W. W. GIGGEY.

TUNNELING MACHINE.

APPLICATION FILED MAR. 13, 1912.

1,140,673.

Patented May 25, 1915.

4 SHEETS—SHEET 1.

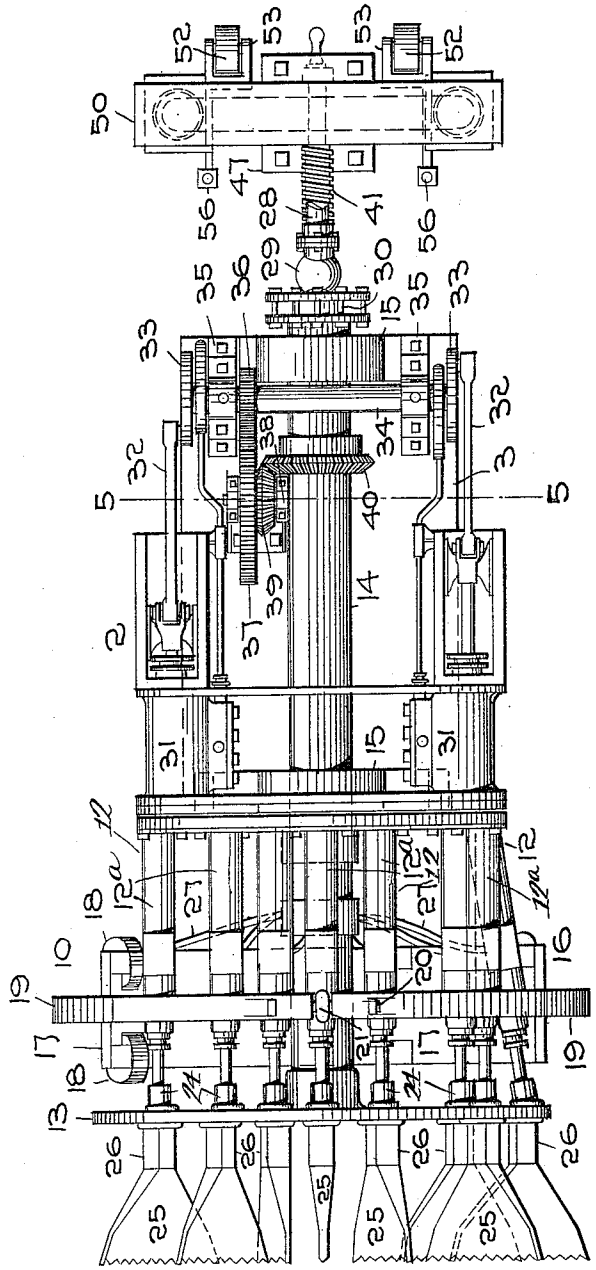


FIG. 1

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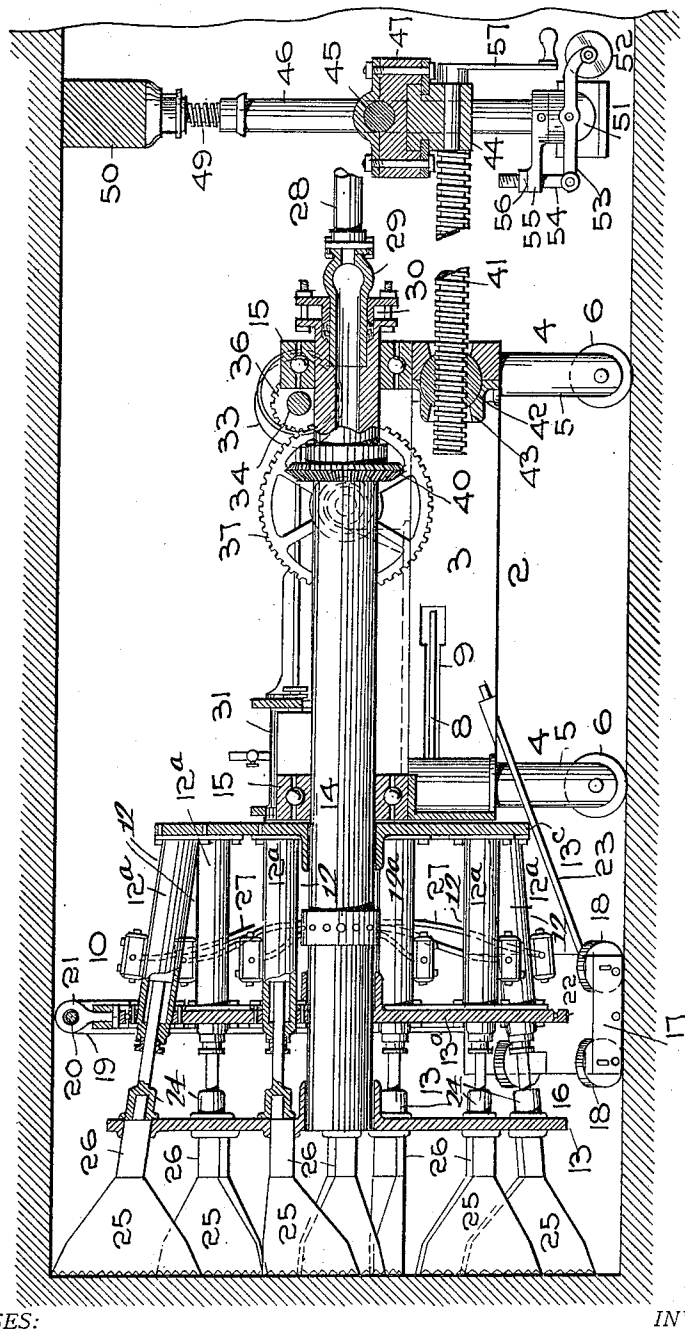


