K2 dan naikan cairan sehingga datar pada skala diatas (dengan cara dibantu menaikkan atau menurunkan cairan pada pipa B dan A).
8. Baca skala, yakni skala (A + B). Nilai B dapat positif atau negatif. Bila B dibawah nol nilai negatif. Bila B diatas nol nilai positif.

### II. PENGUKURAN

1. Buka kran K2 turunkan cairan di titik bawah.
2. Buka kran K.
3. Atur cairan di B skala nol.
4. Pasang sampel tanah.
5. Buka K3 naikan cairan 85 ml.
6. Tutup kran K.
7. Naikan cairan di U sampai skala atas dan datar.
8. Baca skala yakni skala (A + B)



Gbr. Soil Actual  
Volumenometer

### III. PERHITUNGAN

Misal, hasil standardisasi 60 ml = 50 skala.

Misal hasil sampel = 70 skala

Maka volume sampel =  $70/50 \times 60 \text{ ml} = 84 \text{ ml}$ .

### IV. TAMBAHAN

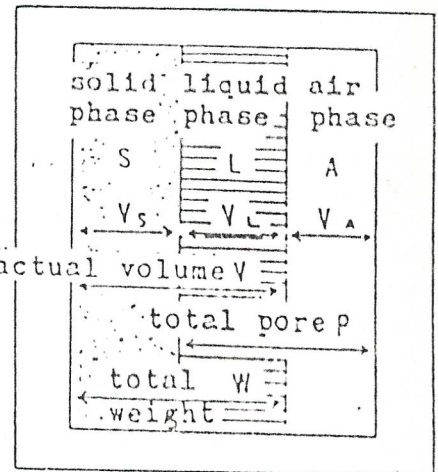
Untuk checking gunakan standardisasi dengan silinder 50 ml.

Catatan :

1. Jangan membuka kran K, ruang sampel atau kran K1 dan K3 pada waktu cairan di pipa U berada diatas (semua sistim dalam keadaan tekanan).
2. Waktu pengukuran, hindari penyinaran langsung (untuk menjaga agar sistem berada dalam temperatur yang stabil/tetap).

Struktur tanah dan Istilah-istilah

- |                                     |                              |
|-------------------------------------|------------------------------|
| 1) Volume total                     | $V_t$                        |
| 2) Berat total                      | $W$                          |
| 3) Volume aktual                    | $V$                          |
| 4) Berat fase padat                 | $S = W - M$                  |
| 5) Volume fase padat                | $V_s = (W - V) / (d - 1)$    |
| 6) Berat air tanah                  | $M = v_l$                    |
| 7) Volume air tanah                 | $V_l = V - V_a$              |
| 8) Volume udara tanah               | $V_a = 100 - V_s$            |
| 9) Porositas                        | $P = 100 - V_s$              |
| 10) Ratio padatan                   | $S = \frac{V_s}{V}$          |
| 11) Ratio air                       | $M = \frac{V_l}{V}$          |
| 12) Ratio udara                     | $A = \frac{V_a}{V}$          |
| 13) Persentase air jenuh            | $H = \frac{M}{P} \times 100$ |
| 14) Persentase udara                | $U = 100 - H$                |
| 15) Kandungan air pada tanah basah  | $M = \frac{M}{W} \times 100$ |
| 16) Kandungan air berdasarkan berat | $M = \frac{M}{S} \times 100$ |
| 17) Spesifik gravity                | $d = \frac{S}{V}$            |



Gbr. Diagram padatan(solid) Cairan(liquid) dan Udara (air) phase pada tanah.

