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PROCESS AND MEANS FOR LOWERING A CONSTRUCTION WITH A COMPARATIVELY LARGE BASE INTO THE SOIL

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Fig: 1.

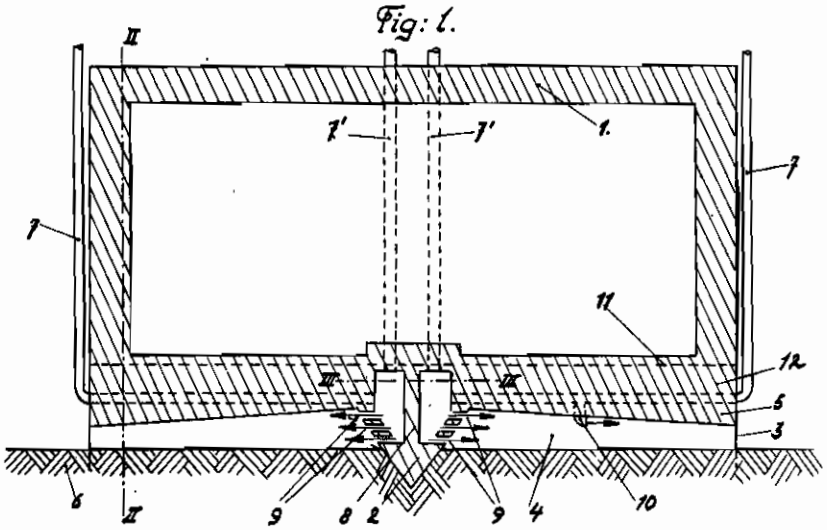


Fig: 2.

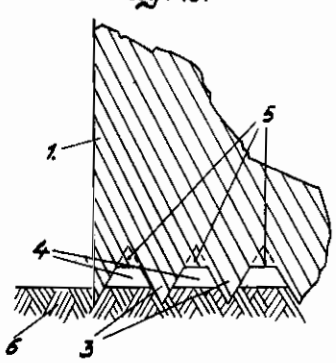
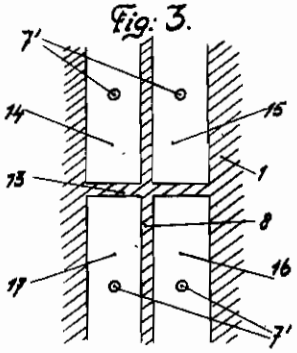


Fig: 3.



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ALIEN PROPERTY CUSTODIAN

PROCESS AND MEANS FOR LOWERING A CONSTRUCTION WITH A COMPARATIVELY LARGE BASE INTO THE SOIL

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The invention relates to the lowering into soil up to the required depth of foundational constructions that have been previously constructed in their entirety or in part—as for example the section of a tunnel, a quay foundation, or any foundational construction in general with a comparatively large basic surface—by means of washing away the supporting soil.

The lowering of piles and sheet pilings according to the jetting method whereby by means of a supporting jet the resistance of the soil is so diminished that the pile or sheet can be introduced into the soil through its own weight or by loading, for example with the help of a drop hammer—is well known and in general use.

The invention, however, relates to the lowering of a foundational construction with a comparatively large basic surface into the soil up to the required depth, and is particularly effective when an even distribution of pressure over the underlying soil is of major importance.

The soil may be excavated, for example to within 1 M of the required depth and is as far as possible flattened. Then the foundational construction is placed and lowered into position, or is wholly or partly constructed on the spot. Thereafter a liquid is led under the construction in supply pipes that have been previously provided. If this is properly done, the sand will be washed away allowing the construction to sink.

Such a method, however, required special procisions. Since irregularities in the previously flattened soil cannot always be avoided, especially when the flattening has to be done under water, and moreover since soil is not, as a rule, homogeneous, an unequally distributed pressure is usually inevitable, causing very great extra strain to the foundation, as for instance in the case of a very long tunnel section. Besides, if the liquid were then to be supplied, there would be the difficulty that the water would flow along quite irregular paths of the least resistance which cannot be ascertained beforehand, so that the soil would not be washed away evenly over the whole surface. Consequently, the right position and an even pressure for the construction on the soil would not be obtained.

Therefore, according to the invention ribs, preferably with a triangular cross section, are fixed to the base of the construction. When a foundational construction provided with such ribs is lowered on to soil that has been previously flattened or dredged, these ribs penetrate the soil to a certain depth. Hereby the immediate advantage is gained, namely that the pressure of the construction is much more evenly distributed over the underlying soil surface; eventual irregularities in the soil now exercise far less influence on the distribution of pressure, so that there is less likelihood of extra strain in the construction.

