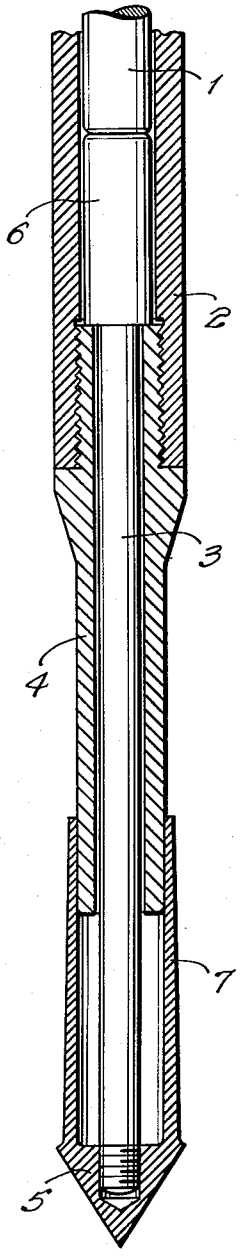
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APPARATUS FOR DETERMINING THE BEARING CAPACITY OF SOIL AT VARIOUS DEPTHS

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APPARATUS FOR DETERMINING THE BEARING CAPACITY OF SOIL AT VARIOUS DEPTHS

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My invention relates to an apparatus for determining the carrying capacity and the resistance of soil layers at different depths. The data obtained are of utmost importance for all kinds of groundworks, more particularly for foundations and especially so for foundations on piles, allowing the determination of the depth to which the piles must be driven into the soil and the load which each pile can safely carry.

The apparatus used hitherto for this purpose consists mainly of a pressure body shaped generally as a reversed cone fixed to a rod by which said pressure body can be forced into the soil either manually or mechanically, the force necessary to press the pressure body deeper and deeper into the soil being registered by a suitable dynamometer.

It is obvious that in this way it is impossible to determine exactly the resistance of the soil acting upon the pressure body since the soil being in contact with the rod and adhering to it causes a certain resistance due to friction which is measured together with the resistance of the soil acting upon the pressure body. In order to eliminate this unwanted frictional resistance when determining the force acting on the pressure body the rod is located in a tube which engages with its lower end the upper face of the pressure body. By exerting a vertical force on said tube, it is forced into the ground to a desired depth pushing before it the pressure body which is in contact with the lower end of the tube. When the pressure body has reached the soil layer the resistance of which has to be determined, the force acting on the tube in downward direction is removed and by applying a force to the upper end of the rod located in the tube and carrying at its lower end the pressure body, a downward movement is imparted to said pressure body forcing it deeper into the soil over a short distance, the tube surrounding the rod forming a lining of the hole in the ground, in which lining the rod is moved in downward direction without any objectionable friction. The lower end of the tube is provided with a stuffing box.

In case resistance data of soil layers at different depths are wanted, it is necessary, after a first measurement has been carried out, to proceed to a greater depth. Therefore the tube has to be driven further into the soil whereby it comes again into contact with the top surface of the pressure body and is then pushed in downward direction until the desired depth is reached, after which a new determination of the ground resistance can be carried out.

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Such an apparatus is described in Dutch Patent 43,095. In order to prevent the soil from penetrating into the tube by its lower end a stuffing box in said end is provided. However, in operation such a stuffing box is insufficient to achieve a soil-tight sealing of the tube because, when a measurement is carried out, the pressure body is pressed deeper into the soil while the tube remains in its place, so that a certain space is formed between the top surface of the pressure body and the lower end of the tube, which can be easily filled with ground, which has originally been pressed in outward direction in the course of the downward movement of the pressure body. If, in order to proceed with a measurement of the resistance of a deeper layer, the cone is driven further into the soil by means of a tube as set out above, the soil between the top surface of the cone and the bottom end of the tube is strongly compressed and the stuffing box is not able to prevent soil particles from penetrating the lower end of the tube and partially filling the space between the tube and the rod to the lower end of which the pressure body is attached. These soil particles cause heavy friction when in the following determination of the soil resistance the pressure body is pressed further into the soil by means of the rod sliding in the tube, so that it is impossible to obtain a measurement with a desirable degree of accuracy. Moreover, these ground particles cause heavy wear of the lower part of the rod, whereby the clearance between the stuffing box and the rod is increased which of course facilitates the penetration of ground particles into the lower end of the tube.

