United States Patent

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[33] **Sweden**
[31] **9070/68**

[54] METHOD AND TRACK SECTION FOR LAYING TRACK IN TUNNEL DRIVING

4 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** ..... **104/3,** 61/84, 238/10 R

[51] **Int. Cl.** **E01g 3/00,** E01g 3/06, E01b 29/00

[50] **Field of Search** ..... 61/84, 85; 104/1–6; 238/6, 10 R

[56] **References Cited**

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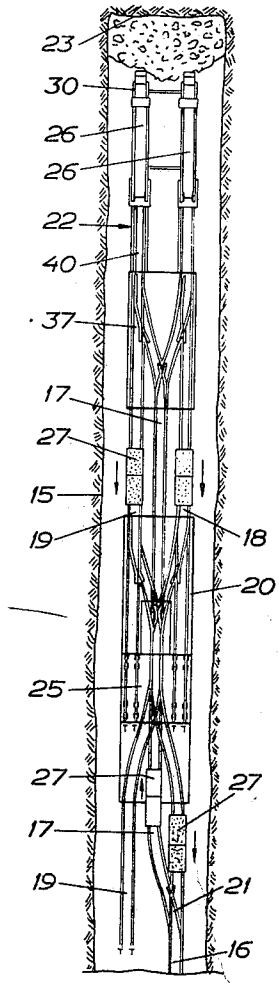
ABSTRACT: A track section for laying a trackway during tunnel boring to provide support for equipment to be advanced as the tunnel progresses, which is longitudinally and slidably supported at the forward and rear end subsections thereof, respectively, on the tunnel floor in front of the tunnel haulage tracks and on said tracks. The track section is advanced slidably as a whole by application of hydraulic power jacks between the forward end section and the tunnel haulage tracks. Upon advancement, the tunnel haulage tracks are extended by laying additional tracks on the tunnel floor underlying the intermediate subsection. The track portions of the intermediate subsection may be swung up for increasing the accessibility to the underlaying tunnel floor during tracklaying.



