W. R. COLLINS.

TUNNELING MACHINE.

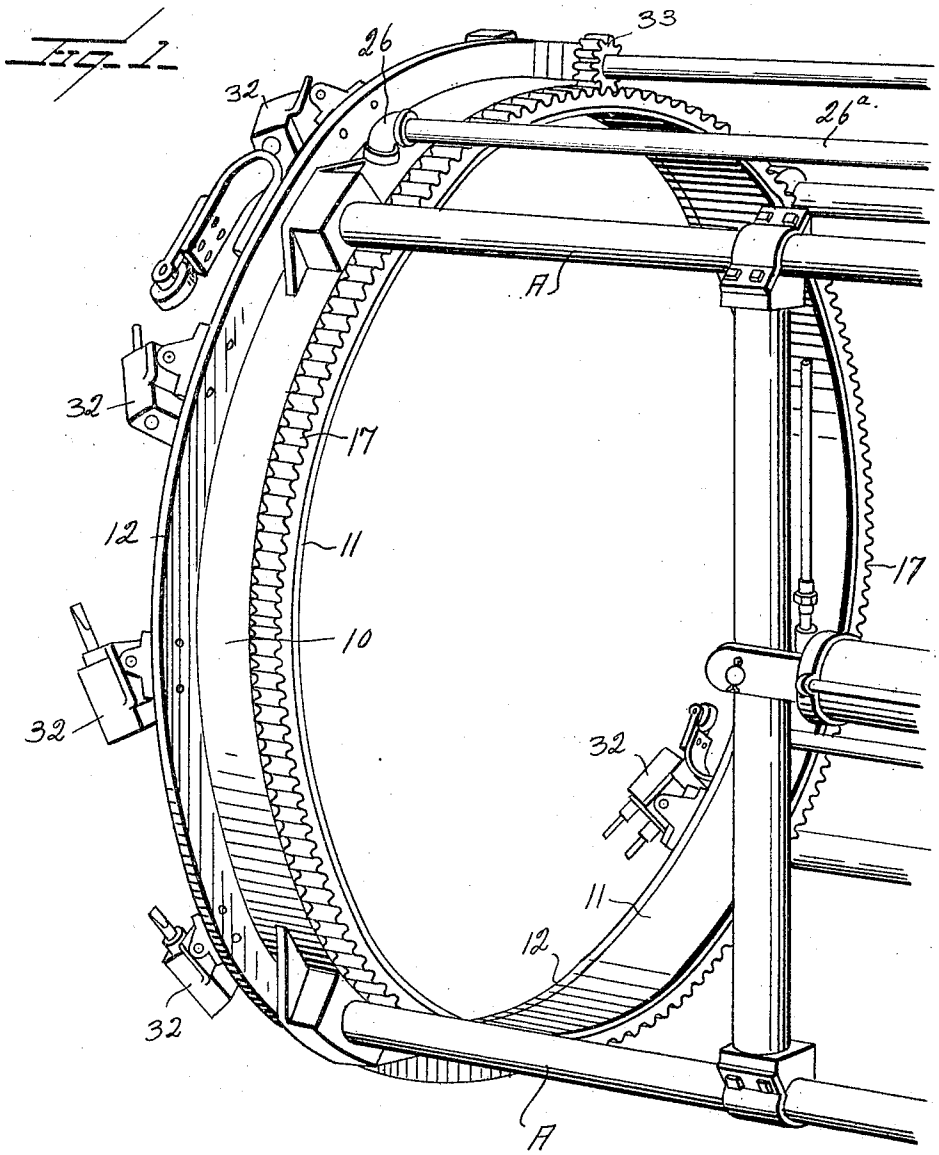
APPLICATION FILED SEPT. 4, 1920.

1,404,929.

Patented Jan. 31, 1922.

2 SHEETS—SHEET 1.

Fig. 1.



INVENTOR.

W. R. Collins

BY

Watson E. Coleman

ATTORNEY.

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2 SHEETS—SHEET 2.

Fig. 2.

