Jan. 9, 1962 O. D. BROGDEN 3,016,201

TUNNEL CLEANING MACHINE

Filed Dec. 15, 1959 3 Sheets-Sheet 1

FIG. 1

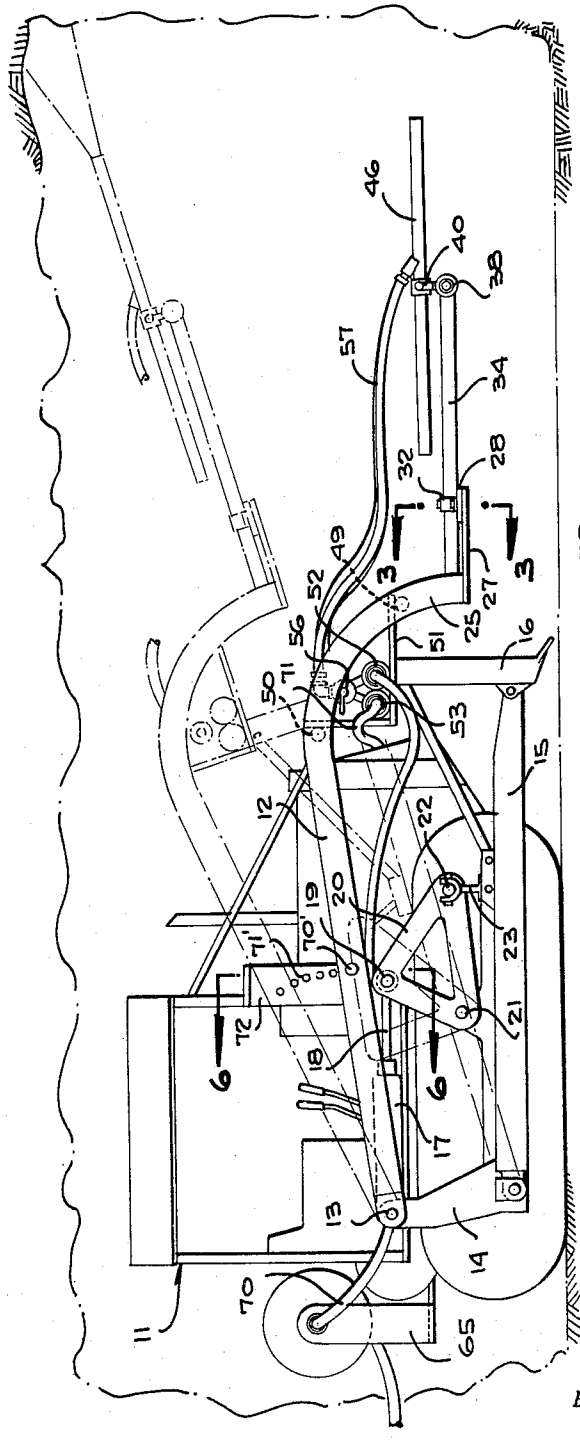
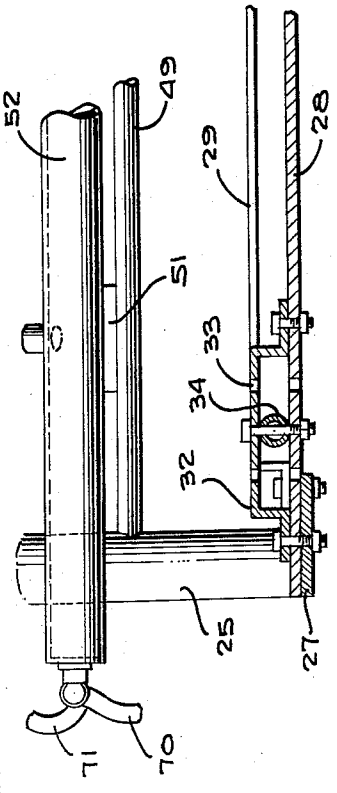


