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PROCESS FOR THE IMPROVEMENT OF FOUNDATION
SOIL WITH REGARD TO NATURAL SOIL AND
ARTIFICIAL FILLINGS (BOTTOMINGS)
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2,929,219

FIG. 1

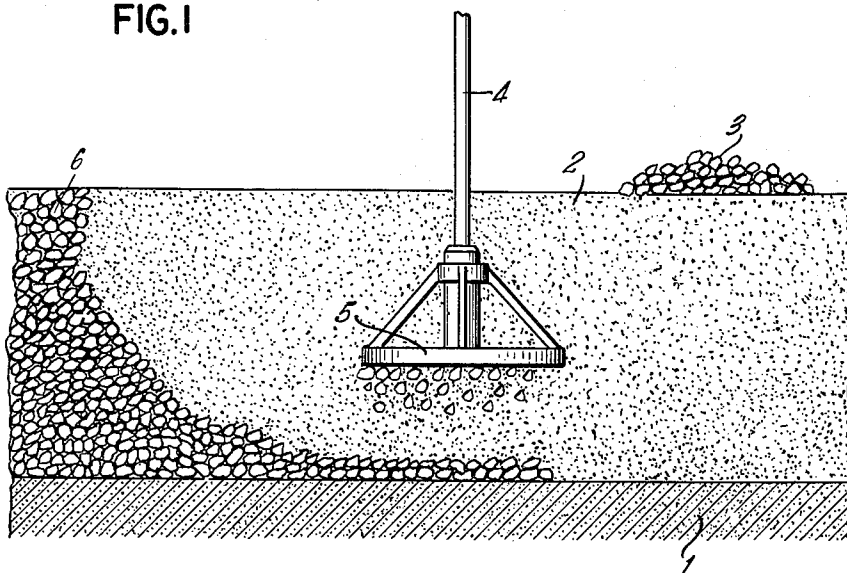
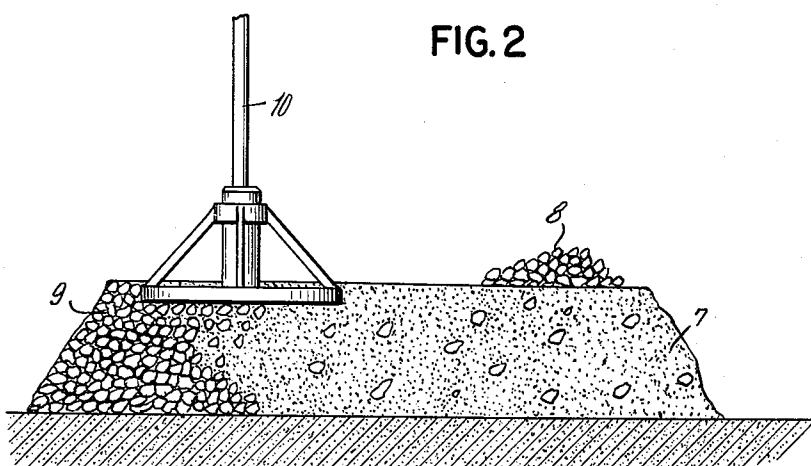


FIG. 2



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PROCESS FOR THE IMPROVEMENT OF FOUNDATION SOIL WITH REGARD TO NATURAL SOIL AND ARTIFICIAL FILLINGS (BOTTOMINGS)

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3 Claims. (Cl. 61-36)

The invention refers to a process for improving foundation soil for construction purposes.

One of the oldest and best-known methods of dealing with non-stable foundation soil, e.g. clay, lime, mud or muck, is to excavate and remove this nonstable soil, and replace it with a good supporting foundation, such as sand or gravel, if necessary by making use of a good binding material or poured concrete.

There are, however, many cases where such methods prove impractical, especially when dealing with a foundation pit that must be pumped free of water from time to time and requires expensive supporting.

Another method consists of removing such soft layers of soil by blasting so that the top layers of boulders and gravel are caused to sink (moorland blasting). In blasting, the firm top soil is blasted upwardly and caused to fall back with force upon the softer soil beneath, thus forcing it laterally out. Blasting carried out in this manner may cost only less than half of the total cost of complete excavation but no absolute assurance can be given that the soft non-stable soil will be effectively removed.