FIG. 2

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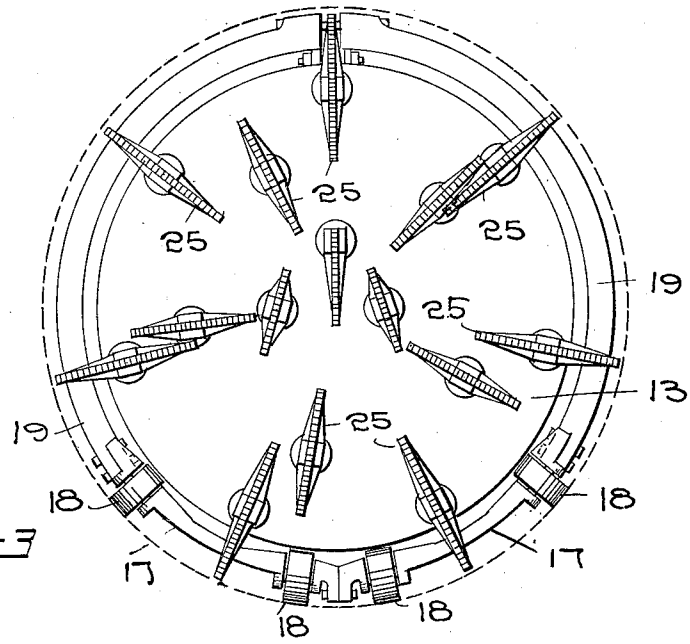


FIG. 3

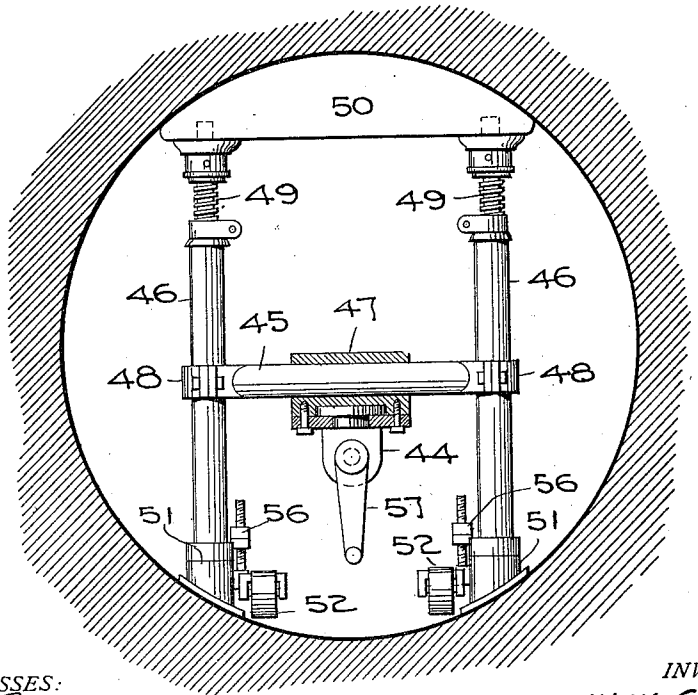


FIG. 4

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TUNNELING MACHINE.

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4 SHEETS—SHEET 4.

