

J. N. BACK.
TUNNEL EXCAVATING MACHINE.
APPLICATION FILED NOV. 3, 1910.

1,011,712.

Patented Dec. 12, 1911.

2 SHEETS-SHEET 1.

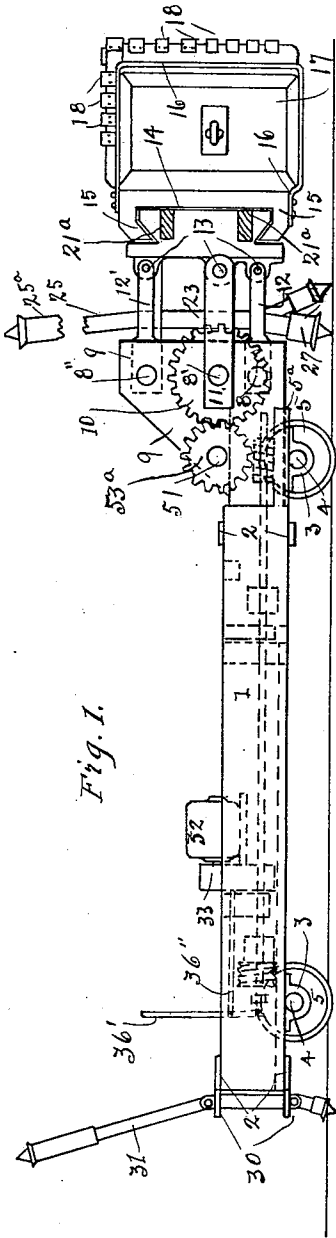


Fig. 1.

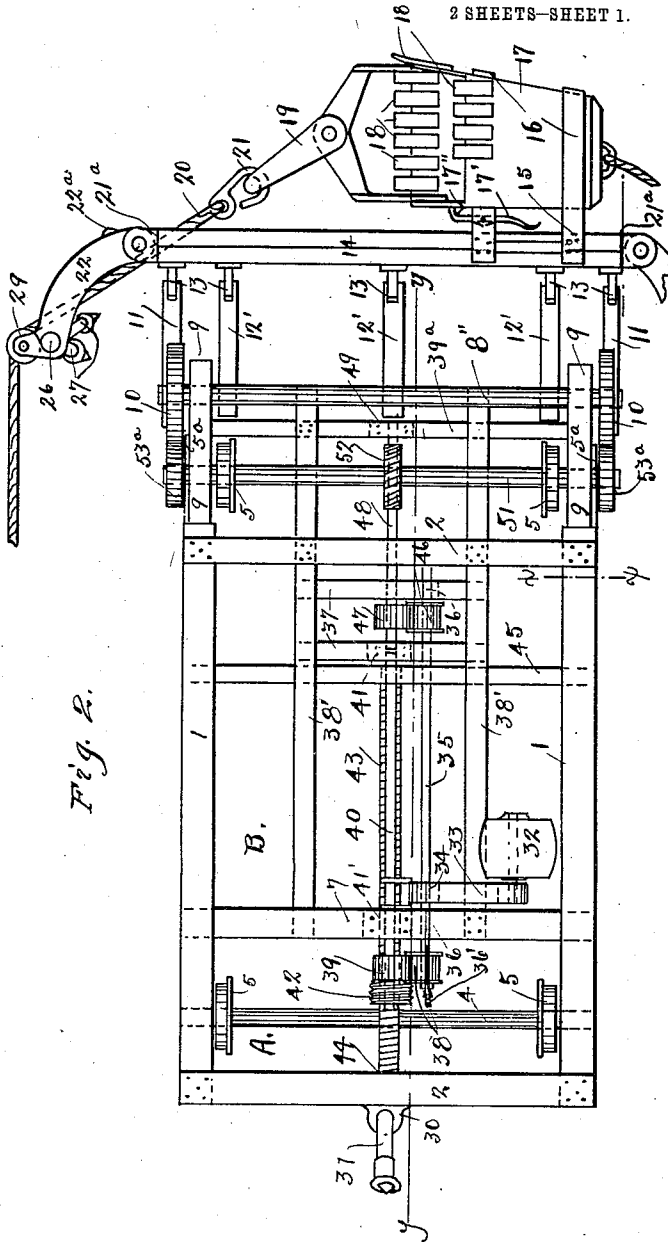


Fig. 2.