18) Apparent Spesifik gravity atau Bulk density =  $d = \frac{S}{100}$

19) Aktual spesifik gravity  $d = \frac{W}{V}$   
m

20) Perbandingan Cairan - padatan  $L = \frac{V}{V}$   
s l s

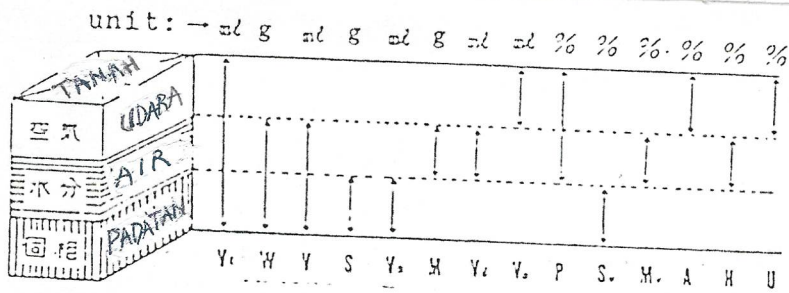
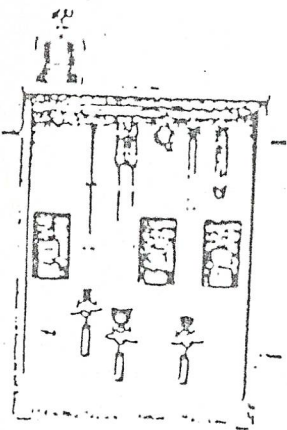


Fig. 5

EQUIP. SOIL ACTUAL VOLUMENOMETER  
ITEM No. AG 105  
MAKER KIYA SEISAKUSHO, LTD.  
Q'TY 1



331

331 SOIL ACTUAL VOLUMENOMETER  
Model 100

This instrument measures the actual volume (volumetric sum of solid phase and liquid phase) of the soil sample collected or filled up by sampling cylinder with whole volume of 100 ml.

Sample capacity: 100 ml  
Measuring range: 25 - 100 ml  
Accuracy:  $\pm 0.1$  ml  
Dimensions: 40 x 17 x 55 cm  
Weight: 12 kg  
Accessories:  
Sample cylinders .... 1 set  
(6 pcs. with case)



INSTRUCTIONS

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№ 331-B

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KIYA SEISAKUSHO, LTD.

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Kiya No. 331-B

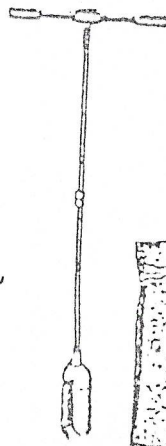
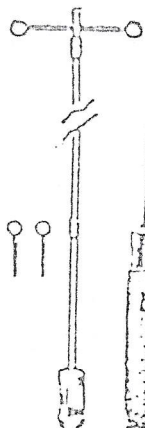
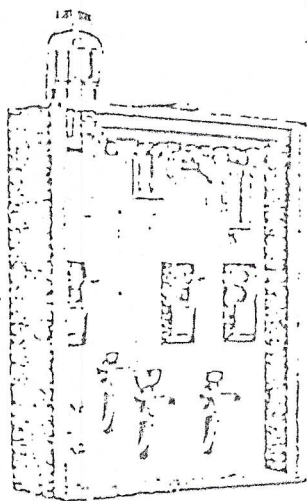
## SOIL ACTUAL VOLUMENOMETER SET

Model 100S

This is a set consists of necessary tools for soil survey by using the actual volumenometer(Model 100).

### \* Components and Specifications

- 1) Soil actual volumenometer .....1 unit
  - Sample capacity: 100 ml
  - Measuring range: 25 - 100 ml
  - Accuracy: within 0.1 ml
  - Dimensions: 40 x 17 x 55 cm
  - Weight: 12 kg
- 2) Soil sample cylinders .....10 sets
  - Capacity: 100 ml
  - Materials: made of nickel plated brass
  - No. of a set: 6 pcs.
  - Case: canvas, hand carrying type
- 3) Soil sampler .....1 set
  - Sampling capacity: 100 ml
  - Sampling depth: 100 cm
  - (with extention rods, 2 pcs. of 50 cm)
  - Case: canvas, shoulder type
  - Accessories: brush and knife
- 4) Soil auger .....1 set
  - Edge diameter: 10 cm
  - Auger depth: 100 cm
  - (with extension rods, 2 pcs. of 50 cm)
  - Case: canvas, shoulder type
  - Accessories: 2 spanners





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## SOIL ACTUAL VOLUMENOMETER

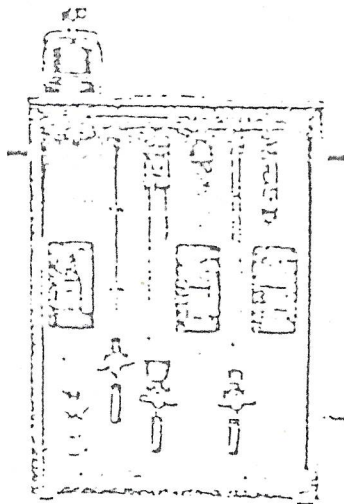
Model 100

(Three Phase Distribution Measuring Instrument)

This instrument measures the actual volume (volumetric sum of solid phase and liquid phase) of the soil sample collected or filled up by sampling cylinder with whole volume of 100 ml. Three phase distribution of soils such as moisture ratio, porosity, and solid phase ratio can be derived from the relation between the said value (V) the weight (W) and the specific gravity (d). It is noteworthy that the measurement can be completed within 1 or 2 minutes with high accuracy without any thermal dehydration.

