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i z Pracowni Gleboznawstwa Melioracyjnego IMUZ w Lublinie
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A New Apparatus for Testing Soil Permeability

Nowy model aparatu do badań przepuszczalności wodnej gleb

Новая модель аппарата для исследований водопроницаемости почв

The lack of a convenient and at the same time accurate apparatus for testing the hydrophysical properties of soil induced the author to construct a new contrivance for studying the water permeability of soil (Phots. 1—4, Figs. 1—4).

The set consists of the following parts (the numbers of the parts correspond to the numbers in the photographs and figures):

1. metal cylinder with an overflow to keep a constant level of water;
2. strengthening ring with wire mesh placed in the centre;
3. metal cylinder, 500 ml of capacity, containing the soil sample with its natural structure preserved;
4. metal funnel with wire mesh;
5. glass measure burette graduated from bottom to top, with a stopcock at the bottom and an overflow at the top limiting its capacity to 250, 500 or 1000 ml (Phot. 2).
6. a glass measuring cylinder, 2000 ml of capacity (lower container);
7. stand for 10 sets with a pipe leading water from the main (provided with screw clamps to regulate the water flow) and with an outlet for water coming from the overflows.

The apparatus is provided with a reducer. Parts 1, 2, and 3 can be exchanged to measure soil permeability in 250 ml samples.

