Nov. 6, 1962 G. H. SÖKJER-PETERSEN ETAL 3,062,045

AUGERS FOR SOIL SURVEY AND A PROCESS OF USING SAID AUGERS

Filed June 8, 1959 2 Sheets-Sheet 1

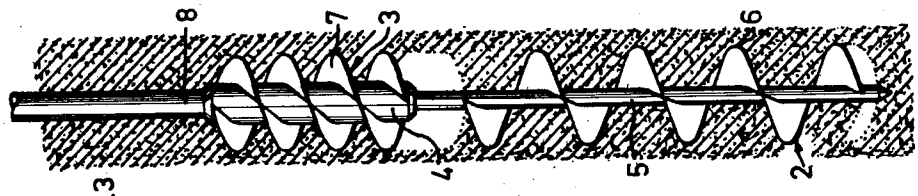


FIG.3

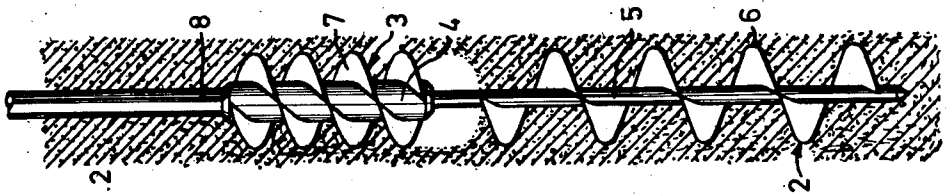


FIG.2

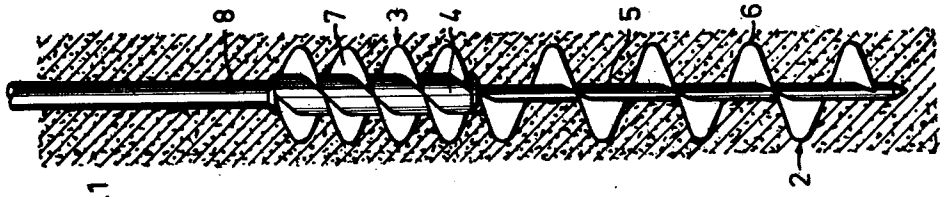


FIG.1

G.H. SÖKJER-PETERSEN,
J.E. JOHANSSON, AND
KARL-ERIK NYMAN
INVENTORS

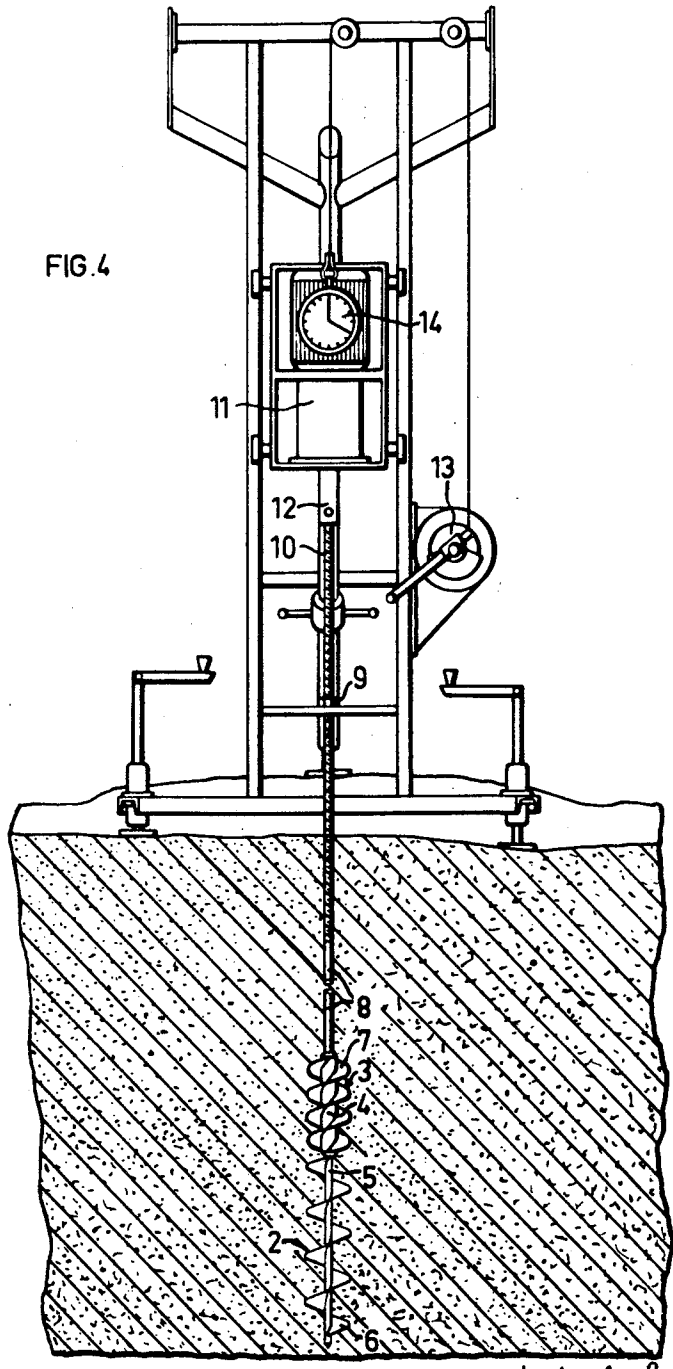
BY Wenderoth, Lind & Ponack
ATTORNEYS

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FIG. 4



G.H. SÖKJER-PETERSEN,
J. E. JOHANSSON,
AND
KARL-ERIK NYMAN
INVENTORS

BY Wenderoth, Lind & Ponack
ATTORNEYS

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AUGERS FOR SOIL SURVEY AND A PROCESS OF USING SAID AUGERS

Gunnar Hannibal Sökjer-Petersen, Hagagatan 34A, Orebro, Sweden; Jan Erik Johansson, Klovervagen 13, Lund, Sweden; and Karl-Erik Nyman, Osbyholm, Sweden

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This invention relates to an auger for soil survey and a process of using said auger.

One object of the invention is to simplify the soil surveying work by providing a new implement which makes it possible in a single boring operation both to obtain a reliable value of the shear strength and to take strata samples suitable for laboratory testing as well as to determine the character of the friction or cohesion materials of the strata through which the auger is driven.

The invention thus primarily relates to an auger for soil survey comprising an auger rod, an auger bit mounted on said auger rod to be driven into the soil with the aid of said rod, the auger bit including two screws, a lower and an upper, which are coaxially and non-rotatably connected together but have freedom of a limited relative axial movement, the upper screw being fixedly connected to the auger rod and the lower screw having a relatively high and thin thread to guarantee, when screwed into the soil, the least possible disturbance thereof.

Secondly, the invention relates to a process of making a soil survey with the use of an auger of the above-mentioned type. This process comprises driving the auger to the desired depth with the two screws close together axially, withdrawing the auger without rotation, measuring the required withdrawing force on one hand while only the upper screw is raised to the limit of the relative axial movability of the two screws and on the other hand while after that the lower screw also is raised, thereby detaching a soil cylinder filling out the screw thread interstices, and calculating the shear strength of the soil from the difference between the force values measured during the two stages of withdrawal.