FIG. 3



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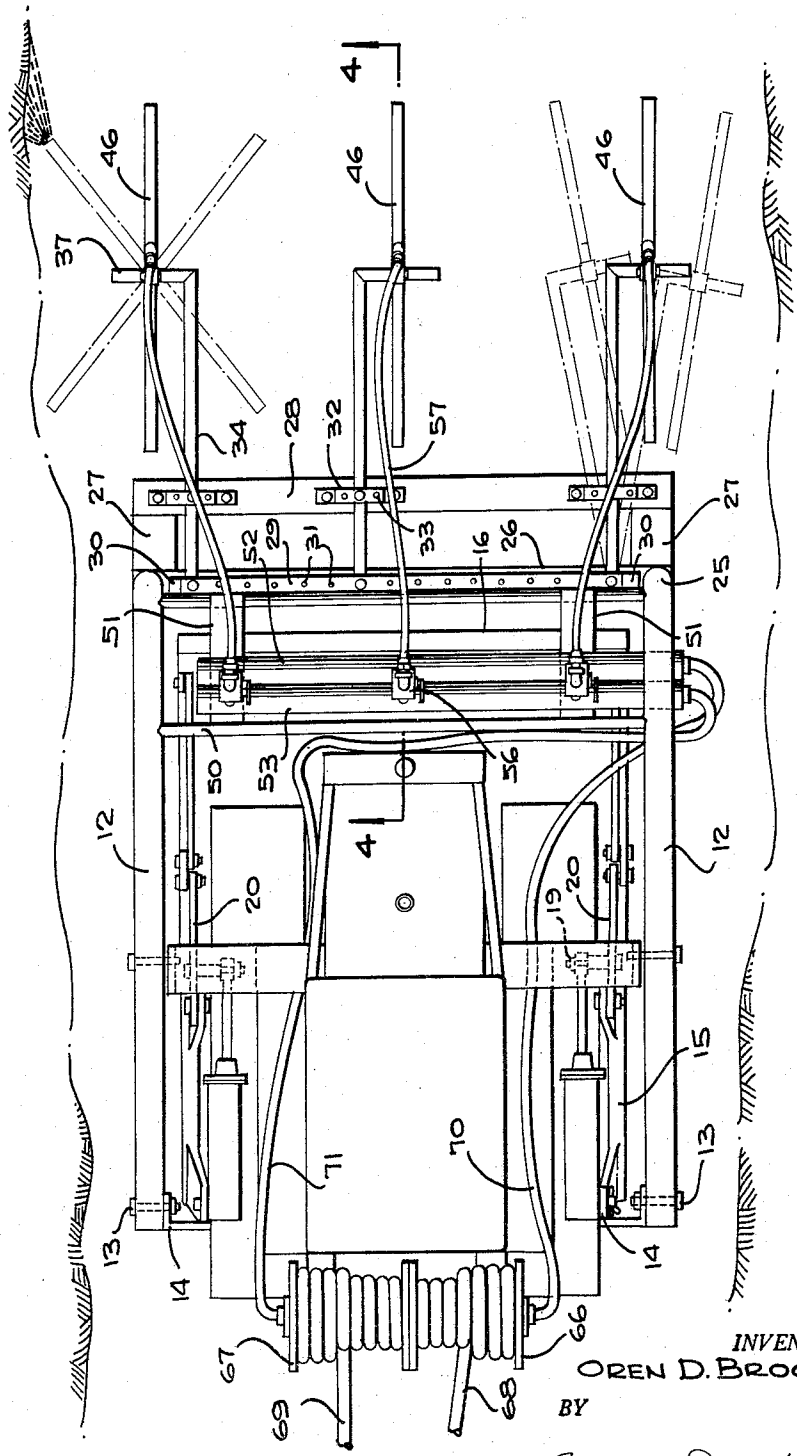


