

A-Soil-Core Sampling Machine for Examination of Root System

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This is a small-sized vibrohammer of about 300 kg in weight including an engine (Fig. 3. and Fig. 1). It is suitable for work in a small experimental lot because it can be carried turning closely at the corner, and crushes down little area of field under its small base. It is really strong in vibromotive force for its size for it is able to dig up a block of soil as large as 30 cm × 30 cm in area and 100 cm in depth. It is usually worked by two persons.

A block of soil as mentioned above can be dug up in 15-30 minutes after the start of driving, and the whole work including procedures before and after digging will sufficiently be finished in 50-60 minutes. This machine is distinguished in digging of deep layers of soil. And the soil obtained is in its natural condition.

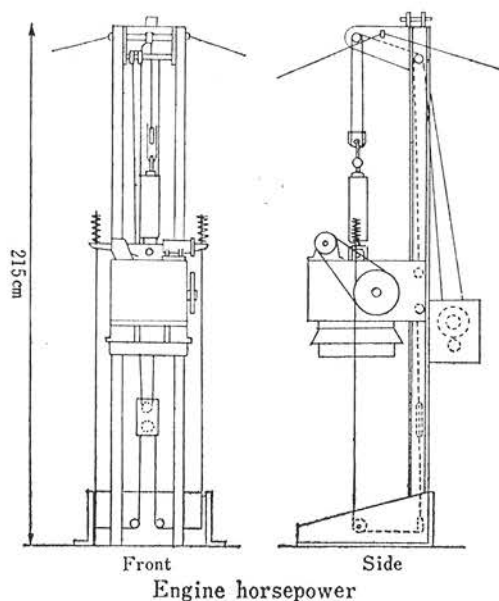


Fig. 1. Soil-core sampling machine

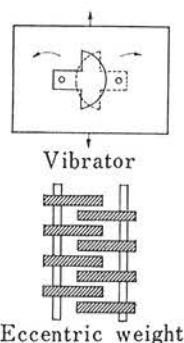


Fig. 2. Structure of vibrator

Main parts of the machine and the working procedures of it are as follows:

Main parts and their mechanisms

a) **Vibrator.** Four eccentric weights (Fig. 2) on each of the two parallel shafts which are contained in a box generate vibration by high speed symmetrical rotation. The vibration is counteracted with each other in the horizontal direction, and acts severely only in the vertical direction being doubled in its intensity. The vibrator is 80 kg in weight and 38 cm × 30 cm × 24 cm in size. The eccentric weight is eight in number and 750-1,000 in r.p.m. The eccentric moment is 92 kg-cm, and the vibromotive force 750-1,000 kg.

b) **Leader.** This is the support to hang the vibrator and sampling frame, and also controls the direction to drive the frame.

c) **Flange.** The flange is connected to the vibrator and weight the latter. It has a shape suitable to drive the sampling frame.

d) **Sampling frame.** There are several types of the frame to be chosen according to the purpose of experiment (Fig. 4.).

e) **Winch.** This is used for raising and

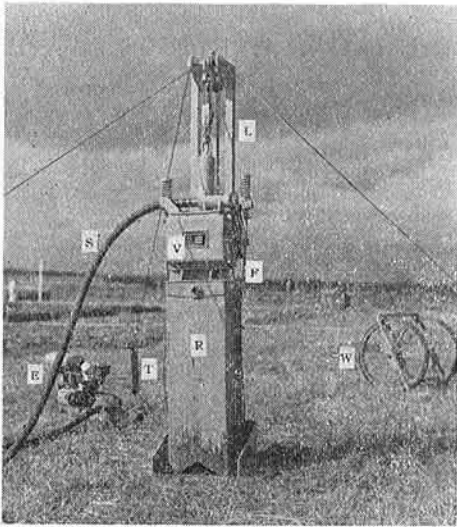


Fig. 3. Soil-core sampling machine

- V: Vibrator
- L: Leader
- F: Flange
- R: Sampling frame
- E: Engine
- S: Flexible shaft
- W: Wheel
- T: Stay