If the auger is withdrawn completely, without rotation, an excellent sample is obtained, which consists of the soil cylinder detached and raised by the lower screw. Several samples can of course be taken from different depths in that the boring is continued in the same bore hole after each sampling.

Whether the penetrated strata have the character of friction or cohesion materials can be determined by listening to the sounds transmitted by the auger rod during boring.

The invention is illustrated by way of example on the accompanying drawing, in which:

FIGS. 1, 2 and 3 are side elevations of an auger bit, designed in accordance with the invention, in different boring stages;

FIG. 4 is a view on a smaller scale of the auger together with a machine for driving the auger into the soil and withdrawing it therefrom.

FIGS. 1–3 show how the auger bit is composed of a lower screw 2 and an upper screw 3. The core 4 of the upper screw 3 has a bore in its lower end portion and thus forms a guide sleeve, while the lower screw 2 has a core 5 of smaller dimension, the upper portion of which is guided in the sleeve 4 for instance by means of splines in the sleeve and on the core 5, these parts also having cooperating stops (not shown) so that the screws permit axial movement relative to each other over but a short distance, e.g. 4 cm.

As will appear from the drawing, the lower screw 2 has a small core diameter in relation to its outer diameter and besides its thread 6 is very thin: it may consist for example of a sheet metal strip welded to the core. The purpose of this dimensioning of course is that the lower screw shell disturb the material through which it is driven as little as possible. The upper screw 3, here shown as being two-threaded, can be constructed in a similar way, i.e. with two sheet metal strips 7 as threads.

The upper screw 3 is secured to an auger rod 8 which in a known manner can be prolonged by the required number of 1 m. long auger extensions.

The auger driving machine shown in FIG. 4 is provided with a driving assembly 11 comprising a motor, preferably a silent-running electric motor, and the necessary transmissions. The assembly has a downwardly directed output shaft with a coupling sleeve 12 for engaging the upper end of the auger rod, and the entire driving assembly is vertically movable, guided on the frame of the auger machine, to load the auger by its weight. The assembly 11 is connected by a cable to a winch 13 which permits regulation of the load on the auger and raising the assembly to withdraw the auger. Connected between the cable and the assembly 11 is a dynamometer 14 so that the vertical force on the auger is always readable. Preferably, the dynamometer is equipped with a peak indicator so that the peak of the withdrawing force can be determined with complete safety, or with a device continuously recording the withdrawing force.