### \* Specifications

Sample capacity:	100 ml
Measuring range:	25 - 100 ml
Accuracy:	$\pm 0.1$ ml
Dimensions:	40 x 17 x 55 cm
Weight:	12 kg
Accessories:	Sample cylinders (6 pcs. with case) .....1 set



331

• Principle

- 1) The soil is a substance having a grained structure, and consists of three phases, i.e., the solid phase, the liquid phase and the air phase, as shown in Fig.1. The actual volume means the total of the volumes of the solid phase and the liquid phase. This unit is an instrument measuring the actual volume of the soil directly.
- 2) When the actual volume is known, the fundamental physical properties of the soil can be obtained very simply and systematically one by one, as shown in Fig.3, such a method is called the actual volume method.
- 3) The instrument has a structure shown in Fig.2; measuring tubes and U-shaped tubes are all made of acrylic resin, and the metal parts are of alloy or brass, and they are correlated. The measuring range is from 25 ml to 100 ml, and the accuracy is  $\pm 0.1$  ml.
- 4) The sample cylinder can be commonly used for not only the actual volumeter but a soil pF measuring apparatus and a soil permeability measuring apparatus; it has an inner diameter of 50 mm, a height of 51 mm, and the inner capacity of 100 ml; it is made of metal and has the weight of about 80 g. For collecting the soil in nature, a soil sampler(optional parts) is used. (Refer to Fig.4)

• Operation

- 1) Turn the cock K to the left to open.
- 2) Open the cock K1 to adjust the liquid surface at the center of the measuring tube B, and close K1.
- 3) Open the cock K3 to adjust the liquid surface at the point of 60 ml in the measuring tube A, and close K3.
- 4) Open the cock K2 to adjust the liquid surface at the measuring point in the lower part of the U-shaped tube, and close K2.

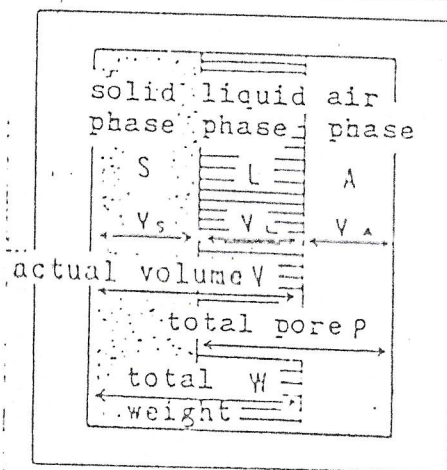


Fig. 1

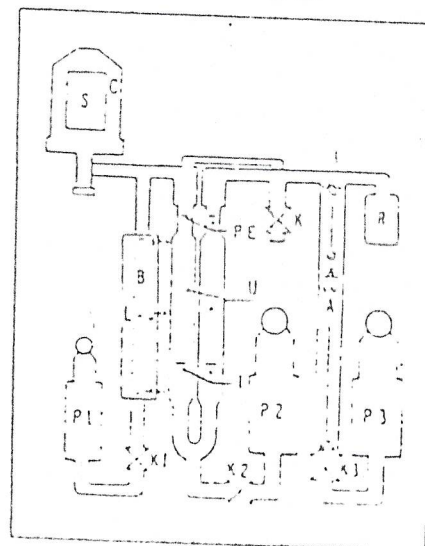


Fig. 2

66P

- 5) Remove the cover C of the sample chamber, put a basin, a net plate, a sample cylinder, and test pieces of 60 ml (10, 20, 30 ml) of the instrument into, and close the chamber tightly.
- 6) Turn the cock K to the right to close, open the cock K2 to raise the liquid surface in the U-shaped tube, and when the surface reaches the upper point E, close K2.
- 7) Adjustment of point O is completed when all of the liquid surfaces are at point E.
  - a) When the right liquid surface is higher, lower the liquid surface of the micro tube B.
  - b) When the left liquid surface is higher, raise the liquid surface of the micro tube B.