In simple cases, soft foundation soils can be improved by forcing in stones and gravel. To prevent the soil escaping from the side of the area being worked, it is necessary to fence it in with planking and piles. The effect of this method is very limited and does not extend to any great depth.

Compared to these aforementioned methods, the process of the present invention improves the foundation soil without actually removing the non-stable layer. A load of particulate stable fill material, such as stones, is deposited on the top-soil and is forcefully shaken down through the non-stable soil to the firm sub-soil beneath, thus forcing up the soft soil between the interstices of the stones until a firm carrying foundation of stones packed close together is formed within the soft layer.

By shaking such a filling of stones into the soft soil, the stones form a stable base together with the soft soil which fills out the interstices between the stones. The process has practical importance especially for the technique of foundation construction, for example, to improve natural soft soils where, on the one hand, it is too expensive to remove this layer but where, on the other hand, stone or gravel is available at an advantageous price. It is also suitable for making non-stable embankments stable.

By using this process it is possible to construct dikes, railway and road embankments from generally unsuitably non-stable soil which will thus be prevented from settling.

This formation of a stable stone base makes it possible to construct embankments at a much steeper gradient with very little danger of sliding occurring. The lateral embankment surfaces may be blocked in to prevent the soil from being forced out at the sides.

In carrying out this process the stone rubble or gravel can either be added in individual loads and shaken into the soil until the required depth has been reached or the

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entire estimated quantity of fill material can be calculated and placed on top of the soft soil in a single load.

The most suitable equipment for this process are shaking implements which more or less grip the particulate fill material, for example perforated plates, grid type shaking implements and similar implements which permit the soft liquified soil to be forced upwardly between the stone material and to reach the surface. By fencing in the working surface with planks and piles, any lateral escape of soil can be prevented during the process of filling in the stone material.

The accompanying drawing illustrates in

Fig. 1, the process of improving foundation soil with natural soil layers, and in

Fig. 2, filling a soft-soil embankment with stones.

Referring now to Fig. 1, there is shown a stable layer of sub-soil 1 with a superposed layer 2 of relatively loosely packed, soft soil, for instance muck. In the two-step method of the present invention, a load of stones or gravel 3 is placed upon the soft soil layer and is then forcefully shaken into the soft soil by means of a vibrating implement 4 which has secured thereto a grid 5. The vibrating grid forces the particulate fill material downwardly into the soft soil, displacing the soft soil upwardly and sidewardly through the interstices of the fill material to form a stable stone or gravel base 6 whose interstices are filled with soft soil. As shown at the extreme left of Fig. 1, this procedure is continued until the stable foundation has reached the desired depth and the soft layer 2 has been transformed into a load supporting, compact foundation 6.

In Fig. 2, a stable sub-soil is shown to support an embankment 7 of soft soil which contains a loose sprinkling of stones or gravel whose proportion is insufficient to make the embankment load supporting or stable. Similarly to the method described in connection with Fig. 1, stones or gravel 8 is placed upon the embankment and forcefully shaken thereto by vibrating implement 10. The grid of the shaker 10 prevents the particulate fill material 8 from escaping laterally as it is forced down into the soft soil. The procedure is continued until the entire embankment consists of a stable foundation, such as shown at 9 in Fig. 2.

What I claim is:

1. In the method of improving the stability of soft soil foundations by adding particulate stable fill material thereto, the steps of placing the stable fill material upon the soft soil foundation and forcefully shaking the fill material into the soft soil down to the stable sub-soil to force the soft soil upwardly and sidewardly through the interstices of the fill material.

2. In the method of forming muck into a stable foundation by adding particulate stable fill material thereto, the steps of placing the stable fill material upon the muck and forcefully shaking the fill material into the muck down to the stable sub-soil to force the muck upwardly and sidewardly through the interstices of the fill material.

3. In the method of forming muck into a stable foundation by adding stone rubble upon the muck and forcefully shaking the stone rubble into the muck down to the stable sub-soil to force the muck upwardly and sidewardly through the interstices of the stone rubble.

References Cited in the file of this patent**UNITED STATES PATENTS**

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OTHER REFERENCES

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