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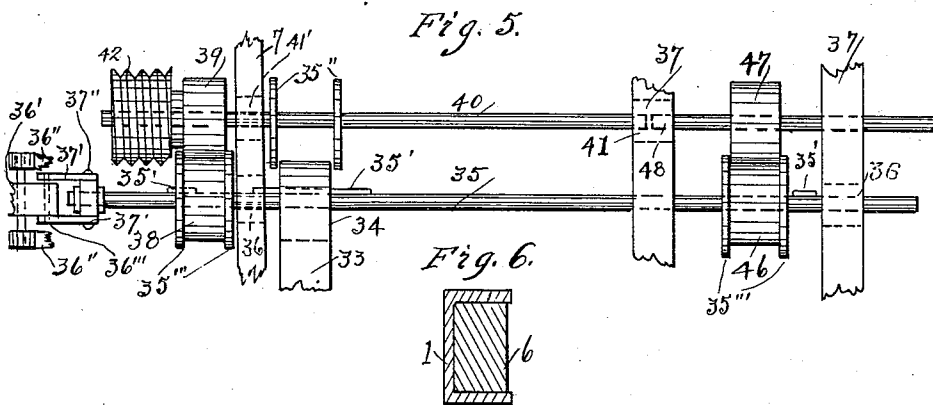
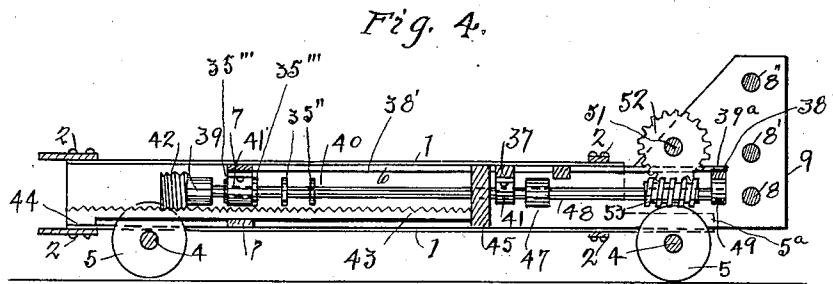
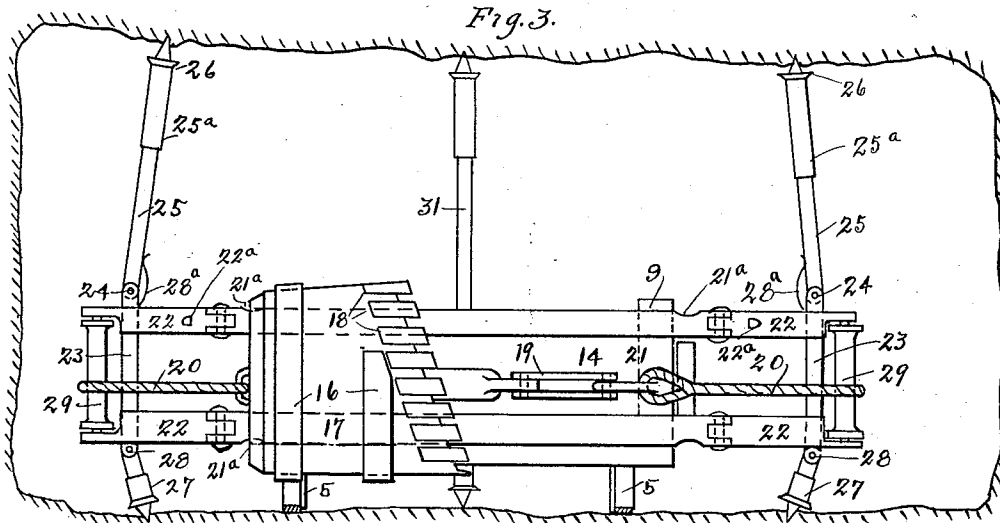
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UNITED STATES PATENT OFFICE.

JOHN NELS BACK, OF SEATTLE, WASHINGTON.

TUNNEL-EXCAVATING MACHINE.

1,011,712.

Specification of Letters Patent.

Patented Dec. 12, 1911.

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To all whom it may concern:

Be it known that I, JOHN NELS BACK, a citizen of the United States, and a resident of Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Tunnel-Excavating Machines, of which the following is a true and full specification.

The principal object of my invention is to provide a machine of this character of great power but not necessarily of great weight, having quickly adjustable bracing means to prevent movement of the machine during the process of excavating, and which can be successfully operated within the narrow limits of tunnels or drifts of mines.

Referring to the accompanying drawings, Figure 1 is a side elevation of my device, the pivoted arms being removed from the head beam. Fig. 2, a plan view, the operating cable and one set of the pivoted arms upon the head beam broken away. Fig. 3, a front elevation, the outline of the drift or tunnel showing in cross section. Fig. 4, a longitudinal sectional view upon the line $y-y$ of Fig. 2, some of the parts being omitted at the forward end. Fig. 5, an enlarged detail view of the power transmission gearing and clutch mechanism, with parts broken away. Fig. 6, a cross sectional view upon the line $x-x$ of Fig. 2.