\* Note: This operation is performed by opening K2, lowering the liquid surface in the U-shaped tube to the lower observation point 1, and opening K.
- 8) After adjusting point O, adjust point O of the sliding scale L to the liquid surface of the micro tube B.
- 9) Open the cock K2, adjust the liquid surface of the U-shaped tube to the lower observation point 1, close K2, and open the cock K.
- 10) Take the test pieces and the sample cylinder out from the sample chamber and set the collected soil as removing the cover of the cylinder. At this time, confirm whether the rubber packing of the sample chamber is clean or not.
- 11) Open the cock K3, set the liquid surface of the measuring tube A at the predicted value, and close K3. Close the cock K, open the cock K2, and raise the liquid surface up to the upper point E in the U-shaped tube. When the difference of the liquid surface at the upper point is large, adjust the liquid surface of the measuring A and when it is small, adjust the liquid surface of the tube B.

\* Note: When lowering or raising the liquid surface of the measuring tube A or B, be sure to lower the liquid surface of the U-shaped tube, open K and then adjust.
- 12) When the liquid surface is fit at the upper point E in the U-shaped tube, the value is the actual volume of the soil in the sample chamber.

$$V = A + B \quad \text{or} \quad V = A - B$$

where; V: actual volume of soil sample

A: measuring tube A

B: measuring tube B

\* Note 1: Don't open the cock K, the sample chamber or cocks of K1 and K3 when keeping the liquid surface of the U-shaped tube raised (the whole system is under a compressed state).

\* Note 2: When measuring, avoid the direct sunshine as much as possible (for keeping the whole system at an equal temperature as much as possible).

• Soil Structure and Term

1) Total volume	$V_t$
2) Total weight	$W$
3) Actual volume	$V$
4) Weight of solid phase	$S = W - M$
5) Volume of solid phase	$V_s = (W - V)/(d - 1)$
6) Weight of soil water	$M = V_l$
7) Volume of soil water	$V_l = V - V_s$
8) Volume of soil air	$V_a = 100 - V$
9) Porosity	$P = 100 - V_s$
10) Solid ratio	$S_v = V_s$
11) Water ratio	$M_v = V_l$
12) Air ratio	$A = V_a$
13) Water saturation percentage	$H = M_v/P \times 100$
14) Air percentage	$U = 100 - H$

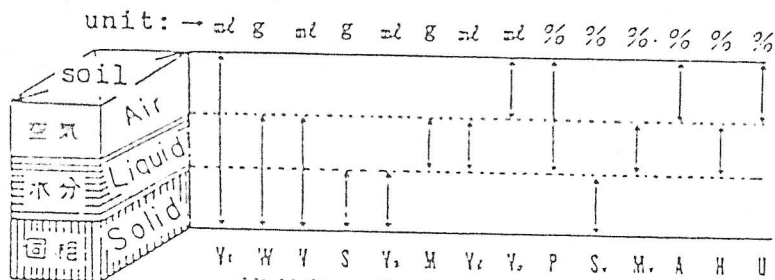


Fig. 3

15) Water content by wet soil	$M_m = M/W \times 100$
16) Water content by weight	$M_o = M/S \times 100$
17) Specific gravity	$d = S/V_s$
18) Apparent specific gravity or Bulk density	$d_o = S/100$
19) Actual specific gravity	$d_m = W/V$
20) Water-solid ratio	$L_s = V_l/V_s$

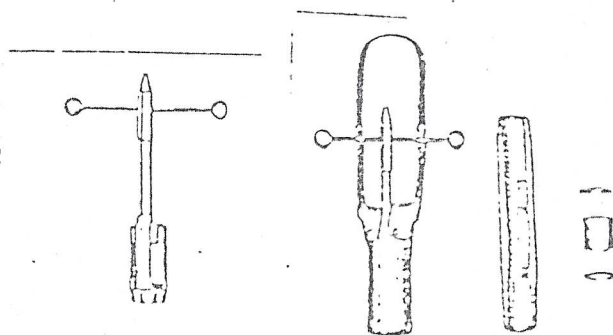


Fig. 4: Soil Sampler & Cylinders