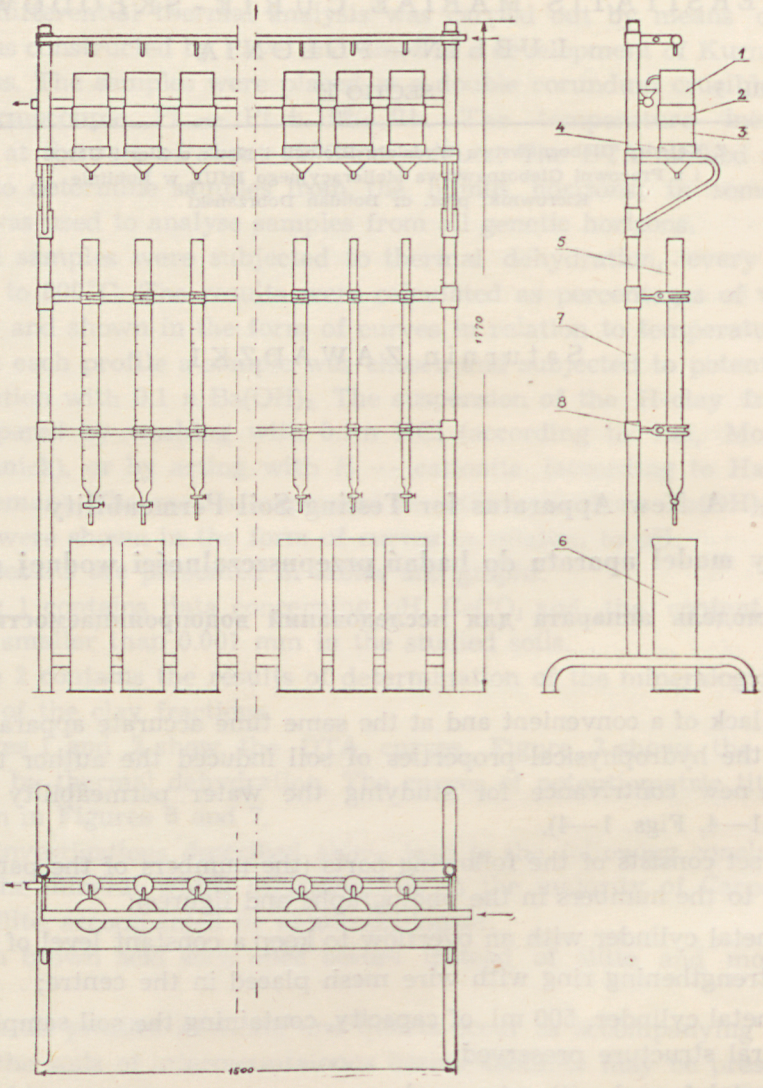


Fig. 1. Apparatus for testing soil permeability

THE USE OF THE APPARATUS

The soil sample, with its natural structure preserved, is placed in the metal cylinder of 250 or 500 ml capacity (during transportation the cylinder is covered with lids). The cylinder is placed so as to establish connection with the funnel at the bottom; at the top it is covered with the strengthening ring, on which the upper container is placed. If the samples are of 250 ml capacity, the reducer is introduced into the funnel. The set is tightened with rings of elastic rubber and placed on the stand.

According to the supposed intensity of water flow, the 250, 500, or 1000 ml burette is attached (Phot. 2); the stopcock should be open.

Then water is let into the upper container and its temperature is measured. When the water level in the upper container has reached the overflow, the stopcock of the burette is closed. At this moment the measurement begins.

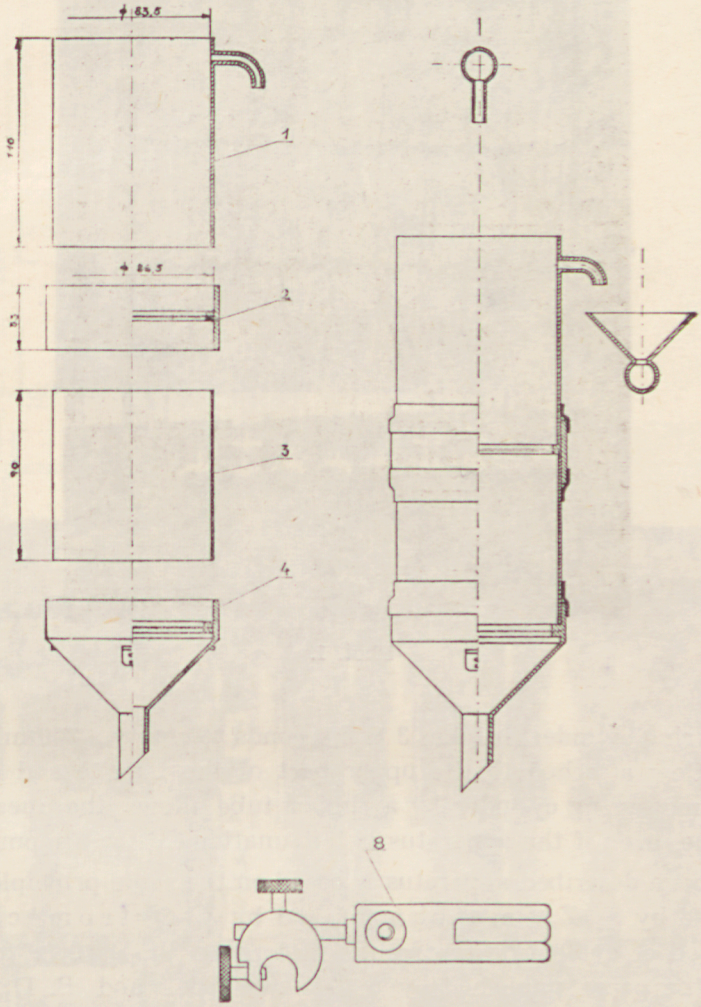
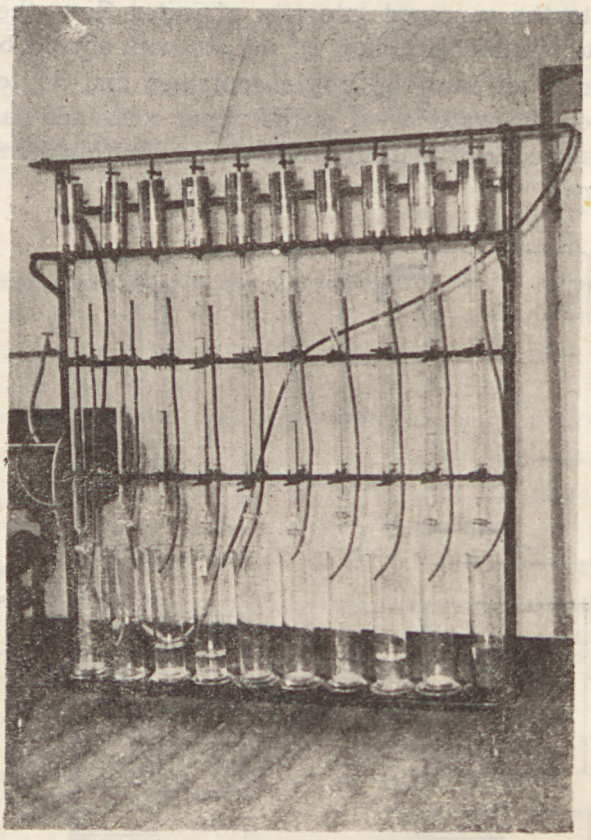