The outer frame A of the machine is formed of the two parallel channel irons 1, secured together at their ends by the cross pieces 2, riveted as shown, at the four corners of the rectangular frame thus formed. Upon the under side of the channel irons 1 are the extensions 3 in which are journaled the axles 4 having the traction wheels 5, the lower edges of the channel irons 1 being extended at their forward ends as at 5^a. Slidably mounted within the channel irons 1 are the parallel side bars 6 which have their rear ends rigidly secured together by the cross pieces 7, and their forward ends secured together by the shafts 8, 8' and 8'' which shafts pass through and are rigidly secured to the enlarged upwardly extending portions 9 of the side bars 6, thus forming the rectangular inner frame B, which slides in the outer frame A first described, in the direction of its length. Upon the projecting ends of the shaft 8' are revolvably mounted the gear wheels 10 having rigidly secured to them the links 11. Upon the outer ends of the shafts 8 and 8''

are pivoted the rear ends of the links 12 and 12'. The forward ends of all the links, 11, 12 and 12' are pivotally connected at 13 to the head beam 14, upon which slides the carrier 15, to which carrier is secured the arms 16 which embrace the shovel 17 having the teeth 18 upon its forward cutting edges, and the link 19 to which is attached the cable 20, by means of the hook 21. The shovel 17 is held in the carrier 15 by the latch 17', pivoted upon the carrier 15 and which coöperates with the projection 17'' upon the side of the shovel 17. At each end of the head beam 14 are the extensions 21^a, upon which are pivoted the arms 22, having the projections 22^a. Through the arms 22 loosely pass the rods 23 to the upper ends of which are pivoted, at 24, the extensions 25, upon which are sleeved the tubes 25^a, terminating in the points, as shown, and having the foils 26. See Figs. 2 and 3. The internal diameter of the tubes 25^a is threaded to fit the extensions 25 so as to permit of longitudinal adjustment. From the lower ends of the rods 23 swing the legs 27, upon the pivots 28. The springs 28^a are secured to the rods 23 and press upon the extensions 25, for a purpose presently to appear. Between the free ends of the arms 22 are mounted the rollers 29, over which passes the cable 20. The extensions 30 are provided at the rear of the outer frame A, through which loosely passes the toggle brace 31 of the same description, substantially, as the braces carried by the arms 22 just described. Mounted upon the inner frame B is the motor 32, connected by the belt 33 to the pulley 34 which is keyed to the shaft 35, mounted in the bearings 36, one of which bearings is secured to the cross piece 37 and the other to the cross piece 7 at the rear end of the inner frame B. The cross pieces 37 are secured to the stringers 38', which are in turn secured to the rear end 7 of the inner frame B from which they extend forwardly and are secured to the cross piece 39^a. Upon one end of the shaft 35 is keyed the pinion 38, which meshes with the pinion 39, secured to the shaft 40, which shaft is revolvably mounted in the bearings 41 and 41' upon the rear end of the inner frame B and one of the cross pieces 37 respectively. To the rear end of the shaft 40 is secured the worm gear 42 which engages the rack 43, secured at 44 to the cross piece 2 of the outer frame A,

at one end, its opposite end being secured to the cross piece 45 which extends across from one to the other of the channel irons 1. Keyed to the forward end of the shaft 35 is the pinion 46, which meshes with the pinion 47 secured to the shaft 48, one end of which shaft turns in the bearing 41, its opposite end turning in the bearing 49 upon the cross piece 39^a. The shaft 35 is movable longitudinally in its bearings 36, the pinions 38 and 46 and the pulley 34 being keyed thereto by the keys 35', the washers 35'' upon the shaft 40 holding the pulley 34 in place as the shaft 35 is shifted, the flanges 35''' upon the pinions 38 and 46 holding them in place during the shifting of the shaft 35. To conveniently shift the shaft 35 I provide the lever 36' which is pivoted in the bearing 36'' secured to the rear end 7 of the inner frame B. The lower end of the lever 36' is pivotally connected at 36''' to the links 37' pivotally connected to the cross head 37'', through which passes the end of the shaft 35. When the shaft 35 is in the position shown in Fig. 5 the pinion 38 is engaged by its key 35' and the pinion 46 is out of engagement with its key 35'. By moving the upper end of the lever 36' the shaft 35 is moved laterally toward the rear of the machine, causing the pinion 46 to be engaged by its key 35', and the pinion 38 to be freed of its key 35', the pulley 34 at all times remaining in operative engagement with its key 35'.

Just above the front axle 4 is the shaft 51 which extends across the forward end of the inner frame B and passes loosely through the enlarged portions 9 of the side bars 6. To the shaft 51 is secured the worm wheel 52 which engages the worm 53 upon the shaft 48. To the outer ends of the shaft 51 are secured the gear wheels 53^a which mesh with the gear wheels 10.