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2 Sheets-Sheet 1

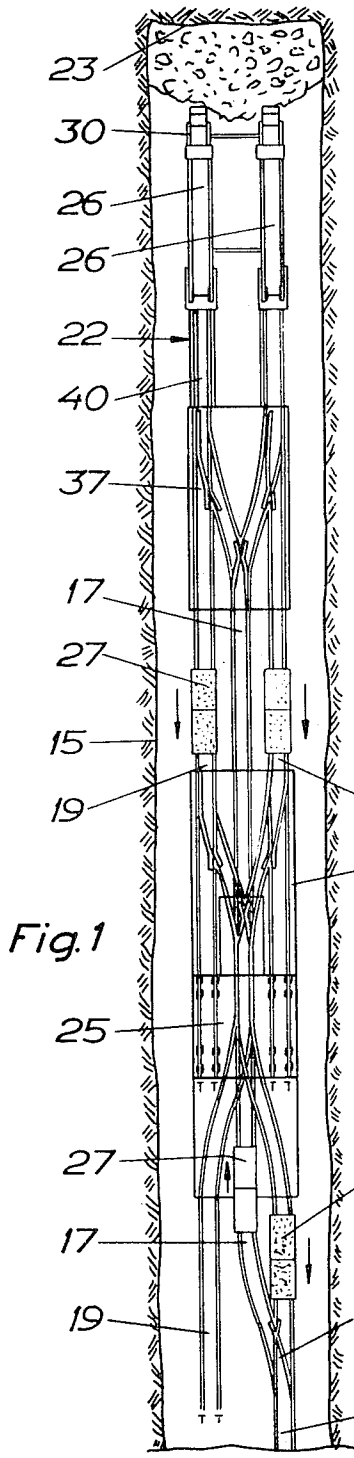

Fig. 1

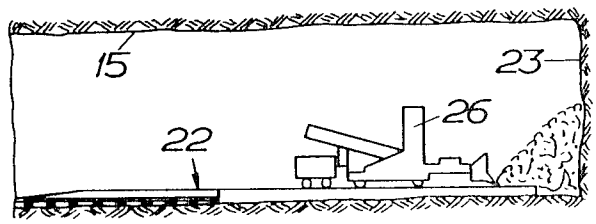

Fig. 2a

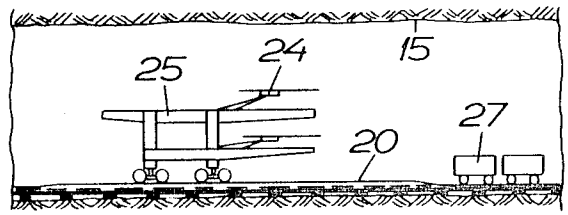

Fig. 2b

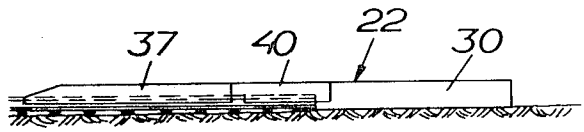

Fig. 3

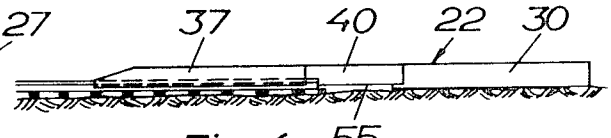

Fig. 4

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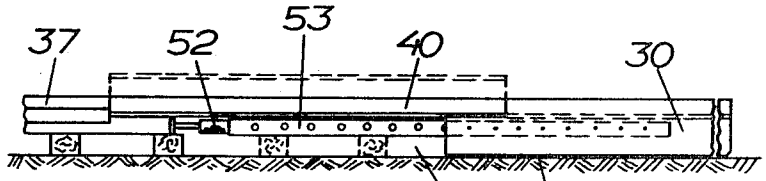
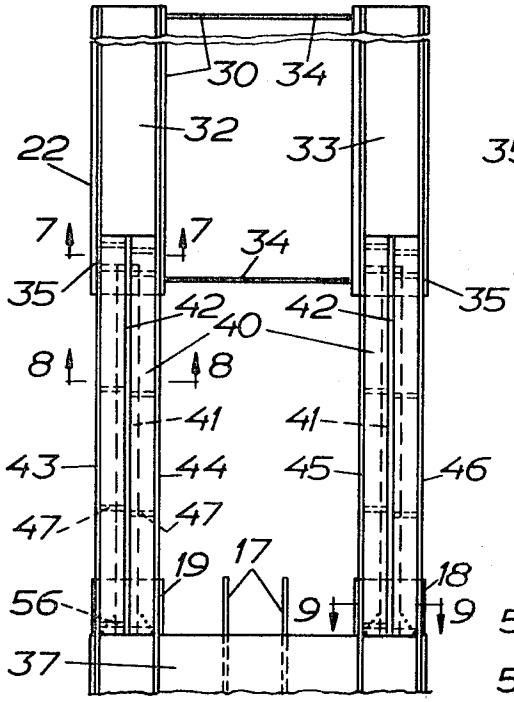


