

DESCRIPTION

TITLE OF INVENTION: A RETRACTABLE TUNNEL BORING SYSTEM

FIELD OF THE INVENTION

The present invention relates to the field of tunnel boring machine technology, and more particularly to a retractable tunnel boring system.

BACKGROUND OF THE INVENTION

A Tunnel Boring Machine (TBM), as a specialized engineering machine for tunnel excavation, has been widely employed in subway, railway, highway, municipal, and hydropower tunnel projects. TBMs utilize a non-open, or closed-face, excavation method, which results in minimal impact on surrounding road surfaces, structures, and subterranean geological strata such as soil and rock. Advantageously, this approach serves to reduce construction duration, lower noise levels, and mitigate the risk of collapse, while also providing enhanced adaptability to accommodate complex engineering environments.

During engineering operations utilizing a Tunnel Boring Machine (TBM), it is typically necessary to construct a launch shaft and a reception shaft. The TBM is positioned within the launch shaft and excavates towards the reception shaft, where it is subsequently disassembled for reuse. However, due to the complexity of certain projects, particular scenarios such as large overburden, single-ended

tunnels (without an exit), or the absence of a reception shaft, often necessitate either in-tunnel disassembly or abandonment of the TBM. In-tunnel disassembly, however, presents significant challenges due to the confined space within the tunnel, making dismantling and reassembly cumbersome. Furthermore, repeated disassembly, transportation, and reassembly of the equipment can increase the failure rate and adversely affect project quality. In such situations, the optimal solution would be to retract the TBM along its original excavation path. Nevertheless, this approach is currently unfeasible because, during the TBM's advancement, jacking pipes continuously used to push the TBM forward. The inner diameter of these jacking pipes is smaller than the outer diameter of the TBM, thereby preventing the TBM from being retracted along the original path.

To this end, the present invention provides a retractable tunnel boring system, which effectively addresses the aforementioned problems. This system allows for the rapid and convenient retraction of a tunnel boring machine along its original path, thereby significantly reducing engineering difficulty and lowering costs.

SUMMARY OF THE INVENTION

To overcome the shortcomings of the prior art, the present invention provides a retractable tunnel boring system, which allows the rapid and convenient retraction of a tunnel boring machine along its original path, thereby significantly reducing engineering difficulty and lowering costs.

The present invention provides the following technical solution to solve its technical problem:

A retractable tunnel boring system, comprising:

- a casing assembly, wherein the casing assembly is tubular;
- a body assembly, detachably connected to the casing assembly; and
- a cutterhead assembly, detachably connected to a front end of the casing assembly, and connected to an advancing end of the body assembly;

first cutting tools, detachably disposed at a peripheral edge of the cutterhead assembly, wherein at least a portion of an outer surface of the first cutting tool is located radially outward of an outer surface of the casing assembly.

As an improvement to the present invention, the cutterhead assembly defines a tool slot, the tool slot being oriented toward an interior of the body assembly, and a shank of the first cutting tool is detachably inserted into the tool slot.

As an improvement to the present invention, the cutterhead assembly comprises a limiting block and a locking block, and wherein the tool slot is L-shaped and comprises a limiting slot unit and an insertion slot unit with an opening, the limiting block being disposed on a side of the limiting slot unit distal from the insertion slot unit, a shank of the first cutting tool being inserted into the insertion slot unit and abutting against the limiting block, the locking block being inserted through the opening into the insertion slot unit and abutting against the shank of the first cutting tool.

As an improvement to the present invention, the body assembly comprises a cutterhead protection mechanism, a translation driving mechanism, and a connecting pipe mechanism connected in sequence away from the cutterhead

assembly; the cutterhead protection mechanism defining an axial bore and a transport opening disposed below the axial bore; the axial bore being configured to allow a rotating shaft of a driving device to pass through, the cutterhead assembly having a connection portion configured to connect to the rotating shaft of the driving device, and the transport opening being configured to allow muck to pass through.

As an improvement to the present invention, the cutterhead protection mechanism further comprises a muck screen disposed adjacent to the transport opening and configured to allow muck to pass through.

As an improvement to the present invention, the cutterhead protection mechanism further comprises an entrance on an upper side thereof, a receiving space being defined between the cutterhead protection mechanism and the cutterhead assembly, the entrance communicating an interior space of the translation driving mechanism with the receiving space, the cutterhead protection mechanism comprising an entrance cover plate detachably mounted to cover the entrance.