FIG. 2

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TUNNEL CLEANING MACHINE

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FIG. 4

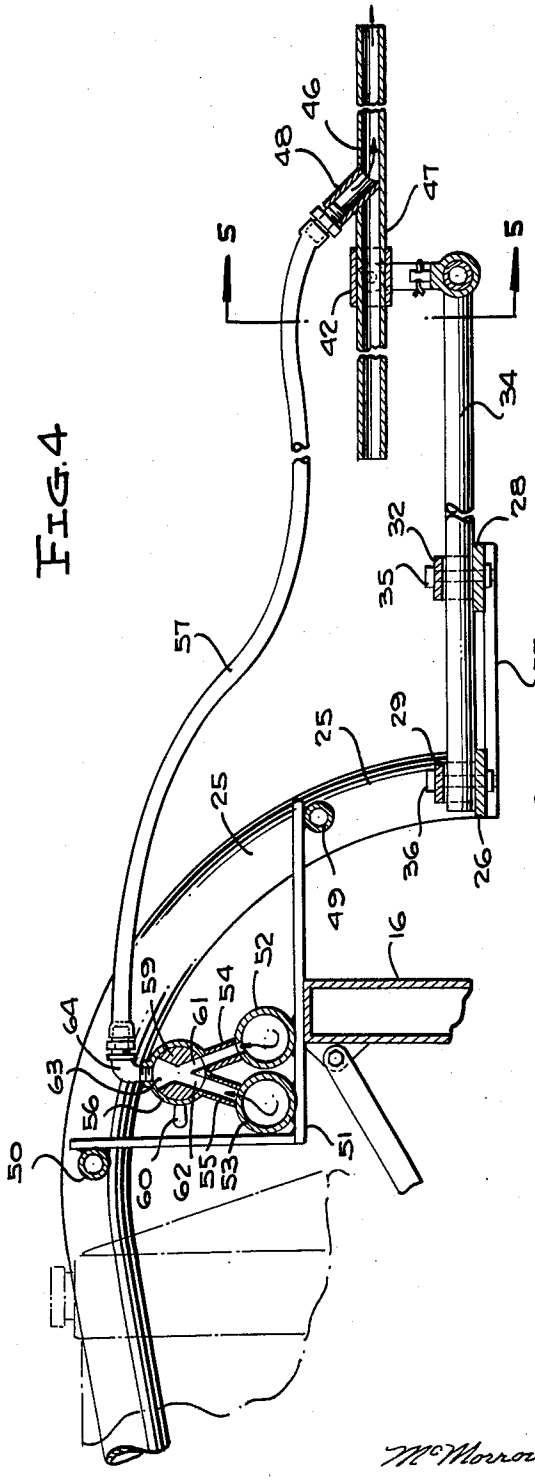


FIG. 5

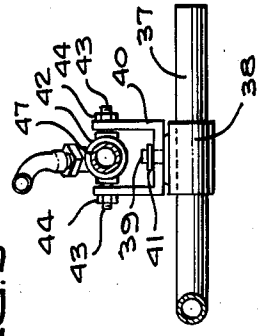
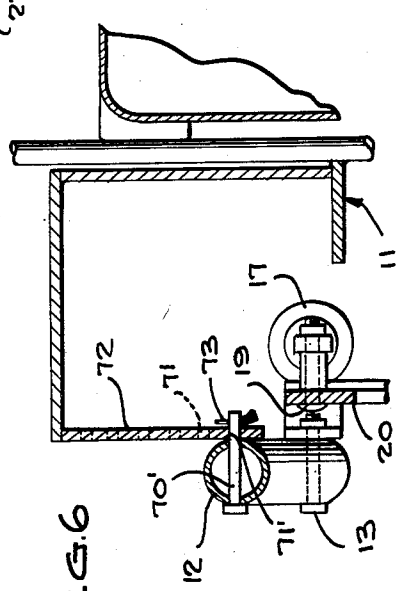


FIG. 6



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United States Patent Office

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3,016,201

TUNNEL CLEANING MACHINE

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2 Claims. (Cl. 239—164)

This invention relates to construction machinery, and more particularly to an apparatus adapted to be attached to the front of a tractor or similar vehicle for use in cleaning up a tunnel, employing a mixture of water and air under pressure as the cleaning medium.

A main object of the invention is to provide a novel and improved tunnel cleaning machine which is relatively simple in construction, which is easy to set up for use, and which provides a substantial saving in time and labor in cleaning up a tunnel after the tunnel has been excavated.

A further object of the invention is to provide an improved tunnel cleaning attachment for use on a tractor or a similar vehicle, said attachment involving relatively inexpensive components, being easy to install, being easy to set up for use, and providing a means for efficiently employing air under pressure and water in a desired mixture as a cleaning medium without necessity of employing human labor for directing said cleaning medium onto the surfaces of the tunnel to be cleaned.

A still further object of the invention is to provide an improved tunnel cleaning machine which is easy to maneuver, which may be easily adjusted to provide the required cleaning action in accordance with the dimensions and conditions of the tunnel to be cleaned, and which requires a minimum amount of human effort in its operation.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

FIGURE 1 is a side elevational view of an improved tunnel cleaning machine in accordance with the present invention.

FIGURE 2 is a top plan view of the machine illustrated in FIGURE 1.

FIGURE 3 is an enlarged cross sectional detail view taken on the line 3—3 of FIGURE 1.

FIGURE 4 is an enlarged vertical cross sectional view taken on the line 4—4 of FIGURE 2.

FIGURE 5 is a vertical cross sectional view taken on the line 5—5 of FIGURE 4.

FIGURE 6 is an enlarged vertical cross sectional detail view taken on the line 6—6 of FIGURE 1.