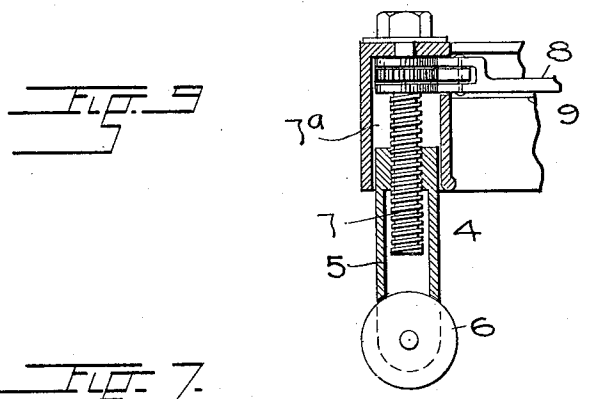


FIG. 9.

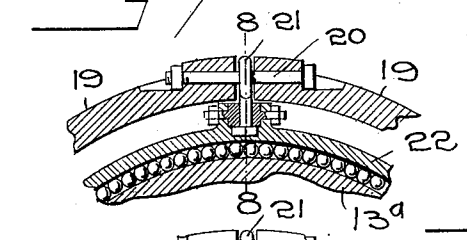


FIG. 7.

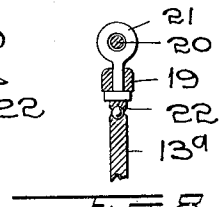


FIG. 8.

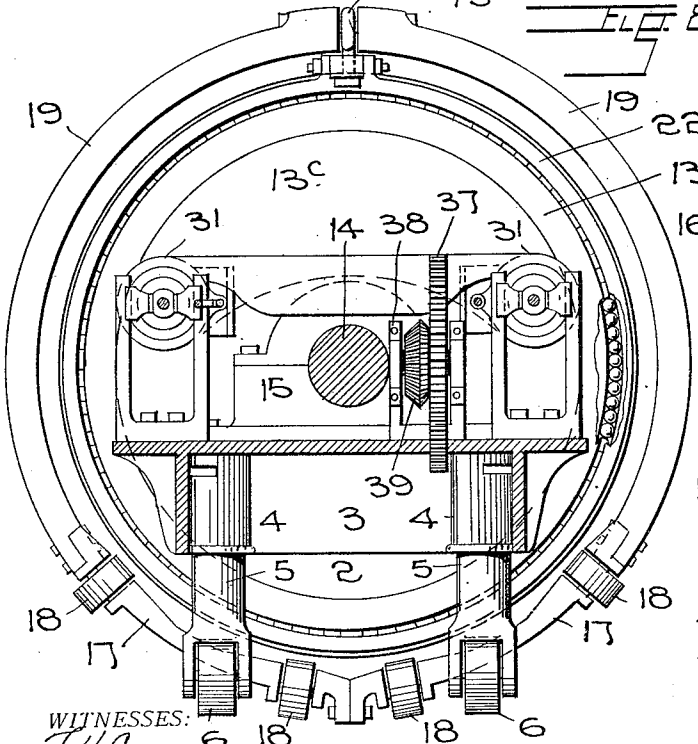


FIG. 1.

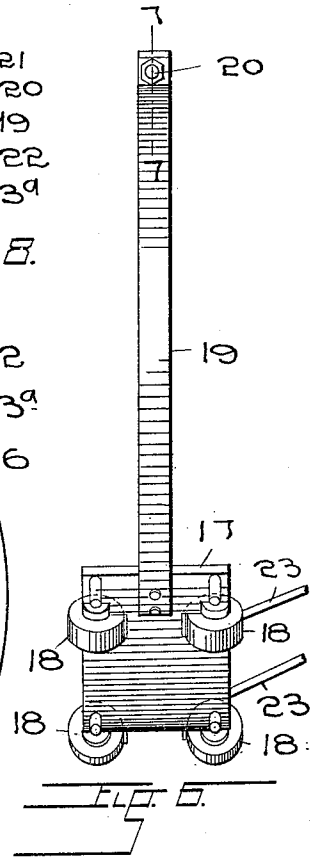


FIG. 6.

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UNITED STATES PATENT OFFICE.

WALTER W. GIGGEY, OF NETHERLAND, COLORADO.

TUNNELING-MACHINE.

1,140,673. Specification of Letters Patent. Patented May 25, 1915.

Application filed March 13, 1912. Serial No. 683,520.

To all whom it may concern:

Be it known that I, WALTER W. GIGGEY, a citizen of the United States, residing at Netherland, in the county of Boulder and State of Colorado, have invented certain new and useful Improvements in Tunneling-Machines, of which the following is a specification.

This invention relates to new and useful improvements in tunneling-machines and more especially in the class of machines in which a plurality of reciprocating hammers have a percussive action upon the rock which it is desired to penetrate.