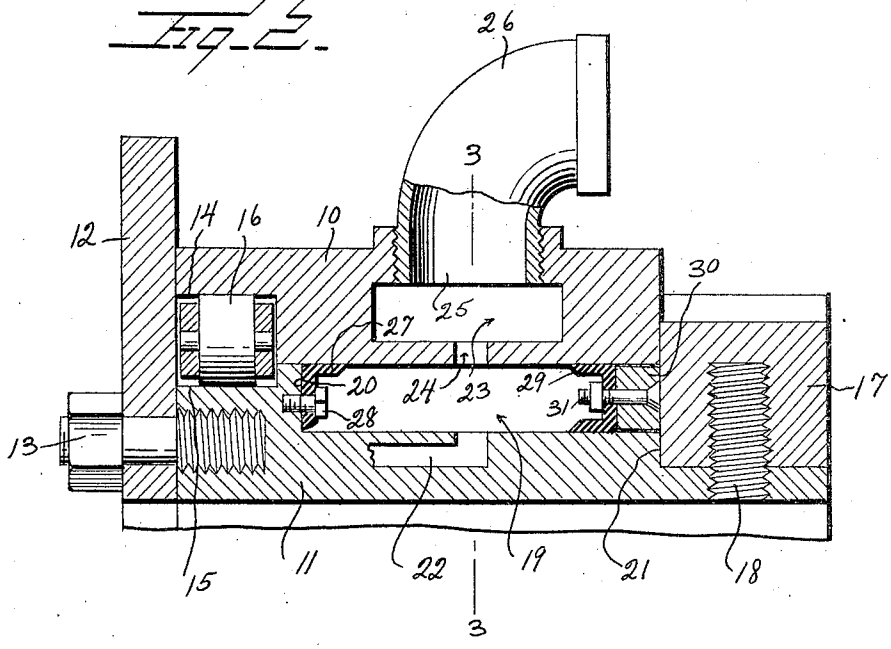
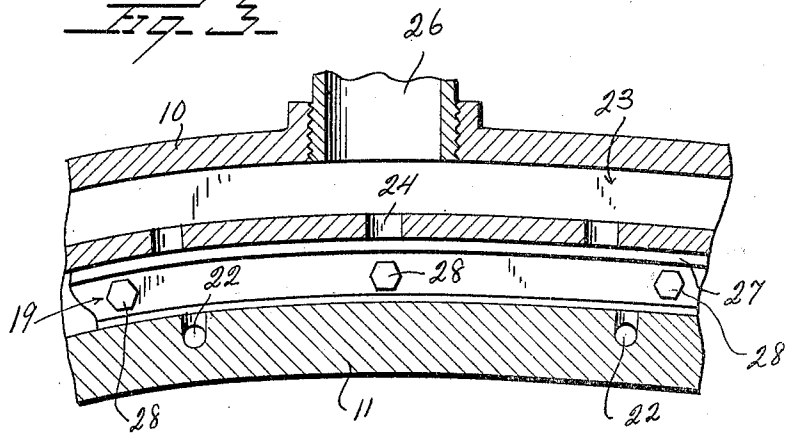


Fig. 3.



INVENTOR.

W. R. Collins

BY

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ATTORNEY.

UNITED STATES PATENT OFFICE.

WILLIAM R. COLLINS, OF DENVER, COLORADO.

TUNNELING MACHINE.

1,404,929. Specification of Letters Patent. Patented Jan. 31, 1922.

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To all whom it may concern:

Be it known that I, WILLIAM R. COLLINS, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Tunneling Machines, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to tunneling machines such as that described and illustrated in my Patents #973,107 granted to me on October 18, 1910, #1,000,075 granted to me on August 8, 1911, and #1,061,451 granted to me on May 13, 1913, and particularly to improvements therein relating to the manner of packing the air space between the rotating cutter carrying cylinder or drum and the relatively fixed frame of the machine.

The tunneling machines to which this invention relates, as illustrated and described in my prior patents, include a carriage having an end frame provided with a bearing, and mounted upon this bearing is an annular, revoluble cutting head, the cutting head carrying a plurality of air actuated drills. The end frame has a circular air channel formed therein which communicates by pipes with a source of air, and this air channel communicates with air channels on the rotating drum or head leading to the air channels of the several drills.