Fig. 2. Some parts of the apparatus.

The amounts of water percolating through the soil sample are measured in equal intervals by means of the graduated burette (the intervals are 5, 10, 15, or 30 minutes, according to the intensity of percolation). When the burette is full its stopcock is opened and the contents let into

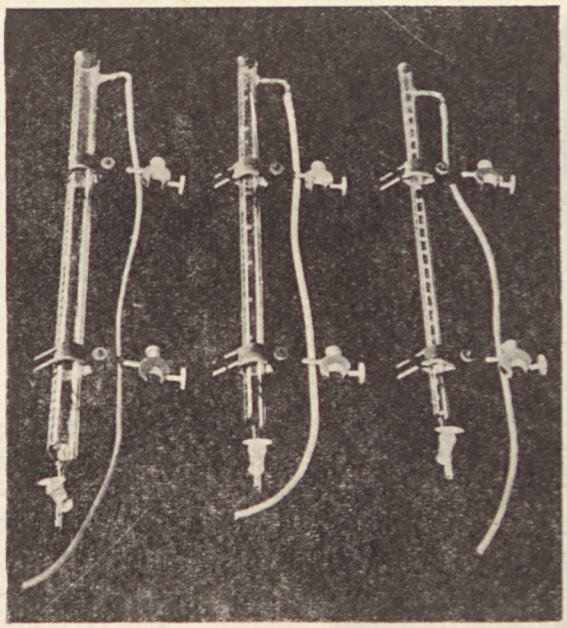


Phot. 1.

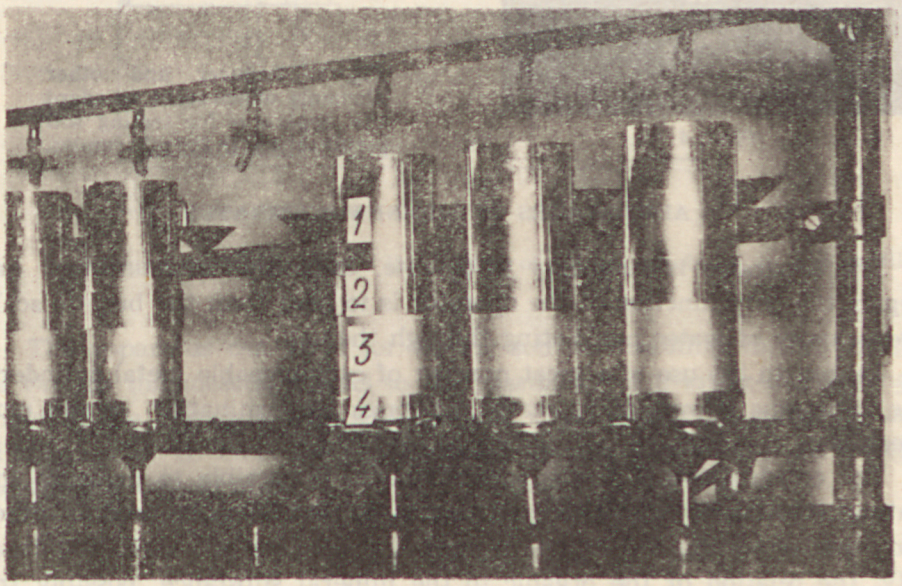
the measuring cylinder (it takes 3 to 5 seconds to empty a 250 ml burette). The overflow attached to the upper part of the burette and connected with the measuring cylinder by a rubber tube allows the measurement to continue, even if the apparatus is left unattended for a moment.