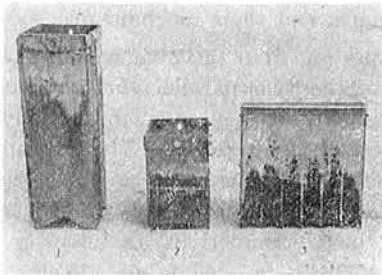


Fig. 4. Sampling frame

- 1 Sampling frame (30cm×30cm×100cm)
- 2 Ditto (30cm×30cm×30cm)
- 3 Ditto (60cm×5—10cm×45cm)

lowering of the vibrator and sampling frame. Frequency and amplitude of the vibration are also regulated by a weak downward tension exerted on the winch at the time of driving.

f) Engine. The engine has the capacity of 5.5 hp. It has a clutch.

g) Flexible shaft. This is the transmitter of rotation from the engine to the vibrator.

h) Stay and Wire. These stay the leader.

i) Wheel. This is used for carrying the

machine. The leader is easily attached to and detached from the wheel when the main of the machine is laid down on it.

Working procedures

An outline of the work and the time required for the work are as follows:

a) The machine is brought to the fixed place, and the leader is set up.

b) The wheel is detached.

c) The leader is fixed vertically with the wires from four stays. This work, however, can be omitted when the sampling frame is only 30 cm or so in depth.

d) The engine is connected with the vibrator by the flexible shaft.

e) The vibrator is raised by the winch, and a sampling frame is fitted in the lower part of it.

f) The engine is started, and then driving is begun by working the clutch.

g) When the driving is finished, the sampling frame is fixed to the vibrator with a pin.

h) The vibrator with the sampling frame is raised continuing a moderate vibration.

i) The sampling frame is detached from the vibrator by pulling out the pin. The soil is taken out from the frame by turning the latter upside down.

The work to get a block of soil is finished in this way. The work to get a block of soil is finished in this way. The work needs at least two workers, and the best number of workers is 3-4, as a few hands are required for handling of the soil obtained.

The time required for getting a block of soil is different according to the depth of driving and the water content of soil. The more the water content is, the quicker the progress of driving is.

The driving is not so much affected by the amount of gravel in the soil. It takes usually 50-60 minutes to finish the whole work to get a block of 30 cm×30 cm×90 cm in the field of our station.

The work includes procedures before and after the driving. In case a block to dig is 30 cm deep, driving can be finished in one minute or so, and the whole work will be completed in about 30 minutes. The work will efficiently proceed, when several sampling frames are

prepared for use.

Compression and crack of soil in the frame and fall of soil from the frame are matters of concern at the time of digging, and so some references will be made to the occurrence of them.

Compression and sinking are apt to occur when the soil contains much water. The smaller the diameter of the frame is, the more frequent the occurrence of compression is, causing a sinking of the surface soil. However, there occurs usually little sinking but occasional cases of it about 3 cm in depth, so far as our experience goes, in case a frame of 30 cm × 30 cm × 100 cm is driven to a depth of 90 cm.

The soil, especially the surface, is apt to crack, when it is dry. Crack also often occurs between the subsoil and the surface soil. The occurrence of crack can be reduced by previous sprinkling of water on the surface of soil.

There is a fear for the fall of soil from the sampling frame, when it is raised. The soil, however, does not fall unless vibration is too strong at that time, so far as we know. It is apt to occur, when the subsoil is light.

Small gravel, tile and something like these are not to be obstructions for driving a frame

because the frame breaks them in its way, or moves them aside. It, however, seems to be hard to drive a frame which is encountered with big roots, large gravel or concrete.

Any type of sampling frames, round, square or rectangular in the shape of its cross can equally be used in case its size is 100 cm in depth and 120-140 cm in circumference.

References

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