The general object of my present invention is to provide improved means for packing the space between the rotating cylinder or drum and the fixed front frame of the machine so as to prevent the escape of air between these two parts.

A further object is to provide improved means for this purpose including air retaining leather or composition rings which are so mounted within the packing space that they prevent the compressed air from escaping between the rotating cylinder or drum and the front frame.

And a further object is to so support and form these packing rings that the outside flange of packing rings will glide upon the inside face of the end frame in which the cylinder or drum rotates, while the web or inner flange of the leather channel or packing ring may be pulled around with the rotation of the drum without pulling the leather packing ring or channel-shaped ring out of shape and render it worthless.

These objects and other objects will appear more fully from the following description.

My invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a perspective view of one end of a tunneling machine having my improvement applied thereto;

Figure 2 is a sectional view taken on a plane radial to the circular end frame of the machine and extending through the end frame and the allied parts;

Figure 3 is a section on the line 3—3 of Figure 2.

In these drawings, it will be seen that I have illustrated a portion of the forward end of a tunneling machine constructed in accordance with my invention. I have not attempted to illustrate the details of a machine of this character, as these are well understood by all cognizant with the art and are fully illustrated in my prior patents.

Referring to the drawings, it will be seen that the cast iron end frame 10, which is fixed from rotation on carriage A, surrounds a cylinder or drum 11. This drum is designed to rotate and carries upon its forward end a circular face plate 12 which is bolted to the front edge of the drum or cylinder by bolts 13. Compressed air operated cutters or drills are mounted upon this circular face plate to rotate therewith. The outer end of the cast iron frame 10 is annularly channelled, as at 14, on its inside face and the outside face of the drum or cylinder 11 is also channelled, as at 15, these complementary channels 14 and 15 constituting an annular chamber within which are disposed roller bearings 16. The drum 11 projects beyond the rear edge of the fixed frame 10 and carries upon it an exteriorly toothed gear ring 17 which may be attached to the outwardly projecting end of the drum by means of screws 18 or in any other suitable manner. All of these parts are of ordinary and usual construction.

The outer face of the drum 11 is annularly channelled, as at 19, this channel terminating at its forward end in a shoulder 20 but extending to the rear end face of the drum outward of the shoulder 21 defining the seat for the gear ring 17. From this channel 19, or packing space as it will hereafter be called, ducts 22 lead to the air ports of the several drills 32 attached to the front head of the machine, that is through the face plate 12 or

equivalent part, these ducts opening into the space 19. The frame or end member 10 is also formed with a circular air chamber 23 communicating by a duct or ducts 24 with the space 19. The circular air chamber 23 has a port or inlet opening 25, and engaged with the walls of this port is an elbow 26, in turn connected to a pipe line 26ª conveying compressed air to the circular air chamber 23.

It is obviously necessary that the joints between the drum 11 and the frame 10 should be such as will prevent the leakage of compressed air to these joints. To this end, I dispose against the shoulder 20 or end wall of the packing space 19 an L-shaped packing ring, designated generally 27, this packing ring being of leather or composition and having a base attached to the shoulder 20 or wall by means of screws 28. The free edge of this L-shaped packing ring is bevelled, and the free margin of this packing ring bears against the inner face of the fixed end frame 10. At the opposite end of the packing space 19 there are two joints to be protected, as is obvious from Figure 2, and to this end I provide a channelled-shaped packing ring 29 having a base portion and two free marginal portions, one bearing against the outer face of the drum and the other bearing against the inner face of the frame 10, and I mount this channelled packing ring 29 upon a steel ring 30, which is a floating ring approximately filling the space between the outer face of the drum 11 and the inner face of the annular frame 10 but loose therein so that it may shift circumferentially. The leather packing ring 29 is held to this ring 30 by means of screws 31.