The above-described apparatus is based on the same principle as those constructed by S. Ziemnicki (5), and by J. Ostromęcki (1, 2). The method of evaluating the results, according to Darcy's formula, is given in the paper published by S. Ziemnicki and B. Dobrzański (5): *)

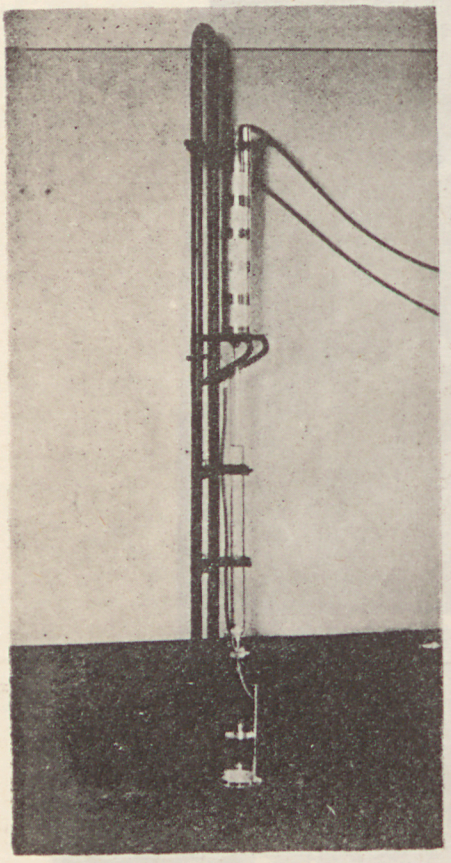
*) $Q = k\,i\,F$
Q — the flow of water in units of time
k — the coefficient of permeability
i — pressure decrease
F — diagram



Phot. 2.



Phot. 3.



Phot. 4

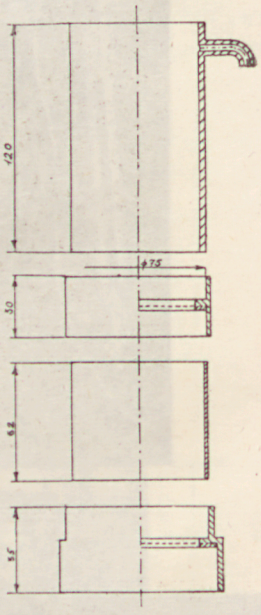


Fig. 3. Reducer and other elements which serve to adapt the apparatus for testing soil permeability in 250 ml samples.

ADVANTAGES OF THE NEW APPARATUS

The apparatus is very easy to operate. Once the measurement has begun, the only function of the operator is to read from the burette scale the volumes of water percolating through the soil.

Thanks to the use of a great number of exchangeable metal cylinders, the apparatus allows us to carry out mass determination of soil permeability.

The construction of the apparatus makes it possible to preserve the natural structure of the tested soil sample, so that it can be used for other purposes, as testing the volume weight, the swelling and shrinking capacity, the relation of the organic to the mineral substance, possibly the content of roots in the given volume, etc. This permits an increase in the possibilities of carrying out measurements, the number of repetitions remaining unchanged (not less than 3).