Fig.5

Fig.6



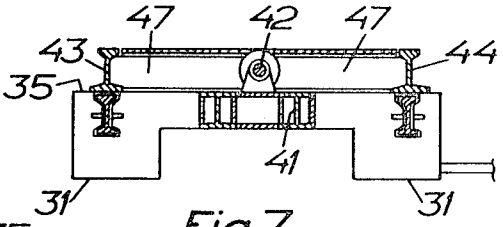


Fig.7

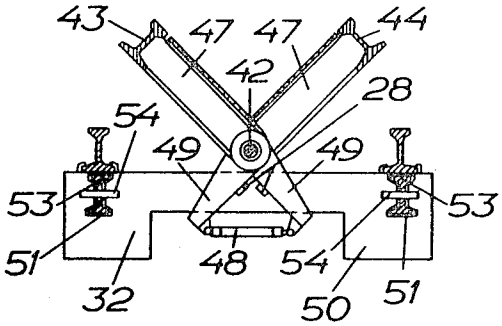


Fig.8

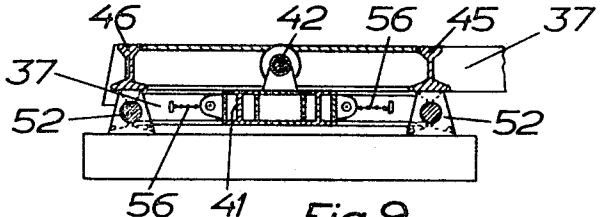


Fig.9

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METHOD AND TRACK SECTION FOR LAYING TRACK IN TUNNEL DRIVING

This invention relates to a method for laying a track way during boring and to a track section to be used in connection with the track laying method in question. More particularly the instant method and track section is intended for tunnel boring by means of track supported equipment such as drilling units mounted on a drill wagon, at least one loading machine, and muck cars. In the tunnel boring process this equipment is moved along track portions connected with the tunnel haulage tracks to and from working position on the track section. Heretofore, considerable time losses have arisen in connection with tracklaying, which is performed at regularly repeated intervals subsequent to loading and hauling out of the tunnel of dislodged material by advancing the tunnel haulage tracks a distance corresponding to the progress of the tunnel reached per round of blast. By reason of the tracklaying operations, work at the tunnel head is usually more or less prevented. A somewhat better utilization of the tracklaying time may be had in connection with the use of auxiliary advanceable track sections. In a prior such solution, the drill wagon and the loading machines of the equipment are permanently disposed on the track section which is composed by track units adapted for advancement and subsequent retraction relative to one another by hydraulic equipment. This heavy equipment requires that the drill wagon and the loading machines be shuttled as loading weights to and fro between the various track units during their advancement an auxiliary shuttling track has to be added and removed with resultant time losses.

It is therefore an object of the invention to reduce the time losses during tunnel driving in connection with tracklaying and to provide a track section which makes possible such saving of time which, has simple and relatively lightweight design, and is adapted for advancement by application of simple hydraulic pushing jacks directly against the tunnel tracks.

In order to accomplish the aforementioned objects one aspect of the invention contemplates a method for laying track during tunnel boring whereby track supported equipment and an advanceable track section therefore are utilized and along which track section said equipment, which comprises drilling units mounted on a drill wagon, at least one loading machine, and muck cars, is moved along track portions connected to the tunnel haulage tracks to and from working position on the track section at the tunnel head, said method comprising the steps of supporting said track section longitudinally displaceably at the forward and rear end subsections thereof, respectively, on the tunnel floor in front of the tunnel haulage tracks and on the tunnel tracks, advancing said track section as a whole relative to the tunnel haulage tracks so as to expose a portion of the tunnel floor under the intermediate subsection of said track section ahead of the tunnel haulage tracks, moving said drilling units forward to working position at the tunnel face and extending said tunnel haulage tracks in forward direction by laying additional track on the tunnel floor under said intermediate portion while simultaneously working said drilling units at the tunnel head.

According to another aspect of the invention there is provided a track section for laying track during tunnel boring wherein track supported equipment is used and in which said track section is advanceable relative to the tunnel haulage tracks towards the tunnel head and includes track portions connected to said tunnel haulage tracks for movement of said equipment to and from working position on said track section at the tunnel head, said track section comprising the following longitudinally fixedly interconnected parts

a. a front supporting frame resting on the tunnel floor in front of the tunnel haulage tracks, and including track portions disposed on a higher level above the tunnel floor than said tunnel haulage tracks,

b. an intermediate subsection carried by said supporting frame and including track portions disposed on said higher level such as to rest slidably on said tunnel haulage tracks and to connect with said track portions of said supporting frame,

c. a transfer subsection resting on said tunnel haulage tracks and including track portions connecting the track portions of said intermediate subsection with said tunnel haulage tracks for movement of said equipment therebetween, and means for advancing said track section as a whole relative to said tunnel haulage tracks thereby to open a tracklaying space on the tunnel floor between said carrying frame and said tunnel haulage tracks and underlying said intermediate subsection when said track section has been advanced relative to said tunnel haulage tracks.

The above and other purposes of the invention will become obvious from the following description and from the accompanying drawings in which an embodiment of the invention is illustrated by way of example. It should be understood that this embodiment is only illustrative of the invention and that various modifications thereof may be made within the scope of the claims.

In the drawings,

FIG. 1 shows a top view and section of the forward end of a tunnel in which is applied a track section according to the invention.

FIG. 2*a* and 2*b* are fragmentary vertical sections through the tunnel part in FIG. 1 with the devices therein shown in side view.

FIG. 3 shows a side view of the track section before advancement.

FIG. 4 shows the track section in FIG. 3 having been advanced a distance corresponding to the advance per round of shots.

FIG. 5 shows a fragmentary enlarged side view corresponding to FIG. 4 during the process of advancement.

FIG. 6 is a fragmentary top view of the track section in FIG. 5.

FIG. 7 is an enlarged section on the line 7—7 in FIG. 6.

FIG. 8 shows a section on the line 8—8 in FIG. 6 with the track portions on the intermediate subsection of the track section swung up for tracklaying purposes.

FIG. 9, finally, is a section on the line 9—9 in FIG. 6.