The invention has for its object to provide an apparatus of the class named in which simplicity of construction is combined with durability and thorough practicability in use and which, to this end, consists of the features hereinafter described, all of which will be fully understood by reference to the accompanying drawings in the various views of which like parts are similarly designated and in which,

Figure 1 represents a plan view of my improved apparatus, Fig. 2 a central, vertical, longitudinal section thereof, partly in elevation, Fig. 3, a face view of the revoluble head included in the construction, and the thereon arranged percussion hammers, Fig. 4, a cross-sectional view of the tunnel, showing the structure which supports the screw by means of which the machine is advanced into the bore, Fig. 5, an enlarged transverse section taken along the line 5—5, Fig. 1, Fig. 6, a side elevation of the bearing which supports the revoluble head of the machine, Fig. 7, a fragmentary section along the line 7—7, Fig. 6, Fig. 8, a section taken along the line 8—8 Fig. 7, and Fig. 9, a vertical sectional view of one of the adjusting supports of the carrying truck.

Referring to the drawings by numerals, the carrying truck 2 is composed of a rectangular frame 3 which is vertically adjustably mounted upon four supports 4. The latter, which are best shown in Fig. 9 of the drawings, consist each of a hollow, cylindrical pedestal 5 which is formed in its upper extremity with an internal screw-thread for the reception of an adjusting screw 7 which is rotatably suspended from the frame 3. The pedestals 5 which are supported upon revoluble wheels 6, project with their upper extremities, into correspondingly shaped sockets 7^a which are formed in the frame 3, and the screws 7 are operatively associated with hand-levers 8, by means of a ratchet and pawl movement in a manner similar to that of the ordinary jack-screw. The operating levers 8 on the four supports extend normally in slots 9 cut in the sides of the frame 3 where they are accessible, when it is desired to elevate all or part of the frame and the thereon supported operating mechanism.

The hammer-head 10, which carries the drills 12 by means of which the rock is disintegrated, consists of three parallel disks 13, 13^a and 13^c which are firmly secured upon the end of a horizontal, hollow shaft 14, which is revolubly mounted in journal bearings 15 upon the truck 2. The head 10 is furthermore supported upon a carrier 16, which consists of two segmental plates 17, which are joined below the head 10 and which, in practice, are movably supported upon the floor of the tunnel by means of revoluble wheels 18. The upper ends of the plates 17 connect with the lower extremities of two segmental arms 19 whose upper ends terminate in adjacency to each other above the head and are connected by means of a bolt 20. Suspended from the last named member by means of an eye bolt 21 is a ring 22 which concentrically surrounds the middle disk 13^c and is formed in its inner surface, with a ball run for the reception of anti-friction balls which engage the concave outer edge of the disk 13^a. The carrier 16, which in the above described manner serves to relieve the bearings 15 of the greater part of the wearing strain caused by the weight of the head 10, is rigidly connected with the truck 2 by means of anchor-bolts 23, whose extremities are secured in lugs on the segmental plates 17.

The pneumatic drills 12, are each composed of a cylindrical housing 12^a in which a piston has a reciprocating movement and which is rigidly secured to the disks 13^c and 13^a. The piston rods which protrude beyond the extremities of the housings 12^a, terminate in chucks 24 which serve to connect the percussion hammers 25, whose angular shanks 26, project through corresponding openings in the foremost disk 13. The various drills 12 are arranged on the head so that the centers of their chucks are disposed in circular concentric series, and the hammers, whose serrated working faces are oblong, are secured in the respective chucks

so that those comprised in one series, overlap those in the adjoining ones. The motive fluid by which the drills are actuated is conducted thereto through flexible conduits 27 which communicate with the bore of the hollow shaft 14 and the latter is connected with the source from which the said fluid is derived, by means of a pipe 28 whose head 29 revolubly projects through a stuffing box 30 at the extremity of the shaft.

Mounted upon the truck 2 is a duplex, reciprocating engine the cylinders 31 of which are arranged at its foremost end, on opposite sides of and in parallel relation to the shaft 14 and whose pistons connect, by means of pitmen 32, with wrist pins of crank-wheels 33 at the extremities of a driving shaft 34 which is mounted transversely of the frame 3, in journal bearings 35. The rotative movement of the driving shaft is transmitted to the longitudinal shaft 14 by means of a pinion 36 which meshes with a spur-wheel 37, which being supported in bearings 38, carries a bevel gear-wheel 39 which operatively engages a similar wheel 40 on the shaft 14.

