METHOD AND MEANS FOR CREATING SUBTERRANEAN EXCAVATIONS AND/OR CONSTRUCTIONS

Abstract: A system and method for creating a subterranean construction including an excavation means adapted to excavate a first material from a subterranean position, means for clearing this first material from the excavation site, and means for supplying the void left by the excavation with a supply of a second material that is dissimilar to the first material.
METHOD AND MEANS FOR CREATING SUBTERRANEAN EXCAVATIONS AND/OR CONSTRUCTIONS

TECHNICAL FIELD

The present invention relates to a means and method for creating subterranean excavations and/or constructions. For the purpose of this specification, the term construction is intended to include, but not be limited to, piers, retaining walls, piping, ceilings, floors, barriers and filters.

BACKGROUND ART

In this specification unless the contrary is expressly stated, where a document, act or item of knowledge is referred to or discussed, this reference or discussion is not to be construed as an admission that the document, act or item of knowledge or any combination thereof was at the priority date, publicly available, known to the public, part of common general knowledge; or known to be relevant to an attempt to solve any problem with which this specification is concerned.

When excavating down to a required level for whatever reason, it has hitherto been necessary to excavate the walls of the excavation site at approximately 45° in order to prevent the earth walls from collapsing inwardly on the excavation site. Only once the desired base level had been reached could work commence on the construction of a structure or construction in the excavation.

Methods of shoring the walls of an excavation have been developed which allow a trench or bore etc with vertical walls to be dug, thus reducing the size of the excavation and the amount of earth mat needs to be excavated.
Shoring methods have included such techniques as using structural elements to brace the excavation, and even filling a hole with a slurry while the excavation is taking place.

However, these shoring operations can be time consuming and therefore costly.

It is an object of the present invention therefore to provide a means and method of creating subterranean excavations and/or constructions that substantially ameliorates the aforementioned difficulties associated with known excavation techniques, or at the least, provide the public with a useful alternative.

It is a further object of the invention to provide a means and method of creating a subterranean excavation and/or construction that involves excavating as little material as possible.

Other objects and advantages of the present invention will become apparent from the following description, taken in connection with the accompanying drawings, wherein, by way of illustration and example, an embodiment of the present invention is disclosed.

For the purpose of this specification the word "comprising" means "including but not limited to", and the word 'comprises' has a corresponding meaning.

DISCLOSURE OF THE INVENTION

In one form of this invention although this may not necessarily be the only or indeed the broadest form of this there is proposed a system for creating a subterranean construction including an excavation means adapted to excavate a first material from a subterranean position, means for clearing this first material from the excavation site, and means for supplying the void left by the excavation with a supply of a second material that is dissimilar to the first material.
In a further form, the invention may be said to reside in a method of creating a subterranean construction by excavating and removing a first material from a subterranean position, and backfilling the void left by the excavation and removal with a supply of a second material that is dissimilar to the first material.

Preferably, the second material is adapted to form, at least in part, the construction.

Preferably, in an alternative, the second material is a granular material.

Preferably, the subterranean position is a bore, shaft or tunnel.

Preferably, the bore or tunnel is approximately horizontal.

Preferably, the excavation means is adapted to excavate in any desired direction away from the subterranean position, so that this position is a starting position for the excavation and construction process-

Preferably, the void left by the excavation is pressurised with the second material, and this second material exerts pressure on the excavation means that drives it in the desired direction.

Preferably, the excavation means is adapted to excavate upward from the first subterranean position.

Preferably, in an alternative, the excavation means is adapted to excavate downward from the first subterranean position.

Preferably, the excavation means includes at least one digging tooth.

In one form, the or each tooth is supported by means which are driven so as to provide a cutting action.
Preferably, the or each tooth is supported by means which are driven so as to reciprocate.

In one form, said tooth support means is a chain.

In a further form, the chain is continuous, and passes around at least a pair of sprockets, at least one of which are driven.

Preferably, the chain is driven by a power source.

This power source may be a hydraulic, electric or internal combustion motor.

Preferably, the second material is adapted to solidify

Preferably, the second material is a cementious material.

Preferably, the material that is adapted to solidify is a concrete slurry.

Preferably, the means for clearing excavated material does so by entraining this material in a fluid stream.

Preferably, said means creates a flow of the fluid at or neat the excavation face, for the purpose of entraining excavated material and removing this from the excavation site.

Preferably, the fluid is air.