The cable 20, after passing around the rollers 29, extends rearwardly to the shaft or other outlet of the mine or tunnel, where its ends may be connected to an ordinary power driven winding drum which pays out the cable from one side and winds it up upon the other side, in a well known manner, the same constituting no part of my present invention.

From the foregoing it is believed that the construction and operation of my device will be fully understood. The device, as best seen in Figs. 2 and 3, shows the shovel in readiness to take a cut from the forward wall of the tunnel, the teeth 18 upon the perpendicular side of the shovel 17 being in contact with the wall to be cut and the gear connections between the shafts 35 and 40 being in the positions as shown in Fig. 5. If the motor 32 be now started the worm wheel 42 upon the shaft 40, through its connections with the motor 32, will be caused to

revolve, and, through the coöperation of the rack 43, will cause the inner frame B to advance with relation to the outer frame A, forcing the perpendicular side of the shovel 17 hard against the wall of the tunnel to be cut, the toggle action of the brace 31 at the rear of the machine, the upper part of which contacts with the roof and the lower part with the floor of the tunnel, preventing retrograde movement of the machine, thus holding the shovel 17 to its work. In the meantime the power has been applied to the cable 20 which runs over the right hand roller 29, drawing with it the shovel 17, and, through the latch 17' and projection 17'', advances the carrier 15, the toggle action of the brace carried by the right hand pair of the arms 22, the foils 26 of which contacting respectively with the roof and floor of the tunnel, prevents any sidewise movement of the machine. When the carrier 15 has advanced along the head beam 14 sufficiently to bring the rear end of the latch 17' into contact with the projection 22^a upon the arm 22, the rear end of the latch 17' is forced outwardly causing its forward end to lose contact with the projection 17'' which releases the now loaded shovel 17 and permits it to drop to the floor of the tunnel, along which it is dragged by the cable 20 to the perpendicular shaft or other outlet, where it is dumped. By reversing the movement of the cable 20 the shovel 17 is returned to the position shown in Figs. 2 and 3, and the operation just described is repeated. When the inner frame B has been advanced from time to time until it has reached its limit of movement with relation to the outer frame A, the motor 32 may be reversed and the outer frame A drawn forward with relation to the inner frame B, to its position as shown in Figs. 1, 2 and 4. During this movement the rear toggle brace 31 offers no resistance to the forward movement of the outer frame A, and the forward toggle braces carried by the arms 22 are positioned so as to hold the inner frame B while the outer frame A is being drawn up to it.

When it is desired to adjust the shovel 17 to different cutting levels the upper end of the lever 36' is moved forward, which, through its intervening connections with the shaft 35, causes the latter to shift rearwardly, freeing the pinion 38 from its key 35' and drawing into engagement with the pinion 46 its key 35', which, through the pinion 47, shaft 48, worm 53 and wheel 52, causes the shaft 51 and its attached gear wheels 53^a to revolve in one direction, causing the gear wheels 10 and their attached links 11 to revolve in the opposite direction, carrying the head beam 14, carrier 15 and shovel 17 either up or down as the case may require.

Many changes in the construction and general arrangement of the various parts of the device will readily suggest themselves to others skilled in the art, without departing from the spirit and scope of my invention, and I do not, therefore, desire to be limited to the exact form of embodiment herein shown and described.

What I claim as new and desire to protect by Letters Patent, is—

1. A tunnel excavating machine comprising an extensible frame, traction wheels, a shovel slidably mounted upon said frame, means for sliding the shovel, means for extending said frame and toggle braces to prevent movement of said frame.

2. A tunnel excavating machine comprising an outer frame, traction wheels under said outer frame, an inner frame movable with relation to said outer frame, a head beam, a carrier slidably mounted upon said head beam, a shovel mounted in said carrier, means for sliding the carrier, means for moving said inner frame and toggle joint braces to prevent movement of said outer frame.

3. A tunnel excavating machine comprising an extensible frame, traction wheels for said frame, a shovel mounted to slide transversely of said frame, means for sliding

said shovel, means for extending said frame and toggle joint braces to prevent both lateral and longitudinal movement of said frame during the process of excavating.

4. A tunnel excavating machine comprising an extensible frame, traction wheels therefor, a shovel mounted to slide transversely of said frame, means for adjusting said shovel vertically, means for sliding said shovel, means for extending said frame and toggle bracing means to prevent movement of said frame.

5. A tunnel excavating machine comprising an inner and an outer frame movable longitudinally with relation to each other, traction wheels for said outer frame, a rack upon said outer frame, a worm gear upon said inner frame coöperating with said rack whereby said inner frame is moved with relation to said outer frame, a shovel mounted upon and slidable transversely of said inner frame, means for adjusting said shovel vertically, means for sliding said shovel and toggle braces for said frames to prevent movement thereof in certain directions.

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