As an improvement to the present invention, the translation driving mechanism comprises:

- a front casing connected to the cutterhead protection mechanism;
- a rear casing connected to the connecting pipe mechanism; and
- a plurality of driving cylinders having opposite ends respectively connected to the front casing and the rear casing, wherein extension and

retraction of the driving cylinders is configured to drive the front casing to move relative to the rear casing.

As an improvement to the present invention, the connecting pipe mechanism comprises a connecting casing and a sealing casing, the sealing casing covers an opening of the connecting casing distal from the cutterhead assembly, the sealing casing defines a transfer port configured to allow muck to pass through.

As an improvement to the present invention, the connecting pipe mechanism further comprises a sealing door detachably mounted to cover a passage defined in the sealing casing.

As an improvement to the present invention, the first cutting tools are mounted on the cutterhead assembly at equidistant circumferential intervals.

The beneficial effects of the present invention are as follows. Due to the above-described configuration, when the tunnel boring machine advances, the body assembly is connected to the rear of the casing assembly, and the cutterhead assembly is connected to the front end of the casing assembly. The cutterhead assembly is driven by the driving device inside the body assembly to rotate, cutting through underground soil layers, rock layers, etc., and is actuated by hydraulic cylinders, intermediate jacking stations, jacking pipes, and jacking devices to move forward, thereby performing the tunneling operation. Since at least a portion of the outer surface of the first cutting tools is located outside the outer surface of the casing assembly, the inner diameter of the tunnel excavated

by the cutterhead assembly is larger than the outer diameter of the casing assembly, allowing the tunnel boring machine to advance through the formation without obstruction. Conversely, when the tunnel boring machine is to be retrieved, the first cutting tools are detached from the cutterhead assembly, resulting in the outer diameter of the cutterhead assembly being smaller than the inner diameter of the casing assembly. The cutterhead assembly is then detached from the casing assembly, followed by the body assembly. A driving device is then used to pull the body assembly and the cutterhead assembly backward, causing them to retract through the interior of the casing assembly and the jacking pipes until they are returned to the launch shaft, thereby facilitating disassembly and retrieval.

BRIEF DESCRIPTION OF THE DRAWINGS

To more clearly illustrate the technical solutions of the embodiments of the present invention, the accompanying drawings necessary for the description of the embodiments are briefly introduced hereinafter. The drawings in the following description merely illustrate some embodiments of the present invention, and for a person of ordinary skill in the art, other drawings may also be derived from these drawings without requiring inventive effort.

FIG. 1 is a schematic structural view of the tunnel boring machine of the present invention from one perspective.

FIG. 2 is a schematic structural view of the tunnel boring machine of the present invention from another perspective.

FIG. 3 is a schematic structural view of the tunnel boring machine of the present invention in a retracted state.

FIG. 4 is a front-end view of the tunnel boring machine of the present invention.

FIG. 5 is a first section view of the tunnel boring machine of the present invention.

FIG. 6 is a first section view of the tunnel boring machine of the present invention.

FIG. 7 is an enlarged view of detail A in FIG. 6.

FIG. 8 is an enlarged view of detail B in FIG. 6.

FIG. 9 is a partial exploded schematic view of the tunnel boring machine of the present invention from one perspective.

FIG. 10 is a partial exploded schematic view of the tunnel boring machine of the present invention from another perspective.

FIG. 11 is a partial schematic view of the cutterhead assembly of the tunnel boring machine of the present invention from one perspective.

FIG. 12 is a partial schematic view of the cutterhead assembly of the tunnel boring machine of the present invention from another perspective.

FIG. 13 is a partial section view of the cutterhead assembly of the tunnel boring machine of the present invention.

FIG. 14 is a partial explosion view of the cutterhead assembly of the tunnel boring machine of the present invention.

Labels shown in the above figures:

100. casing assembly; 101. first threaded hole; 102. second threaded hole; 110. cutterhead housing; 120. front body housing; 130. rear body housing; 200. body assembly; 201. shaft hole; 202. transport opening; 203. entrance; 204. transfer port; 205. passage; 206. second through hole; 210. cutterhead protection mechanism; 211. muck screen; 212. entrance cover plate; 220. translation driving mechanism; 221. front housing; 222. rear housing; 223. driving cylinders; 230. connection pipe mechanism; 231. connecting casing; 232. sealing casing; 233. sealing door; 400. cutterhead assembly; 401. tool slot; 401a. limit slot; 401b. insertion slot; 402. opening; 403. first through hole; 410. first cutting tool; 411. tool shank; 420. limit block; 430. lock block; 440. second cutting tool.