Preferably, pumping the second material into the void left by excavation, forces the excavation means upwardly or in the desired direction of excavation if this is not upwardly.

In a further form, the invention may be said to reside in a method of utilising the abovementioned means for creating a subterranean structure comprising the
steps of drilling a pair of vertical bores, drilling a horizontal bore between the vertical bores, inserting the means for creating a subterranean structure into the horizontal bore so that it can then excavate in the desired direction, and backfilling the void left by excavation with a second material that is dissimilar to the first material.

Preferably, the horizontal bore is sealed at both ends in order to prevent the second material from filling the vertical bores.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of this invention it will now be described with respect to an embodiment which shall be described herein with the assistance of drawings wherein;

Figure 1 is a not to scale, schematic view of the system; and

Figures 2 and 3 are cross-sectional views through the horizontal bore in Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to Figure 1, where there is a pair of substantially parallel, vertically spaced apart bores 2, called 'guide' bores, having a horizontal, or 'excavating' bore 4 passing between them proximate to their ends. The horizontal bore 4 is drilled at the required depth i.e. if the construction, which for the purposes of this example is a wall, is to be constructed to a depth of 5 meters below ground level, the horizontal bore 4 is dug at this depth.

The equipment for forming the subterranean structure is then directed down into the bores and set up in the following fashion.
A wear strip 6 is passed between the two vertical bores 2 via the horizontal bore 4, the wear strip 6 being sized and adapted to seal against the sides of the horizontal bore 4 along its edges so as to create a cavity above the wear plate 6, and one below it.

The wear strip 6 supports a chain 8 on its upper side in guide tracks 10, so that the chain 8 can be driven with a reciprocating motion with respect to the wear/seal strip 6. Connected to the chain 8 is a plurality of sets of upwardly directed digging teeth 12, which, when the chain is driven, have a cutting action.

Formed into the underside of the wear strip is a pair of passageways 14 with a series of holes 16 passing through the walls thereof along their respective lengths. Each end of these passageways 14 is then connected to a conduit 20 that supplies it a second material, which for the purposes of this example is concrete, from a source 22 up at ground level.

A further conduit is fed down each one of the vertical bores 2 to the end of the horizontal shaft 4 just above the wear plate 6.

In use, concrete is supplied via the conduits 20 to the passageways 14 running in the under or sealing side of the wear strip 6; this concrete then passes through the holes 16 in the walls of these passageways and out into the cavity below the wear strip 6. Concrete 19 continues to be pumped into this cavity until sufficient pressure is reached in this lower cavity that the concrete begins to force the wear strip 6 upwards towards ground level.

As it does this, the chain 8 is being driven so as to reciprocate from side to side. As the wear strip 6 is forced upwardly by the pressure of concrete 19 beneath it, so to are the digger teeth 12 forced upwardly, and these are also reciprocating with a cutting action by virtue of their attachment to the chain 8. When these digger teeth 12 come into contact with the roof of the horizontal bore 4, they cut away at and excavate earth, which falls from the ceiling of the bore 4.
One of the pair of further conduits 30 provides a fluid, which for the purposes of this example is air, at pressure to the cavity above the wear strip 6, and the other conduit 32 provides a source of vacuum. Between them they create air movement along the upper cavity of the horizontal bore 4 from one end to the other, which is sufficient to entrain the excavated earth therein, and this waste material extraction line 32 draws this earth up to ground surface.

As the concrete 19 cures, it forms a subterranean wall 40 in the ground without the need to excavate additional earth beyond that which had to be displaced in order to allow the wall 40 to be formed in the first place.

So long as concrete 19 is continued to be pumped into the cavity below the wear strip 6, the wear strip 6, chain 8, digging teeth 12, and the other ancillary equipment associated with these, will continue to be displaced upwards by the concrete until the digging teeth 12 break through at ground level.

A curtain seal 42 extends down from the ends of the wear plate 6 so as to prevent the concrete from filling the vertical bores 2. With such seals, the cement does not need to cure before the wear plate is displaced upwardly. In this example we would start at the bottom and pressure on until the desired height has been reached. Leave the ends in until material solidifies and then remove chains and seals etc if necessary and fill bores. Another solution to this problem however might be to pressurise the vertical bores by filling them with the second material. The wear plate would then need to be extended in length so that it seals to the edges of the vertical bores 2.