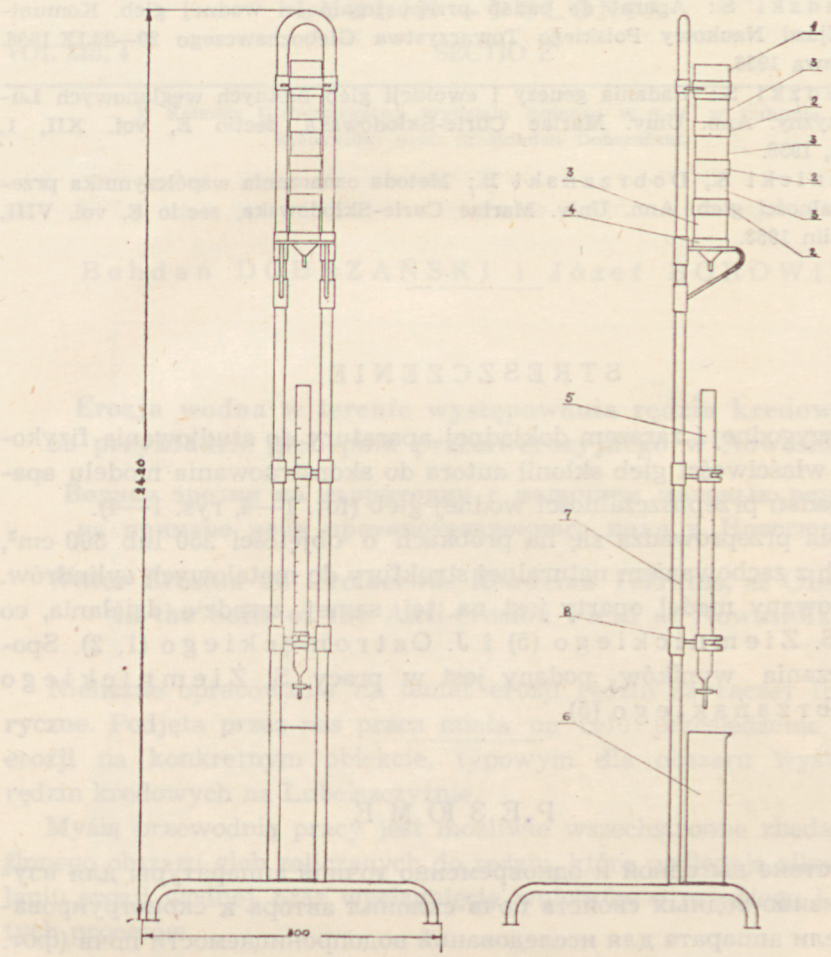


Fig. 4. A tower set which allows the testing of soil permeability in soil profiles

The apparatus can serve for testing soil permeability in soil profiles of various thicknesses, thanks to the possibility of a tower-like arrangement of the cylinders with soil samples when a special stand is used (Phot. 4, Fig. 4). Thus the conditions of the experiment can be brought nearer the natural ones.

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STRESZCZENIE

Brak wygodnej i zarazem dokładnej aparatury do studiowania fizyko-wodnych właściwości gleb skłonił autora do skonstruowania modelu aparatu do badań przepuszczalności wodnej gleb (fot. 1—4, rys. 1—4).

Badania przeprowadza się na próbkach o objętości 250 lub 500 cm^3, pobranych z zachowaniem naturalnej struktury do metalowych cylindrów.

Opracowany model oparty jest na tej samej zasadzie działania, co aparaty S. Ziemnickiego (5) i J. Ostromęckiego (1, 2). Sposób obliczania wyników podany jest w pracy S. Ziemnickiego i B. Dobrzańskiego (5).

РЕЗЮМЕ

Отсутствие выгодной и одновременно точной аппаратуры для изучения физико-водных свойств почв склонил автора к сконструированию модели аппарата для исследований водопроницаемости почв (фот. 1—4, рис. 1—4).

Исследования производятся на образцах по объему 250 либо 500 $см^3$, взятых при сохранении естественной структуры в металлические цилиндры.

Разработанная модель опирается на ту же самую основу действия, что и аппараты С. Земницкого (5) и Ю. Остроменцкого (1 и 2). Способ исчисления итогов представлен в работе С. Земницкого и Б. Добржанского (5).

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