DESCRIPTION OF THE EMBODIMENTS

In order to make the aforementioned objectives, features, and advantages of the present application more clear and understandable, the specific embodiments of the present application will be described in detail below with reference to the accompanying drawings. Many specific details are set forth in the following description to facilitate a thorough understanding of the present application. However, the present application may be embodied in many different ways from those described herein, and a person of ordinary skill in the art may make similar modifications without departing from the spirit and scope of the present application. Therefore, the present application is not limited by the specific embodiments disclosed below.

In the description of the present application, it should be understood that when terms such as “center”, “longitudinal”, “transverse”, “length”, “width”, “thickness”, “upper”, “lower”, “front”, “rear”, “left”, “right”, “vertical”, “horizontal”, “top”, “bottom”, “inner”, “outer”, “clockwise”, “counterclockwise”, “axial”, “radial”, “circumferential and the like, appear, these terms indicating orientation or positional relationships are based on the orientation or positional relationships shown in the accompanying drawings, and are merely for convenience in describing and simplifying the present application, rather than indicating or implying that the device or element referred to must have a specific orientation or be constructed and operated in a specific orientation. Therefore, they should not be construed as limiting the present application.

Furthermore, when terms such as “first” and “second” appear, these terms are used for descriptive purposes only, and should not be construed as indicating or implying relative importance or implicitly indicating the number of technical features referred to. Thus, a feature defined by “first” or “second” may explicitly or implicitly include at least one such feature. In the description of the present application, when the term “multiple” appears, “multiple” means at least two, such as two, three, and so on, unless otherwise explicitly and specifically defined.

In the present application, unless otherwise expressly specified and defined, when terms such as “install”, “connect”, “fix”, and the like appear, these terms should be understood in a broad sense. For example, they can refer to a fixed connection, a detachable connection, or an integral formation; a mechanical

connection or an electrical connection; a direct connection or an indirect connection through an intermediate medium; or an internal communication between two elements or an interaction relationship between two elements, unless otherwise expressly defined. For a person of ordinary skill in the art, the specific meanings of the above terms in the present application can be understood according to specific circumstances.

In the present application, unless otherwise expressly specified and defined, when descriptions such as a first feature being “above” or “below” a second feature appear, their meaning may be that the first and second features are in direct contact, or the first and second features are in indirect contact through an intermediate medium. Furthermore, “above”, “over”, and “on” a second feature can mean that the first feature is directly above or obliquely above the second feature, or merely indicate that the horizontal height of the first feature is higher than that of the second feature. “Below”, “under”, and “beneath” a second feature can mean that the first feature is directly below or obliquely below the second feature, or merely indicate that the horizontal height of the first feature is lower than that of the second feature.

It should be noted that if an element is referred to as being “fixed to” or “disposed on” another element, it can be directly on the other element or intervening elements may also be present. If an element is considered “connected” to another element, it can be directly connected to the other element or intervening elements may also be present. If present, the terms “vertical”, “horizontal”,

“upper”, “lower”, “left”, “right”, and similar expressions used in the present application are for illustrative purposes only and do not imply a single embodiment.

Referring to FIG. 1 to FIG.14, A retractable tunnel boring system, comprising:

- a tubular casing assembly 100;

- a body assembly 200 detachably connected to the casing assembly 100; and

- a cutterhead assembly 400 detachably connected to a front end of the casing assembly 100 and connected to an advancing end of the body assembly 200, the cutterhead assembly 400 comprising:

 - a plurality of first cutting tools 410 detachably mounted on a peripheral edge thereof, wherein at least a portion of an outer surface of each of the first cutting tools 410 is located radially outward of an outer surface of the casing assembly 100.