In the embodiment shown the auger driving machine has a fixed nut 9 and a threaded auger extension 10 which is screwed down through the nut 9 and connected to the output shaft of the driving assembly 11 in order to form, during the entire boring operation, the uppermost portion of the extended auger rod. The nut 9 and the extension 10 have the same pitch as the screw 2 and thus cause it to penetrate precisely by one pitch per revolution, thus eliminating any tendency of the screw to tear loose and disturb the surrounding soil. The nut 9 is of such a design as to permit opening or removing it from the frame for withdrawal of the auger rod from the bore hole in an unhampered manner and without rotation.

FIGS. 1–3 show different stages of such a soil survey for which the auger has been specifically developed. It is assumed in FIG. 1 that the auger is driven to a level where the shear strength is to be determined, while the screws 2 and 3 are in a moved-together position. For this purpose the upper screw 3 may have a slightly higher pitch than the lower one 2. In FIG. 2 the auger rod with the upper screw 3 has been withdrawn the short distance, e.g. 4 cm., possible without raising of the lower screw 2 which thus remains in position in the soil. During this first withdrawing stage the operator observes the withdrawing force which is practically constant after the upper screw 3 has detached the soil cylinder in which it is embedded. The withdrawal is continued and the required force continually observed, the lower screw 2 shearing loose the soil cylinder surrounding it, and a comparison of the values of the withdrawing force observed gives an indication of the shear strength of the soil around the lower part of the auger bit, all sources of error being practically eliminated.

Should a sample be desired for laboratory testing, the auger is withdrawn completely without rotation, and the soil cylinder carried along by the lower screw 2 gives an excellent testing material. In any case, the boring can be continued in the same bore hole, the shear strength determined and samples taken at all desired depths.

With suitable dimensions and after calibration the described auger can also be used for what is usually termed

"probing," it being possible to determine the shear strength by measuring torques instead of withdrawing forces and thus to simplify the procedure to the detriment of the exactitude which may, however, be expected to become better than with the use of an ordinary probe. The two-processes of using the auger may be employed alternately at one and the same boring, exact determinations being made at given depths and more approximate ones at other depths. Consequently, the auger may rightfully be termined a universal tool for soil survey.

What we claim and desire to secure by Letters Patent is:

1. An auger for soil survey comprising an auger rod, an auger bit mounted on said auged rod to be driven into the soil with the aid of said rod, said auger bit including two screws, a lower and an upper, which are coaxially and non-rotatably connected together, said screws being movable relative to each other axially of said auger, and means acting on at least one of said screws limiting the movement of said screws away from each other, the upper screw being fixedly connected to the auger rod and the lower screw having a relatively high and thin thread to guarantee, when screwed into the soil, the least possible disturbance thereof.

2. An auger as claimed in claim 1 wherein the upper portion o fthe auger rod has a thread of the same pitch as the lower screw in order to be driven during boring through a fixed nut, thus causing said screw to penetrate the soil corresponding to its pitch.

3. A process of making soil surveys with the use of an auger comprising an auger rod, an auger bit mounted on said auger rod to be driven into the soil with the aid of said rod, said auger bit including two screws, a lower and an upper, which are coaxially and non-rotatably connected together and are movable axially relative to each other for only a limted distance, the upper screw being

fixedly connected to the auger rod and the lower screw having a relatively high and thin thread to guarantee, when screwed into the soil, the least possible disturbance thereof, said process comprising rotatably driving the auger to the desired depth with the two screws close together axially, withdrawing said auger while holding it against rotation only sufficiently far to move the two screws apart to the limit of their relative movement, measuring the required withdrawing force while only the upper screw is raised to the limit of the relative axial movability of the two screws, and then withdrawing the auger further while holding it against rotation, thereby detaching a soil cylinder filling out the screw thread interstices, and measuring the required drawing force, whereby the shear strength of the soil can be calculated from the difference between the force values measured during the two stages of withdrawal.

4. An auger bit adapted to be attached to an auger rod to be driven into the soil for soil survey, said auger bit comprising an upper screw and a lower screw having their axes aligned and being non-rotatably attached to each other and movable relative to each other in the direction of the aligned axes, means on at least one of said screws for limiting movement of said screws away from each other, the upper screw being adapted to be fixedly secured with its upper end to the auger rod, the lower screw having a relatively high and thin thread to guarantee, when screwed into the soil, the least possible disturbance thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

137,744	West	Apr. 8, 1873
147,857	Morgan	Feb. 24, 1874
2,875,615	Ulvin	Mar. 3, 1959