TUNNEL DRIVING MACHINE

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ABSTRACT

A tunnel driving machine includes an elongated machine frame having a central large frame portion accommodating a tunnel tool driving gear and the associated driving motors and a forwardly extending and rearwardly extending tubular frame portion. The forwardly extending portion accommodates the main shaft for the forward driving tool and it is supported on front bracing in a manner permitting its longitudinal shifting movement relative to the bracing. A rearwardly extending tubular portion is supported in rear bracing which permits a longitudinal shifting movement. In addition to the front and rear bracing, there is a front support and a rear support for the tunnel frame which may be selectively engaged with the tunnel wall during the times at which the front and rear bracing are removed from tunnel-wall engagement and shifted longitudinally. The construction includes driving motors connected between the main frame and the front bracing and main bracing and the rear bracing for facilitating advancing movement of each bracing element within the tunnel during those times at which the frame is supported on the front and rear supports.

6 Claims, 3 Drawing Figures
TUNNEL DRIVING MACHINE

SUMMARY OF THE INVENTION

This invention relates in general to tunnel driving machines, and in particular, to a new and useful tunnel driving machine which includes an elongated machine frame having a forward tubular portion which is supported for longitudinal displacement within a front bracing and a rearward tubular portion supported in rear bracing for longitudinal movement and which further includes means for supporting the frame with the associated drive motors and gearing when the bracings are removed from the tunnel to permit the shifting advancing movement of the whole machine frame.

It is known to construct tunnel driving machines in a manner such that the main frame carries a distributor gear which is driven by one or more driving motors and to locate the tunnel driving tool in immediate proximity to the distributor gear. Such machines may also include, for example, a main drive which is arranged at the end of the tunnel driving machine and connected with the distributor gear by relatively long universal shafts, but such machines are long and bulky and of complicated construction.

A major object of the present invention is to provide a tunnel driving machine where the machine carrier is so designed that it is suitable for connection and for reception of the distributor gear and the main driving motors which are connected thereto. This eliminates the usual connecting means in the form of universal shafts without having to forego the favorable weight distribution of the machine and the absorption of forces by the supporting and bracing elements. In accordance with the invention, the machine frame comprises a front hollow tubular portion which is supported in front bracing and an enlarged housing adjacent this part for accommodating the driving gears for the main shaft. A rear tubular portion extends rearwardly from the gear housing and machine drive and the front and rear tubular portions are supported in respect to front and rear bracing assemblies for longitudinal axial movement. The front tubular member rotatably supports the driving shaft which is connected to the forwardly positioned driving tool and the main distributor gear is connected to the shaft at its rear end which is located in the central portion of the machine frame assembly. The machine frame includes a unified assembly which includes the shaft for the driving tool, the distributor gears, the driving motor gears and the associated coupling and driving motor connection as well as a rearwardly extending tubular part for supporting the frame in a rear bracing assembly. This provides a substantially hollow machine frame with axially symmetrical frame parts forming a closed unit which is provided with the necessary driving gear means for the driving or winning tool. The central main frame portion provides a housing for the distributor gear and driving gears and a mounting for the driving motors and its associated reduction gearing. The motor frame portion of the housing is located centrally between the front and rear bracing and in addition front and rear supports are provided for carrying the load of the frame during those times at which the bracing is advanced in the tunnel. The design is such that the driving machine may be steered through the tunnel and angled during the steering operation to provide even a curved tunnel wall formation. The bracing elements are shifted by fluid motor drives which are carried on the motor frame. A rear tubular unit of the construction is designed as a steering guide element for the machine frame and is advantageously supported within the rear bracing. The rear guiding element also provides means for advantageously mounting the control stand for the tunnel driving operation.

Accordingly, it is an object of the invention to provide an improved tunnel driving machine which includes a single machine frame unit which is supported for longitudinal movement between front and rear bracing elements and which includes additional supporting elements thereon which may be selectively engaged with the tunnel while advancing means associated with the frame are operated to advance the bracing elements progressively during the formation of the tunnel.

A further object of the invention is to provide an improved tunnel driving machine which includes a large machine frame accommodating a driving gear and a centrally arranged drive shaft for the tunnel winning tool and which also provides means for mounting the drive motors and means for shifting the bracing progressively as the tunnel is formed.