It will be understood that these packing rings are approximately, in the working machine, 6′ in diameter. The conditions under which these rings operate are such that the outside flange or margin of the channel-shaped packing ring 29 must glide upon the inside face of the end frame in which the cylinder rotates, while the web or base portion of the ring 29 and the inner flange or margin of the leather ring must contact with the drum. This would cause the channel-shaped packing ring 29 to be pulled out of shape very quickly if it were not that it is attached to and supported by the steel ring backing 30 and if the opposite ring 27 were not supported by the shoulder 20. The packing rings 27 and 29 are held in place by screw bolts 28 and 31 which are spaced from each other a distance of about 2″, and if it were not that these rings are thus supported, the packing rings would be worthless in view of the two forces acting on the ring 29 and on the ring 27, the compressed air acting to force the free margins of these rings out against the outer surface of the drum and the inner surface of the frame 10, or as with packing ring 27 against the inner face of the end frame. While I have heretofore referred to these packing rings as being of leather or composition, I do not wish to be limited in any way as to the particular material from which these rings are to be made, as they might be made of composition, leather, thin and flexible steel or a variety of different materials.

The general operation of the mechanism is as follows: A power driven gear wheel 33 engages the gear 17 and this rotates the drum or cylinder 11, rotating with it the several compressed air drills 32 attached to the face plate 12, this drum rotating within the annular guide formed by the end frame 10. The air to the air ports of the drills on the front head is furnished through the pipe 26ª and through the ports 24, packing space 19 and the port 22.

While I have illustrated a particular form of drilling or tunneling machine to which this packing is to be applied, and while this packing has been devised with particular relation to the tunneling machines illustrated in my patents and of the type illustrated, I do not wish to be limited thereto, as it is obvious that the packing might be applied to other forms of tunneling machines or like mechanism operating on the same principle and embodying concentric members relatively rotating in opposite directions, or one fixed and the other rotating, with an air space between the two members packed to prevent the escape or leakage of air.

I claim:—

1. In a mechanism of the character described including concentric members relatively rotative, the inner member having air channels and the outer member having an air channel and the inner and outer members upon their confronting faces being formed to provide an annular air chamber communicating with the first and second named channels, and means for preventing the leakage of air between the confronting faces of said members comprising annular packing rings extending concentric to the inner and outer members and disposed in the ends of the chamber, each of said packing rings having a base portion and a free marginal portion bearing against the confronting face of one of said members.

2. In a mechanism of the character described including concentric members relatively rotative, the inner member having air channels and the outer member having an air channel and the inner and outer members upon their confronting faces being formed to provide an annular air chamber communicating with the first and second named channels, and means for preventing the leakage of air between the confronting faces of said members comprising annular packing rings extending concentric to the

inner and outer members and disposed in the ends of the chamber, each of said packing rings having a base portion attached to the end wall of the chamber at intervals around the length of the ring and having a marginal portion extending at right angles to the base portion and bearing against the confronting wall of the outer member.

3. In a mechanism of the character described including concentric members relatively rotative, the inner member having air channels and the outer member having an air channel and the inner and outer members upon their confronting faces being formed to provide an annular air chamber communicating with the first and second named channels, and means for preventing the leakage of air between the confronting faces of said members comprising annular packing rings extending concentric to the inner and outer members and disposed in the ends of the chamber, one of said packing rings being channel-shaped in cross section to provide a base portion and two opposite marginal portions adapted to bear against the confronting faces of the two members.

4. In a mechanism of the character described including concentric members relatively rotative, the inner member having air channels and the outer member having an air channel and the inner and outer members upon their confronting faces being formed to provide an annular air chamber communicating with the first and second named channels, means for preventing the leakage of air between the confronting faces of said members comprising annular packing rings extending concentric to the inner and outer members and disposed in the ends of the chamber, one of said packing rings being channel-shaped in cross section to provide a base portion and two opposite marginal portions adapted to bear against the confronting faces of the two members, and a metallic supporting ring disposed in said chamber and concentric to the inner and outer members but freely rotatable with relation thereto, the channelled packing ring being attached to said metallic ring at intervals.

5. In a mechanism of the character described, outer and inner relatively rotative concentric members, said members on their confronting faces being formed to provide an annular air chamber, and packing rings disposed at opposite ends of the air chamber, each of said packing rings having a base and a flexible marginal portion engaging the inner face of one of the rotative members and extending parallel thereto, the base of each packing ring being rigidly supported.