In operation, the truck is advanced into the tunnel as rapidly as the breast of the latter is disintegrated by the action of the hammers, through the instrumentality of a feed-screw 41, one extremity of which projects through a spherical nut 42 which has a universal movement in a correspondingly shaped socket 43 at the rearmost end of the frame 3 of the truck. The opposite extremity of the screw 41 is revolubly supported and held against longitudinal movement in a journal box 44, connected by a swivel-joint, with a block 47 which is clamped upon a horizontal bar 45 whose extremities are adjustably secured, by means of clamps 48, to two upright columns 46. A crank 57, secured upon the protruding extremity of the feed-screw, affords means to manually impart motion thereto. The columns 46 are provided at their lower extremities with feet 51 which are formed to correspond with the curvature of the tunnel, and their upper extremities have threaded openings for the reception of correspondingly threaded adjusting screws 49. The capped upper extremities of the screws 49 are connected by a transverse beam 50 whose upper surface is curved to fit the bore of the tunnel and which, when brought in engagement therewith through the instrumentality of the said screws, serves to rigidly secure the structure in its adjusted position. When, during the operation of the apparatus, the limit of the feed screw has been reached, the supporting structure is loosened by turning the screws 49 in a direction opposite to that of their pitch, after which it is conveyed to a point in proximity to the rear end of the truck, where it is again installed in the manner herein before described. To facilitate the moving of the connected columns from one point of the tunnel to the other, I have provided wheels 52, which are revolubly mounted upon extremities of levers 53, which are fulcrumed upon the columns 46, adjacent their feet and whose opposite arms are engaged by adjusting bolts 54 which extend loosely through apertures in arms 55 projecting from the columns.

To move the supporting structure, the beam is disengaged from the surface of the bore as above described and the wheels 52, which normally extend above the floor of the tunnel, are lowered by manipulation of nuts 56 on the bolts 54, until by engagement with the said floor, they have elevated the structure sufficiently to permit its transportation.

Having thus described the mechanical construction of my invention, its operation will be readily understood.

The motive fluid, preferably air under compression, being introduced through the conduit 28 into the bore of the shaft 14, flows into the various drill housings at the head of the machine and, by its action upon the driving mechanisms of the drills, which it will be understood may be of any suitable construction, imparts a longitudinal vibratory movement to the hammers 25. The duplex engine mounted upon the truck frame 3 is simultaneously actuated by the introduction of motive fluid into the valve chests of the cylinders 31, and the reciprocating movement of the pistons contained therein, is transposed into a rotary motion of the shaft 14 and the therewith connected head 10, in their respective bearings through the instrumentality of the gearing herein before described. While the head 10 revolves, the vibratory hammers will, by reason of their peculiar arrangement, disintegrate the rock upon which they impinge in concentric, overlapping circles and thus produce a cylindrical bore, the diameter of which equals the distance between the outer ends of opposite hammers in the outermost series on the head. At the beginning of the operation and up to the time that the bore is sufficiently deep to permit the placing of the columns 46 which support the feed screw, the truck 2 may be advanced and held in engagement with the breast of the tunnel by any suitable means but, after the columns have been installed in the manner illustrated in Fig. 2, the apparatus is propelled by manipulation of the crank 57 at the end of the feed-screw 41.

The universally movable nut 42 on the frame 3 in coöperation with the swiveled box 44 in which the screw 41 is supported, will effectively prevent binding of the latter in its bearings and at the same time obviate the necessity of careful adjustment of

the supporting structure, while, by regulation of the adjustable supports 4, the frame 3 of the truck 2 may be placed at any selected elevation or angle of inclination, for the purpose of directing the head 10 in accordance with the proposed direction of the tunnel.

It should be understood that while I have shown and described my invention in the best form now known to me, various changes in the form, proportion and arrangement of the parts comprised in the construction, may be resorted to without departing from the principle of this invention.

I am aware that it is old to cut the breast of a tunnel in concentric, overlapping circles by the use of vibratory hammers, and I do not claim this feature broadly, but

What I do claim and desire to secure by Letters-Patent is:

1. In a tunneling machine, the combination with a carrying truck, of a wheeled carrier independently supported in advance thereof, a bearing suspended from the said carrier, a shaft rotatably supported upon the truck, a head on said shaft supported within the said bearing, and a plurality of reciprocating hammers on said head.

2. In a tunneling machine, the combination with a carrying truck, of a carrier independently supported in advance thereof and comprising a circular member having surface wheels and a ball bearing ring suspended therein, a shaft rotatably supported upon the truck, a head rotatably supported upon balls within the said ring, and a plurality of reciprocating hammers on said head.

In testimony whereof I have affixed my signature in presence of two witnesses.

WALTER W. GIGGEY.

Witnesses:

JOHN R. WOLFF,

E. A. LATORRA.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."