A further object of the invention is to provide a tunnel driving machine which is simple in design, rugged in construction, and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages, and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side elevational view of a tunnel driving machine arranged within a tunnel and constructed in accordance with the invention;

FIG. 2 is a top plan view of the tunnel driving machine shown in FIG. 1; and

FIG. 3 is a longitudinal sectional view of a tunnel driving machine indicated in FIG. 1.

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings in particular, the invention embodied therein comprises a tunnel driving machine assembly generally designated 10 which includes a rotatable driving tool or winning tool 1 which is rotatably carried on a main drive shaft 2 by a splined coupling 57 (FIG. 3). The shaft 2 is supported within a main motor frame or housing generally designated 50 which includes a forward tubular portion 12 which is axially displaceably supported within front bracing 8. The frame 50 also includes a central gear housing portion 25, a motor carrier portion 18 and a rear portion or extension 20. The front bracing 8 which is schematically indicated includes a plurality of bracing elements which may be moved radially outwardly to engage against the tunnel wall 54 when the machine frame 50 is to be anchored in position for carrying out the tunnel driving operation.

The machine frame housing portion 25 encloses a distributor gear or drive gear 3 which is connected to the shaft 2 for rotating the shaft. The main drive includes a plurality of driving pinions 56 which are connected through disengageable couplings 19 to reduce by a reduction gear 4. The reduction gear 4 is driven from individual motors 6 through couplings 5 and the couplings 19 may be operated to engage or disengage the gears 56 to the driving motors 6.

In accordance with a feature of the invention, the machine frame 50 also includes a rear guide shaft portion or extension 20 which is supported within rear bracing 10 in a manner to permit its longitudinal shifting movement and its controlled turning for the purpose of varying the position of the axis of the shaft relative to the tunnel being formed for shifting the direction of the tunnel. Between the gear housing 25 and the extension 20 the machine frame 50 includes a mounting portion or machine carrier frame 18 which forward tubular which mounts the individual driving motors 6. A control stand 11 is mounted at the rear end of the extension 20. The drive gear 3 is connected to the shaft 2 through a coupling, preferably a gear or spline coupling 57. The individual motors 6 are connected to the distributor gear 3 by the shaftable couplings 19 so that they can be selectively connected or disconnected to the distributor gear.

Both the forward machine frame part 12 and the tubular rear extension 20 are mounted in the associated front bracing 8 and rear bracing 10 in a manner permitting only longitudinal movement but not rotational movement except under controlled conditions.
In addition to the bracing 8 and 10, there is provided forward and rear support assemblies 7 and 9 located between the front bracing and the driving tool 1 and between the rear bracing and the carrier frame portion 18 respectively. The front support 7 and the rear support 9 include extensible supports or legs 7a and 9a respectively, which are adapted to be shifted outwardly (downwardly) to engage against bridge elements 21 which are slidably entrained on the tunnel wall bottom and which move along with the driving machine.

Directly behind the winning tool 1 which may be, for example, a drill head, there is arranged a dust shield 13 having a charging tube or chute 14 connected thereto. The material which is won is discharged by the blades 15 which are arranged on the drum head of the winning tool 1. At the bottom of the charging chute 14 there is connected a conveyor 16 which extends along the tunnel floor and which for example may be connected with the supporting bridges 21.

In accordance with a further feature of the invention, the machine frame 50 provides a support for articulating separate feed drives for each of the front and rear bracing elements 8 and 10. The feed drive for the rear bracing unit 10 includes piston and cylinder units generally designated 23 which are pivotally mounted on each of a plurality of bracing clamps 22 which, for example, are arranged on each side and the top and bottom of the rear bracing 10 and also pivotted to corresponding locations on the gear housing 25 of the machine frame 50. The bracing clamps are advantageously carried on the bracing assembly 18 in a manner which permits their outward extension or inward retraction from the tunnel wall 54. After the bracing clamps 22 are retracted, the piston cylinder units 23 are operated to advance the rear bracing 10 forwardly. After the bracing 10 is again secured to the tunnel the piston cylinder units 23 may be actuated to advance the machine frame 50 forwardly. Again after the machine frame 50 is advanced forwardly the front bracing 8 may be advanced forwardly by the operation of a piston and cylinder unit 24 which is articulated between the front bracing 8 and the machine frame housing 25. During this operation the entire machine frame 51 slides in respect to its associated front and/or rear bracing. After the driving stroke the machine is supported by means of the front and rear support 7 and 9 on the supporting bridges 21 by extending the support legs 7a and 9a, and the front and rear bracings 8 and 10 are released from the tunnel. This permits the front and rear bracings 8 and 9 to be moved ahead by their associated piston and cylinder units 24 and/or 23.