6. In a mechansim of the character described, an inner member and an outer member concentric thereto, the outer member being fixed and the inner member being relatively rotatable within the fixed member, said inner member on its face confronting the outer member being formed to provide an annular chamber extending inward from one end of the inner member but terminating short of the other end of the inner member, said chamber having air ducts extending therefrom through the inner member and the outer member having air ducts opening into said chamber, and means for preventing leakage of the air from the chamber comprising a substantially L-shaped packing ring attached at intervals to the end wall of the chamber and extending concentric to the inner member, said packing ring having a free margin extending approximately parallel to the axis of the members and contacting with the inner face of the outer member, a floating ring disposed in said chamber at its opposite end from the first named packing ring and concentric to the inner member, and a channel-shaped packing ring attached at intervals to said floating ring and having free marginal portions extending approximately parallel to the outer and inner members and bearing against their confronting faces.

7. In a mechanism of the character described, an annular fixed end frame, an annular drum rotating within the end frame, the inner end of the frame carrying a gear wheel bearing against the adjacent end face of the end frame, the drum upon its outer face being formed with an annular air chamber extending from said gear wheel toward the opposite end of the drum and the drum being provided with air channels leading from said air chamber, the frame being provided with an annular air chamber connected to a source of compressed air and having ports opening into the first named air chamber, a rigid floating ring disposed in the first named air chamber at the end adjacent the gear wheel, a channel-shaped packing ring mounted upon the floating ring and attached at intervals thereto and having a base portion bearing against the floating ring, and marginal portions extending approximately parallel to the outer and inner surfaces of the drum and end frame respectively and urged thereagainst by pressure of the compressed air within the air chamber, an L-shaped packing ring disposed in the opposite end of the first named air chamber having a base portion attached at intervals to the end wall of the air chamber and having a portion extending approximately parallel to the confronting inner face of the end frame and forced thereagainst by the pressure of compressed air.

8. In a mechanism of the character described, outer and inner rotatable elements, one of said elements being formed to provide an annular chamber, the other element form-

ing one wall of this chamber and said elements being relatively rotatable in opposite directions, a floating ring disposed in said annular chamber and approximately filling one end thereof, and a channel-shaped packing ring attached at intervals to said floating ring and having marginal portions extending approximately parallel to the confronting faces of the elements and bearing thereagainst.

9. In a tunneling machine, an annular front frame, an annular drum disposed and fitting within the front frame, the drum upon its outer face rearward of its forward end being cut away to provide an annular seat between the drum and the frame, said drum projecting rearward beyond the frame, this projecting portion being reduced in diameter, a gear ring mounted upon the projecting portion of the drum whereby it may be rotated, a circular face plate bolted to the front end of the drum and extending outward beyond the frame, the frame and drum being formed with coacting roller bearings and the drum having air channels leading through the circular face plate and from said air space, the frame being formed with an annular air chamber having radially extending ducts opening into said annular space between the drum and the end frame, and said circular air chamber being connected to a source of compressed air, and means for preventing leakage of air from said air space in the drum comprising a packing ring having a base portion attached at intervals to the forward end wall of the air space and a free marginal portion extending approximately parallel to and bearing against the inner face of the fixed front frame, a floating ring disposed at the other end of the air space, an approximately channel-shaped packing ring having a base portion disposed against the inner face of the floating ring and attached thereto at intervals, the margins of said packing ring bearing respectively against the drum and the frame and held in contact therewith by the pressure of air within the air space.

10. In a mechanism of the character described, outer and inner relatively rotative, concentric members, said members on their confronting faces being formed to provide an annular air chamber, a floating ring disposed in said annular chamber and approximately filling one end thereof, a channel-shaped packing ring attached to said floating ring and having marginal portions extending approximately parallel to the confronting faces of the elements and bearing thereagainst, and a packing ring disposed at the opposite end of the chamber and having a base, and a flexible marginal portion extending parallel to one of said rotative members and bearing thereagainst, the base of said packing ring being rigidly supported.

In testimony whereof I hereunto affix my signature.

WILLIAM R. COLLINS.