Due to the above-described configuration, during advancement of the tunnel boring machine, the body assembly 200 is connected to middle-rear portion of the casing assembly 100, and the cutterhead assembly 400 is connected to a front end of the casing assembly 100. The cutterhead assembly 400 is driven to rotate by a driving device within the body assembly 200, thereby cutting through underground soil layers, rock formations, and the like. The tunnel boring machine is then advanced by hydraulic cylinders, intermediate jacking stations, jacking pipes, and jacking devices to perform the tunneling operation. Since at least a

portion of an outer surface of the first cutting tools 410 is located radially outward of an outer surface of the casing assembly 100, the inner diameter of the tunnel excavated by the cutterhead assembly 400 is greater than the outer diameter of the casing assembly 100, allowing the tunnel boring machine to advance smoothly. When the tunnel boring machine is to be retracted, the first cutting tools 410 are detached from the cutterhead assembly 400, such that the outer diameter of the cutterhead assembly 400 becomes smaller than the inner diameter of the casing assembly 100. Subsequently, the cutterhead assembly 400 is detached from the casing assembly 100, followed by the body assembly 200. A driving device is then used to pull the body assembly 200 and the cutterhead assembly 400 backward, causing them to retract through the interior of the casing assembly 100 and the jacking pipes until they are returned to the launch shaft, thereby facilitating disassembly and retrieval.

In this embodiment, the cutterhead assembly 400 defines a tool slot 401 oriented toward an interior of the body assembly 200, and a shank 411 of the first cutting tool 410 is detachably inserted into the tool slot 401. This configuration enables the cutterhead assembly 400 to be assembled by inserting the shank 411 into the tool slot 401. Moreover, because the opening of the tool slot 401 faces the interior of the body assembly 200, a user can access the rear side of the cutterhead assembly 400 through the jacking pipes and the body assembly 200 to install or remove the first cutting tool 410. This facilitates both the replacement of the first cutting tool 410 for maintenance and the detachment of the first cutting

tool 410 to allow the body assembly 200 and the cutterhead assembly 400 to retract through the interior of the casing assembly 100 and the jacking pipes.

Preferably, the casing assembly 100 comprises a cutterhead housing 110, a front body housing 120, and a rear body housing 130, wherein the cutterhead housing 110 is detachably connected to the cutterhead assembly 400, the front body housing 120 is connected to a front end of the body assembly 200, and the rear body housing 130 is connected to a rear end of the body assembly 200. The cutterhead housing 110 connects to the cutterhead assembly 400 to protect a side surface of the cutterhead assembly 400, thereby effectively extending the service life of the cutterhead assembly 400 and ensuring the stability of the system. Furthermore, the front body housing 120 and the rear body housing 130 protect the front and rear ends of the body assembly 200, respectively, safeguarding it from damage and ensuring its operational stability. Additionally, when the driving cylinders within the body assembly 200 extend and retract, the front body housing 120 and the rear body housing 130 are capable of moving relative to each other, thereby ensuring the stability of the tunneling operation.

Preferably, a side wall of the cutterhead assembly 400 defines a first through hole 403, and an inner wall of the cutterhead housing 110 defines a first threaded hole 101. Similarly, a side wall of the body assembly 200 defines a second through hole 206, and inner walls of the front body housing 120 and the rear body housing 130 each define a second threaded hole 102. A threaded end of a first threaded member passes through the first through hole 403 and is threadedly

engaged with the first threaded hole 101 to connect the cutterhead assembly 400 to the cutterhead housing 110. Correspondingly, a threaded end of a second threaded member passes through the second through hole 206 and is threadedly engaged with a corresponding second threaded hole 102 to connect the body assembly 200 to the casing assembly 100. Here, the first threaded hole 101 opens toward an interior of the cutterhead housing 110, and the second threaded holes 102 open toward an interior of the casing assembly 100. This configuration allows the first and second threaded members to be installed and removed from within the body assembly 200, thereby facilitating assembly and disassembly of the system.

In this embodiment, the cutterhead assembly 400 includes a limiting block 420 and a locking block 430. The tool slot 401 is L-shaped and comprises a limiting slot 401a and an insertion slot 401b with an opening 402. The limiting block 420 is disposed on a side of the limiting slot 401a distal from the insertion slot 401b. A shank 411 of the first cutting tool 410 is inserted into the insertion slot 401b and abuts against the limiting block 420, while the locking block 430 is inserted through the opening 402 into the insertion slot 401b and abuts against the shank 411.

When the shank 411 is inserted into the insertion slot 401b, it abuts against the limiting block 420, thereby positioning the first cutting tool 410 in one direction. The locking block 430, inserted through the opening 402 into the insertion slot 401b and abutting against the shank 411, secures the first cutting

tool 410 from another direction. This configuration prevents the first cutting tool 410 from loosening or shifting during operation, thereby ensuring the safety and accuracy of the cutting process.