The torque produced by the main drive of the motors 6 driving through the reduction gear to the distributor gear 3 to the winning tool 1 is preferably introduced by the guide 58 which are connected to the wining frame part or extension 20 and thus into the tunnel wall 54.

The rear bracing 10 is designed so that the tunnel driving machine can be steered in any desired direction. The driving cuts can be corrected and the tunnel can be formed in the form of a curve. The rear bracing 10 carries a part of the machine weight and it takes over the forces from the advance, the forces of the torque and the steering forces. The front bracing 8 takes over in addition to the main part of the machine weight, the radial and axial reaction forces which originate from the advance, the torque and the steering operation, and which are transmitted from the winning tool to the end face of the tunnel. The control stand 11 for the tunnel driving machine forms an integral unit with the machine frame 50.

What is claimed is:

1. A tunnel driving machine comprising front bracing means adapted to be engaged in a tunnel against the walls thereof, rear bracing means adapted to be engaged in a tunnel against the walls thereof and being spaced longitudinally from said front bracing means, said front bracing means and said rear bracing means each having a central relatively small diameter receiving bore, a driving machine carrier frame including a forward tubular portion centrally supported within the receiving bore said front bracing means for relative longitudinal movement in respect to said front bracing means, said carrier frame including an intermediate gear housing and motor mounting portion and a rear tubular portion supported within the receiving bore of said rear bracing means for relative longitudinal movement in respect to said bracing means, a forward tubular portion being of relatively small diameter in respect to the tunnel so as to occupy only a minor portion of the tunnel area and to leave a major portion of the tunnel area surrounding them free, a rotatable driving head in front of said bracing means having a shaft rotatably supported in said carrier frame forward tubular portion and said front support engaged with said carrier frame adjacent said front bracing means and being selectively engageable with the tunnel walls, a rear support engaged with said carrier frame adjacent said rear bracing means and being selectively engageable with the tunnel walls, and feed drivemeans carried on said carrier frame and connected to said front bracing and said rear bracing for displacing said front and rear bracing in respect to said carrier frame.

2. A tunnel driving machine, according to claim 1, wherein said carrier frame comprises a symmetrically arranged closed unit arranged around said drive shaft, a distributor gear connected to said drive shaft and arranged within said intermediate gear housing and said motor mounting portion, said feed drive means including a fluid piston and cylinder combination connected between said driving machine carrier frame and said rear bracing means and said driving machine carrier frame and said front bracing means.

3. A tunnel driving machine, according to claim 1, wherein said feed drive means includes a combination piston and cylinder unit connected between said front bracing means and said driving machine carrier frame intermediate gear housing and motor mounting portion.

4. A tunnel driving machine, according to claim 1, wherein said tunnel bracing portion of said machine carrier frame includes a control console, said rear bracing means providing means mounting said tunnel portion in a manner permitting steering of said carrier frame through said tunnel.

5. A tunnel driving machine, according to claim 1, including a control stand mounted on said rear tunnel portion of said machine carrier frame.

6. A tunnel driving machine comprising front bracing means including a plurality of members adapted to move radially outwardly into engagement with a tunnel wall, rear bracing means including a plurality of radially extending members adapted to move outwardly into engagement with a tunnel wall and spaced longitudinally from said front bracing means, said front bracing means and said rear bracing means each having a central relatively small diameter receiving bore, a driving machine carrier frame having tubular portions supported within the receiving bores of and longitudinally displaceable in said front and rear bracing means, front and rear support means engageable with said tunnel frame and adjacent said front bracing means and said rear bracing means respectively, said tubular portions being of relatively small diameter in respect to said tunnel and occupying a minor portion of the tunnel diameter, support means including extendible portions for engaging against said tunnel for supporting said machine frame temporarily when said front and rear bracing means are removed from engagement with said tunnel, a tunnel driving tool arranged at the end of said tubular machine frame and including a shaft extending through a portion of said machine frame, motor means mounted on said machine frame and drivingly engaging said shaft for rotating said shaft and the tunnel driving tool, a first fluid cylinder and piston combination connected between said machine frame and said rear bracing means for moving said rear bracing means relatively in respect to said machine frame and said bracing means is disengaged from said tunnel, and a second fluid piston and cylinder combination connected between said carrier frame and said front bracing means for displacing said front bracing means relative to said tubular portion of said machine frame when said front bracing means is disengaged from the tunnel.