In the tunnel **15** the tunnel haulage tracks consist of a single haulage track **16** which at the forward end of the tunnel is connected with triple tracks laid on the tunnel floor and comprising a central track **17** and two side tracks **18, 19**. On the tunnel tracks **17–19** rests extensibly and slidably a triple tracked switch part **20** for cross connecting the portions of the side tracks **18, 19** in front of and behind the switch part **20** and for connecting them to the corresponding parts of the central track **17**. The haulage track **16** is via a switch **21** connected with the central track **17** and with the side track **18**.

On the tunnel floor in front of the tunnel haulage tracks **17–19** rests extensibly a track section, generally designated by **22**, which is adapted to advance towards the tunnel head **23** and carries track portions connected with the tunnel tracks **17–19** and intended for movement of the equipment used for the tunnel boring from the tunnel tracks to working position on the forward end of the track section **22** at the tunnel head. The equipment in question consists of conventional drilling units **24** for example drill booms carried by a drill wagon designed as a portal and moving along the four rails included in the side tracks **18, 19**. Furthermore, there are used at least one and preferably two conventional loading machines **26** with conveyors for loading muck cars **27** moved forward to the track section **22**.

The track section **22**, FIG. 6, consists of a forward supporting frame **30** which by means of skids **31** rests on the tunnel floor and consists of two rail portions **32, 33** kept together by a suitable number of cross girders **34**. The rails of the track portions **32, 33** are disposed on a higher level than the rails of the tunnel tracks **17–19**.

The track section **22** furthermore consists of a rear transfer subsection **37** which is designed as a switch part. The transfer subsection **37** has track portions which connect the track portions **32, 33** of the supporting frame **30** with the respective side tracks **18, 19** or with the central track **17**. The forward

end of the transfer subsection 37 has its track portions level with the track portions 32, 33 of the supporting frame 30 while the rearward portion thereof connects with the level of the tunnel tracks 17, 19. The transfer subsection 37 rests slidably on the tunnel haulage tracks 17–19.

The track section 22 has rearwardly thereon supporting planes 35 aligned with the track portions 32, 33 from which planes 35 an intermediate subsection 40 extends rearwardly and connects the supporting frame 30 with the transfer subsection 37. To this end the intermediate subsection 40 includes longitudinal girders 41 which are affixed to the track portions 32, 33 of the supporting frame 30 level with the tunnel tracks and extend rearwardly to the forward ends of the side tracks 18, 19 where they are connected by means of chains 56 to the forward edge of the transfer subsection 37. Longitudinal axles 42 extend between the supporting frame 30 and the transfer subsection 37 and are supported on the girders 41 in the central plane of the track portions 32, 33. In the intermediate subsection 40 are furthermore included track portions consisting of rails 43, 44, 45, 46 connected with the rails of the track sections 32, 33 and resting on the support plane 35 and on the furthermost portion of the side tracks 18, 19 and which by means of transverse arms 47 are individually swingably journaled on the axles 42. In each of the two track portions formed by the rails 43, 44 and 45, 46, respectively, two of the transverse arms 47 are extended past the axle 42 by an arm 49 and between the arms 49 is coupled a hydraulically actuated maneuvering cylinder 48. At contraction of the maneuvering cylinder the arms 49 are moved together against abutments 28 on the rear ends of the track portions 32, 33, at which instant the transverse arms 47 and the rails 43, 44 and 45, 46, respectively, are swung up from the position depicted in FIG. 7 to the position in FIG. 8 and are then movable back against the supporting planes 35 when the maneuvering cylinder 48 is extended.

The rear end faces 50 of the supporting frame 30 rearwardly of the track portions 32, 33 are provided with channels 51 for extension girders 53 of a pair of hydraulic jacks 52, the extension girders 53, FIG. 5 being provided with a plurality of transverse longitudinally spaced anchoring holes. The channels 51 are disposed each below one of the rails 43–46, and with the extension girders 53 passing through channels 51, the four power jacks 52 can be braced against the ends of the rails on the side tracks 18, 19. The extension girders 53 are anchored to the end faces 50 of the supporting frame 30 by cross pins 54 inserted into one of the anchoring holes in the extension girders 53. By extension of the hydraulic jacks 52, the supporting frame 30 thus can be advanced, which means that the track section 22 as a whole is advanced stepwise with respect to the tunnel tracks by using the working stroke of the hydraulic jacks 52 and one anchoring hole after the other in the extension girders 53.