When the ribs do not completely penetrate into the soil,—which is entirely a matter of adjusting the form and the distances between each rib to the weight of the construction and the substance of the soil,—channels are formed by the ribs and the surface of the soil. If liquid is now led under the foundation it will find an outlet in these channels. When the velocity of the liquid is sufficiently high, soil will be carried away by it. Such displacement of the topmost layer of soil between the penetrating ribs causes an increase in the pressure per surface unit of soil; equilibrium is consequently disturbed, and the construction sinks until a new equilibrium has been obtained. This process generally takes place continuously, and is carried on until the required depth has been reached.

Since, the ribs, and consequently also the channels limited by them are regularly distributed over the whole of the base of the construction, and since the liquid generally flows through all the channels simultaneously, uniform penetration and almost the same soil pressure is obtained all over.

Moreover, to ensure that pressure is evenly distributed along the whole length of a rib, the removal of soil from the channel itself can be effected regularly. The further one gets from the beginning of the channel, the greater will be the velocity of the liquid required to transport the soil. This determines the width of the channels which can be ascertained by experiment. The necessary decrease in their widths may be obtained by filling them up at the top, increasing towards the direction in which the liquid flows. The velocity of the liquid therefore increases towards the ends.

It is also advisable to take steps to ensure that the stream of the liquid is properly directed into the channels, and that it is as free as possible from strong or mutually very different eddies, e. g. in each channel a number of stream directors may be placed parallel to the length of the channel.

By dividing the number of ribs into at least 3 groups to which the liquid can be supplied independently, the foundation can be lowered as desired; and even the stream of liquid for each channel can be regulated.

For the application of the above invention it is desirable to have fairly homogeneous soil which can be easily washed by the liquid. Less convenient soil may be replaced in advance by one that is more suitable, e.g., by sand.

To avoid subsequent sinking caused by further penetration of the ribs owing to great loads, the pressure on the soil during or immediately after the penetration of the ribs may be increased beyond the maximum that the building is expected to weigh on completion. In addition the channels as well as the spaces adjoining the sides of the foundation may be filled up, for instance with concrete.

The liquid can be led from an axial rib to both sides by means of channels. But this can also be done from one, or from two opposite sides of the foundational construction, whereby in the first case all channels end on one side, and in the second case alternatively on opposite sides.

If an axial rib is applied, by making the ribs on the one side opposite the channels on the other side of said axial rib, and by arranging that most of the liquid for the one channel is supplied from the opposite rib on the other side of the axial rib, the width of this axial rib may be decreased.

The invention also includes within its scope constructions which can be sunk into the soil according to this method and furthermore a separate supporting plate provided with ribs which may be substituted for the specially made lower portion of the construction, and on which therefore the construction can be placed.

In the accompanying drawing two applications of the invention are illustrated, namely with, and without the separate supporting plate.

Fig. 1 shows a cross section of a concrete block with two adjoining tunnel traffic roads;

Fig. 2 shows part of the vertical section along the line II—II of Fig. 1;

Fig. 3 shows part of the horizontal section along the line III—III of Fig. 1.

As the bottom of the tunnel in the drawing there is a lengthwise axial rib 2 of which the cross section is a triangle with its base uppermost, from which axial rib ribs 3 with the same cross section extend to both sides, forming channels between them.

Through a filling 5 on the upper side (Fig. 2) which increases towards the ends of the channel, the width of the channel decreases towards its ends. Experiments have shown that thereby the soil 6, which owing to the weight of the construction 1 partly presses into channels 4 and thus closes them underneath, is carried away very evenly.

From the axial rib 2 by means of a partition 8 and stream directors 9 the liquid supplied by tubes 7 is made to flow outwards to both sides through the channels 4 as indicated by the arrows. An additional supply nozzle is shown by 10.

The part of the body located underneath the line 11 (Fig. 1) may be a separate supporting plate provided with ribs upon which the construction is placed, which in that case has a flat base; notches or the like which have not been indicated on the drawing may be provided to keep the construction in correct position on the supporting plate.

When the specially constructed lower portion 12 forms part of the construction 1, the tubes 7 may be arranged in the middle as indicated by 7'.

According to Fig. 3 there is a cross partition 13 dividing the channels into four groups 14, 15, 16 and 17. If e.g. the rear or the right side of the construction should sink too far, less or no liquid at all is supplied to the groups 14—15 and 15—16 respectively.

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