A further solution may be to develop a moving seal (not illustrated) in the form of a belt running on pulleys or rollers-

In an alternative application, the tunnel providing the starting position may be dug at a lesser depth, and the teeth directed downwardly and backfilled with the
second material from above, so as to excavate in a downward direction whilst backfilling with the second material.

In yet a further, alternate application, the second material used to backfill the excavated cavity is a commercially available granular material which attracts mineral oil deposits from the surrounding ground. After a period of time, the system can be used to excavate over the same plane/line and remove the granules. These granules can then be cleaned of oils/contaminants and reused for the same purpose. This then is a useful technique for extracting oil deposits from the ground.

In yet a further, alternate application, the second material used to backfill the excavated cavity is a granular material such as a fines concrete or sandy slurry. This then is a useful technique for the creation and development of underground aquifer's and water holding facilities that may be able to regulate ground water.

In yet a further alternative application, the second material as before mentioned in this filtering example can be used under roads and buildings that have high ground water or salinity issues. This system can be used to insert a line of course sand underneath the existing infrastructure so that the ground water will drain into the porous corridor of secondary material and drain to a collection point without the demolition of roads and other infrastructure.

It is considered that the means and method for creating subterranean structures according to the present invention would be of particular those who wish to construct subterranean structures such as piers and retaining walls without having to excavate excess earth.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognised that departures can be made within the scope of the invention, which is not to be limited to the details described herein but is to be accorded the full scope of
the appended claims so as to embrace any and all equivalent devices and apparatus.
CLAIMS

1. A system for creating a subterranean construction including an excavation means adapted to excavate a first material from a subterranean position, means for clearing this first material from the excavation site, and means for supplying the void left by the excavation with a supply of a second material that is dissimilar to the first material.

2. The system as in claim 1, wherein the excavation means is adapted to excavate in any desired direction away from the subterranean position, so that this position is a starting positioning for the excavation and construction process.

3. The system as in either of the preceding claims, wherein the void left by the excavation is filled with the second material, and this second material exerts pressure on the excavation means that drives it in the direction of excavation.

4. The system as in any one of the preceding claims, wherein the second material is adapted to form, at least in part, the construction.

5. The system as in any one of the preceding claims, wherein the subterranean position is a bore, shaft or tunnel.

6. The system as in any one of the preceding claims, wherein the excavation means includes at least one digging tooth.

7. The system as in claim 6, wherein the or each tooth is supported by means which are driven so as to cause the or each tooth to act against the first material with a cutting action.

8. The system as in any one of the preceding claims, wherein the means for clearing excavated material does so by entraining this material in a fluid stream.
9. The system as in claim 8, wherein the means for clearing excavated material creates a flow of the fluid at or neat the excavation face, for the purpose of entraining excavated material and removing this from the excavation site.

10. The system as in claim 9, wherein the fluid is air.

11. The system as in claim any one of the preceding claims, wherein the second material is a granular material.

12. The system as in claim any one of claims 1 to 9, wherein the second material is adapted to solidify, and thereby form, at least in part, the construction.

13. The system as in claim 12, wherein the second material is a cementious material.

14. The system as in claim 13, wherein the second material is a concrete Slurry.

15. A method of creating a subterranean excavation and/or construction utilising the system as disclosed in any one of the preceding claim, wherein the method includes the steps of excavating and removing a first material from a subterranean position, and backfilling the void left by the excavation and removal with a supply of a second material that is dissimilar to the first material.

16. The method as in the preceding method claim, wherein the method includes the further steps of drilling a pair of vertical bores, drilling a horizontal bore between the vertical bores, inserting the means for creating a subterranean structure into the horizontal bore so that it can then excavate in the desired direction, and backfilling the void left by excavation with a second material that is dissimilar to the first material.
17. A system for creating a subterranean construction, as described in the specification, with reference to and as illustrated in the accompanying representations.

18. A method of creating a subterranean excavation and/or construction as described in the specification, with reference to and as illustrated in the accompanying representations.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl,

**E02D 29/02** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC.

B. MINIMUM DOCUMENTATION SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched.

Electronic database consulted during the international search (name of database and, where practical, search terms used)

**DWPI: E02D-29/IC and E02D-17/IC** and keywords: remov+, or extract+, or excavatH- or clearf+ or dig+, or replac+ or +fill+, or concret+ or cement+ or set+ or slurry+ or mix+, or cut+, or boH- or shaft+ or tunnel+, tooth+ or teeth+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Date of the actual completion of the international search
05 October 2007

Date of mailing of the international search report
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