During haulage of dislodge material from the tunnel, the drill wagon 25 with the drilling units 24 stands on the switch part 20 and empty cars 27 are moved forward from the track 16 via the switch 21 and the central track 17 to the loading machines 26 working on the track section 22 at the tunnel head. Loaded muck cars are moved back from the track portions 32, 33 and the rails 43, 44 and 45, 46, respectively, via the transfer subsection 37 to the side tracks 18, 19 and, via the central track of the switch part 20, away through the portal of the drill wagon 25 via the switch 21 and the rearmost part of the side track 18 to the haulage track 16. When haulage is finished, the loading machines 26 are moved back via the central track 17 and the switch part 20 to the rearmost part of the side track 19. Subsequently the track section 22 is advanced into the space made free by the loading in front of the tunnel face 23. The advancement is made by means of the power jacks 52 and the extension girders 53 as described above. The loading machines 26 may be driven forward immediately behind the transfer subsection 37 for weighting down the foremost rails of the tunnel haulage tracks 18, 19. As depicted in FIG. 5, during advancement a space 55 underlying the intermediate subsection 40 becomes exposed. With the advancement terminated, the rails 43–46 of the intermediate subsection 40 are resting against the tunnel floor by means of ties. This may be facilitated by swinging up and subsequent felling down of the rails 43–46 by the aid of the maneuvering cylinders 48. Thereupon the drill wagon 25 is moved forward via the track portions of track section 22 to working position for drilling at the tunnel head 23. Tracklaying for advancing the tunnel tracks 17–19 is performed while drilling is in progress and this operation is thus performed without time loss while the main working cycle is running. Track is laid in the space 55 cleared from the ties under the rails 43–46 of the intermediate subsection 40. Simultaneously the track portions of the intermediate subsection 40 consisting of the rails 43–46 are swung up about the axles 42 by means of the maneuvering cylinders 48. Obviously such swinging up may be abandoned and track may be laid directly below the intermediate subsection 40, the swinging up, however, offering more convenience.

The longitudinal girders 41 included in the intermediate subsection 40 can in case of need be anchored to the transfer part 37 by means of chains 56 of adjustable length in order to introduce an angular deviation between on the one hand the supporting frame 30 and on the other the parts resting on the tunnel tracks during advancement, that is to say the intermediate subsection 40 and the transfer subsection 37.

As an alternative there may in small single haulage track tunnels be used but a single loading machine at the tunnel face. In such case the supporting frame and intermediate subsection will, of course, be single tracked and the transfer subsection will be made as a double switch slidably straddling the main haulage track and representing the only multitracked element in the system.

I claim:

1. A track section for laying track during tunnel boring wherein track-bound equipment is used and in which said track section is advanceable relative to the tunnel haulage tracks towards the tunnel face and includes track portions connected with said tunnel haulage tracks for movement of said equipment to and from working position on said track section at the tunnel face, said track section comprising the following longitudinally fixedly interconnected parts

a. a front supporting frame resting on the tunnel floor in front of the tunnel haulage tracks, and including track portions disposed on a higher level above the tunnel floor than said tunnel haulage tracks,

b. an intermediate subsection carried by said supporting frame and including track portions disposed on said higher level, so as to rest slidably on said tunnel haulage tracks and to connect with said track portions of said supporting frame,

c. a transfer subsection resting on said tunnel haulage tracks and including track portions connecting the track portions of said intermediate subsection with said tunnel haulage tracks for movement of said equipment therebetween, and

d. means for advancing said track section as a whole relative to said tunnel haulage tracks thereby to open a tracklaying space on the tunnel floor between said carrying frame and said tunnel haulage track and underlying said intermediate subsection when said track section has been advanced relative to said tunnel haulage tracks.

2. A track section according to claim 1 in which there are provided axles on said intermediate subsection parallel with said track portions thereof, and means for mounting said track portions of said intermediate subsection swingably on said axles for swinging movement transversely of said intermediate subsection.

3. A track section according to claim 2 in which said track sections of said intermediate subsection are rails individually swingably mounted on said axles, transverse arms pivotally journaled on said axles and connected to said rails for mounting them thus, and hydraulic cylinder means connected to said arms for selectively swinging up and felling down said rails by power.

4. A track section according to claim 1, in which said advancing means are hydraulic power jacks insertable between said supporting frame and said tunnel haulage tracks for forward advancement of said track section relative to said tracks.

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