Here, both the limiting block 420 and the locking block 430 are secured to the cutterhead assembly 400 via a respective third threaded member. The third threaded members extend in a direction substantially parallel to the insertion slot 401b. Furthermore, forces applied by the shank 411 to the limiting block 420 and the locking block 430 are directed substantially toward the limiting slot 401a. These forces are primarily transferred by the blocks to the inner walls of the limiting slot 401a and the insertion slot 401b, resulting in enhanced structural stability of the system.

In this embodiment, the body assembly 200 comprises a cutterhead protection mechanism 210, a translation driving mechanism 220, and a connection pipe mechanism 230, connected in sequence away from the cutterhead assembly 400. The cutterhead protection mechanism 210 defines a shaft hole 201 and a transport opening 202 disposed below the shaft hole 201. The shaft hole 201 is configured to allow a rotating shaft of a driving device to pass through, and the cutterhead assembly 400 comprises a connection portion configured to connect to the rotating shaft. The transport opening 202 is configured to allow muck to pass through.

In operation, the rotating shaft of the driving device passes through the shaft hole 201 and connects to the cutterhead assembly 400. The driving device then

actuates the cutterhead assembly 400 to rotate, cutting through soil layers and rock formations. The resulting muck passes through the transport opening 202, is carried by a conveyor belt through the interior of the body assembly 200 and the jacking pipes, and is ultimately discharged at the launch shaft.

In this embodiment, the cutterhead protection mechanism 210 further comprises a muck screen 211 adjacent to the transport opening 202, wherein the muck screen 211 is configured to allow muck to pass through.

The muck screen 211 performs a preliminary screening of the muck by blocking oversized particles and debris, thereby preventing them from entering and jamming the transport opening 202, which would disrupt subsequent transportation. This protects the entire transport system and enhances the efficiency and stability of muck conveyance. The blocked oversized muck is further cut by the cutting tools on the cutterhead assembly 400. Once the fragments are sufficiently reduced in size, they pass through the muck screen 211 for subsequent transport.

In this embodiment, the cutterhead protection mechanism 210 further comprises an entrance 203 on an upper side thereof. A receiving space is formed between the cutterhead protection mechanism 210 and the cutterhead assembly 400, and the entrance 203 communicates an interior space of the translation driving mechanism 220 with this receiving space. The cutterhead protection mechanism 210 includes an entrance cover plate 212 detachably mounted over the entrance 203.

During use, a worker can pass through the entrance 203 to access the receiving space, enabling operations such as installing or removing the first cutting tool 410, or detaching the cutterhead assembly 400 from the cutterhead housing 110. Under normal operating conditions, the entrance cover plate 212 prevents debris from entering and safeguards personnel from the hazardous area within, thereby ensuring a safe working environment.

In this embodiment, the translation driving mechanism 220 comprises a front casing 221 connected to the cutterhead protection mechanism 210, a rear casing 222 connected to the connection pipe mechanism 230, and a plurality of driving cylinders 223. Opposite ends of each driving cylinder 223 are connected to the front casing 221 and the rear casing 222, respectively. Extension and retraction of the driving cylinders 223 drives the front casing 221 to move relative to the rear casing 222.

When the driving cylinders 223 extend, they drive the front casing 221 forward relative to the rear casing 222, thereby advancing the cutterhead protection mechanism 210 and the cutterhead assembly 400 to perform cutting of soil layers and rock formations. Conversely, when the driving cylinders 223 retract, a jacking device advances the jacking pipes, which in turn push the connection pipe mechanism 230 and the entire body assembly 200 forward within the tunnel.

In this embodiment, the connection pipe mechanism 230 comprises a connecting casing 231 and a sealing casing 232. The sealing casing 232 covers

an opening of the connecting casing 231 distal from the cutterhead assembly 400 and defines a transfer port 204 configured to allow muck to pass through.

The sealing casing 232 and the connecting casing 231 are tightly engaged to form a relatively sealed space. The transfer port 204 allows muck to pass through, ensuring that it is smoothly transported from the tunneling face to the rear and maintaining the continuity of muck conveyance throughout the tunneling process.

In this embodiment, the connection pipe mechanism 230 further comprises a sealing door 233. The sealing casing 232 defines a passage 205, and the sealing door 233 is detachably mounted over the passage 205.

Under normal operating conditions, the sealing door 233 ensures the sealing integrity of the sealing casing 232, preventing the ingress of external debris and thereby maintaining a stable internal environment for the body assembly 200. Conversely, when personnel or equipment need to pass through the passage 205, the sealing door 233 can be opened to provide access to the interior of the body assembly 200 for inspection, maintenance, and other operations.