The object of the present invention is to avoid the disadvantages set forth hereabove. It comprises a pressure body, a tubular member having a lower end engaging said pressure body for driving said body to a desired depth into the soil, means located in said tubular member and slidably associated therewith, operable to impart to said body a limited axial displacement relative to said member, a cylindrical extention of said pressure body surrounding and being slidably associated with the end part of said member, the length of said extension being larger than the displacement of said body relative to said member so that a soil tight connection between the pressure body and the tube is achieved in all positions of the pressure body with respect to the tube. Provision is made to limit the maximum value of the movement which can be imparted to the pressure body relative to the tube.

Another advantage achieved by the invention is

a firm guidance of the pressure body transmitting any lateral forces, which act upon said body if the soil is of an inhomogeneous composition, to the tube thereby relieving the rod from bending forces and preventing deformations of said rod.

In a preferred embodiment of the invention the outer diameter of the cylindrical extension is slightly less than the greatest diameter of the pressure body, whereby it is achieved that the ground cannot come into contact with said extension and no frictional resistance is caused which could otherwise falsify the measurements.

For a complete understanding of the invention reference is made to the accompanying drawing in which an embodiment of the invention is shown in vertical section, showing the respective positions of the parts at the end of the stroke of the pressure body.

Referring now to the drawing, the pressure body **5**, shaped as a reversed cone, is forced into the soil by a tube **2** until the soil layer is reached whose resistance has to be determined. A rod **1** is provided for applying a vertical force in order to drive the pressure body **5** further into the soil, the value of this force being representative for the resistance of the soil layer. The tube **2** could engage directly the top surface of the pressure body **5**, but it is preferred to give the tube a tubular end piece **4** of reduced inner and outer diameter by which the tube **2** can engage the pressure body **5**. Preferably the pressure body **5** is not directly connected to the rod **1** but to a rod **3** slidable in the end piece **4** and provided at its upper end with an enlarged portion **6** slidable in the tube **2** and having a greater diameter than the bore of the end piece **4**. By doing so it is achieved that the stroke of the pressure body, which is imparted to it by the force applied in downward direction to the rod **1**, has a limited value. The pressure body **5** is provided with a cylindrical extension **7** enclosing and slidable over the end piece **4** guiding thereby the pressure body in its downward movement and providing a soil tight connection between the pressure body and the end piece. As set forth hereabove the extension **7** extends in upward direction over a length sufficient to ensure a soil tight connection with the end piece **4** in the extreme position of the pressure body **5** as shown in the drawing.

I claim:

1. An apparatus for determining the carrying capacity of soil layers, comprising in combination, a pressure body; a tubular member having a lower end engageable with said pressure body for driving said body to a desired depth into the soil; means located in said tubular member and slidably associated therewith, operable to impart to said body a limited axial displacement relative to said member; and a cylindrical extension on said pressure body surrounding and being slidably associated with the lower part of said member, the length of said extension being larger than the displacement of said body relative to said member.

2. An apparatus for determining the carrying capacity of soil layers, comprising in combination, a pressure body shaped as a reversed cone; a tubular member having a lower end engageable with said pressure body for driving said body to a desired depth into the soil; means located in said tubular member and slidably associated therewith, operable to impart to said body a limited axial displacement relative to said member; and a cylindrical extension on said pressure body surrounding and slidably associated with the lower part of said member, the length of said extension being larger than the displacement of said body relative to said member, and the external diameter of said extension being smaller than the greatest diameter of said cone.

3. An apparatus for determining the carrying capacity of soil layers, comprising in combination, a pressure body shaped as a reversed cone; a tubular member having a lower end engageable with said pressure body, said tubular member having a first bore in its lower part, adjacent to said body, and a second bore of larger diameter in its upper part; a first rod located in the lower part of said member and slidably associated therewith, the lower end of said rod being secured to said pressure body; an enlarged portion forming the upper end of said first rod and having a diameter smaller than the diameter of said bore of said upper part, and larger than that of said bore in the lower part of said tubular member; a second rod slidable in the upper part of said tubular member and engaging said enlarged portion to impart to said pressure body a displacement relative to said tubular member; and a cylindrical extension on said pressure body surrounding and slidably associated with the lower part of said tubular member, the length of said extension being greater than the difference between the length of said first rod connecting said pressure body with said enlarged portion and the length of said lower end of said tubular member, the external diameter of said extension being smaller than the greatest diameter of said pressure body.

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