In this embodiment, the first cutting tools 410 are uniformly distributed at equal intervals along a circumferential direction of the cutterhead assembly 400.

When the cutterhead assembly 400 rotates and cuts, the cutting forces in all directions are balanced. This avoids problems such as cutterhead vibration and uneven wear, thereby improving the service life and cutting efficiency of the cutterhead assembly 400. Furthermore, it ensures stable tunneling progress and prevents deviation of the tunneling trajectory due to uneven forces on the

cutterhead assembly 400.

Preferably, the cutterhead assembly 400 further comprises a plurality of second cutting tools 440 detachably connected thereto and arranged radially at equal intervals in a central portion thereof.

This detachable connection greatly facilitates subsequent maintenance, replacement, and adjustment operations, thereby reducing costs and ensuring construction efficiency. Moreover, when the cutterhead assembly 400 is driven to rotate, the radially arranged second cutting tools 440 stably cut the entire circular face of the tunnel. This arrangement ensures balanced cutting forces across all positions, resulting in effective cutting and stable tunneling operation.

CLAIMS

1. A retractable tunnel boring system, comprising:
 - a casing assembly, wherein the casing assembly is tubular;
 - a body assembly, detachably connected to the casing assembly; and
 - a cutterhead assembly, detachably connected to a front end of the casing assembly, and connected to an advancing end of the body assembly;
 - first cutting tools, detachably disposed at a peripheral edge of the cutterhead assembly, wherein at least a portion of an outer surface of the first cutting tool is located radially outward of an outer surface of the casing assembly.
2. The retractable tunnel boring system of claim 1, wherein the cutterhead assembly defines a tool slot, the tool slot being oriented toward an interior of the body assembly, and a shank of the first cutting tool is detachably inserted into the tool slot.
3. The retractable tunnel boring system of claim 2, wherein the cutterhead assembly comprises a limiting block and a locking block, and wherein the tool slot is L-shaped and comprises a limiting slot unit and an insertion slot unit with an opening, the limiting block being disposed on a side of the limiting slot unit distal from the insertion slot unit, a shank of the first cutting tool being inserted into the insertion slot unit and abutting against the limiting block, the locking block being inserted through the opening

into the insertion slot unit and abutting against the shank of the first cutting tool.

4. The retractable tunnel boring system of claim 1, wherein the body assembly comprises a cutterhead protection mechanism, a translation driving mechanism, and a connecting pipe mechanism connected in sequence away from the cutterhead assembly; the cutterhead protection mechanism defining an axial bore and a transport opening disposed below the axial bore; the axial bore being configured to allow a rotating shaft of a driving device to pass through, the cutterhead assembly having a connection portion configured to connect to the rotating shaft of the driving device, and the transport opening being configured to allow muck to pass through.
5. The retractable tunnel boring system of claim 4, wherein the cutterhead protection mechanism further comprises a muck screen disposed adjacent to the transport opening and configured to allow muck to pass through.
6. The retractable tunnel boring system of claim 4, wherein the cutterhead protection mechanism further comprises an entrance on an upper side thereof, a receiving space being defined between the cutterhead protection mechanism and the cutterhead assembly, the entrance communicating an interior space of the translation driving mechanism with the receiving space, the cutterhead protection mechanism

comprising an entrance cover plate detachably mounted to cover the entrance.

7. The retractable tunnel boring system of claim 4, wherein the translation driving mechanism comprises:
 - a front casing connected to the cutterhead protection mechanism;
 - a rear casing connected to the connecting pipe mechanism; and
 - a plurality of driving cylinders having opposite ends respectively connected to the front casing and the rear casing, wherein extension and retraction of the driving cylinders is configured to drive the front casing to move relative to the rear casing.
8. The retractable tunnel boring system of claim 4, wherein the connecting pipe mechanism comprises a connecting casing and a sealing casing, the sealing casing covers an opening of the connecting casing distal from the cutterhead assembly, the sealing casing defines a transfer port configured to allow muck to pass through.
9. The retractable tunnel boring system of claim 8, wherein the connecting pipe mechanism further comprises a sealing door detachably mounted to cover a passage defined in the sealing casing.
10. The retractable tunnel boring system of claim 1, wherein the first cutting tools are mounted on the cutterhead assembly at equidistant circumferential intervals.