Referring to the drawings, 11 generally designates a conventional tractor on which is mounted an improved tunnel cleaning attachment constructed in accordance with the present invention. The tunnel cleaning attachment comprises the generally longitudinally extending side bars 12, 12 pivotally connected at 13, 13 to the top ends of upstanding brackets 14, 14 rigidly secured to the rear portions of the sides of the frame of the tractor 11. The bracket members 14 may be the same as those to which are pivotally connected the boom members 15 employed to support a bulldozer blade 16 extending transversely across the forward portion of the tractor and controlled in a conventional manner by hydraulic cylinders 17 whose piston rods 18 are pivotally connected at 19, 19

to the top corner portions of triangular link plates 20, 20. The rear corner portions of the link plates 20 are pivotally connected at 21 to the frame of the tractor and the forward corner portions of the link plates are pivotally connected at 22 to upstanding arms 23 secured to the respective boom members 15. Thus, when the piston rods 18 are retracted, the triangular link plates 20 are rotated in a counterclockwise direction, as viewed in FIGURE 1, causing the boom members 15 to be elevated, and causing the bulldozer blade 16 to be similarly elevated. The bulldozer supporting means and the hydraulic cylinder means for elevating same are conventional and in themselves form no part of the present invention.

The forward end portions of the side bars 12, 12 are curved downwardly and forwardly, as shown at 25 and are rigidly connected by the transversely extending terminal bar 26. Rigidly secured to the underside of the bar 26 at its end portions and extending substantially longitudinally and forwardly therefrom are the respective plate members 27, 27, and rigidly secured on said plate members is the transversely extending bar member 28.

Designated at 29 is a transversely extending bracket bar which is provided at its ends with downwardly offset supporting flanges 30, 30 which are respectively secured to the opposite end portions of the transverse bar member 26, whereby the main body of the member 29 is supported above and in parallel relationship to the bar member 26. The member 29 is formed with spaced apertures 31 which register with similar apertures provided in the subjacent member 26. A plurality of relatively short bracket members 32 are secured to the forward bar member 28, the bracket members 32 having their main body portions spaced above the member 28 by substantially the same distance as the main body portion of the bracket member 29 is spaced above the member 26, the horizontal portions of the bracket members 32 being formed with spaced apertures 33 which register with similar apertures provided in the subjacent member 28. Respective elongated conduit members 34 extend through the members 32 and are fastened between the main body portion of the member 29 and the bar member 26, as by respective fastening bolts 35 and 36, the members 34 being thus secured in desired positions of angular adjustment with respect to the longitudinal center line of the tractor, for example, in parallel longitudinally extending positions, as shown in full line view in FIGURE 2, or in positions of desired inclination with respect to the longitudinal center line of the tractor, as shown in dotted line view in FIGURE 2.

The conduit members 34 are provided at their forward ends with the laterally directed nozzle-supporting portions 37.

Secured on the portions 37 are the respective supporting sleeves 38, said sleeves 38 being provided with the upstanding fastening studs 39 on which are engaged the respective generally U-shaped yoke members 40, the yoke members 40 being secured in desired positions of adjustment around the axis of the studs 39 by clamping nuts 41 provided on the studs 39, as shown in FIGURE 5. Nozzle-supporting sleeves 42 are supported by the top end portions of the side arms of the members 40 by opposing studs 43, 43 provided on the sleeves 42 and engaged through the top portions of the arms of the members 40, the sleeves 42 being secured in desired po-

sitions of adjustment around the common axis of the studs 43, 43 by clamping nuts 44 provided on the studs 43, as shown in FIGURE 5. Respective nozzle members 46 are secured in the sleeves 42, said nozzle members being secured by their rear portions 47 which are engaged in and rigidly secured in the sleeves 42, as shown in FIGURE 4. The forward portions of the nozzle members are sealed with respect to the rear portions 47 by the downwardly and forwardly inclined conduit elements 48 which are formed integrally with the nozzle members and which serve as inlet means for the fluids employed as the cleaning medium. As shown in FIGURE 2, nozzle members 46 may be adjusted to desired angles around the axes of the studs 39, and similarly may be adjusted to desired angles around the axes of the studs 43.

A pair of spaced transverse rod members 49 and 50 rigidly connect the curved forward end portions 25 of the side bars 12, as is clearly shown in FIGURE 2. A pair of generally L-shaped right angled bracket members 51, 51 are secured to the transverse cross bars 49, 50, with the bottom portions of the angle bars 51 supportingly engaged on the top edge of the bulldozer blade 16, as shown in FIGURE 1. Rigidly secured on the bracket members 51, 51 are the transversely extending tubular headers 52 and 53 which are provided with spaced pairs of upwardly extending outlet conduit elements 54 and 55 connected through respective manually controlled rotary valves 56 and flexible conduits 57 to the respective nozzle intake conduits 48.

As shown in FIGURE 4, each valve 56 is provided with a rotor 59 and an operating handle 60, the rotor 59 being provided with the respective inlet passages 61 and 62 registrable with the conduit elements 54 and 55 and which communicate with a flaring outward passage 63 which is adapted to the communicate with the elbow-shaped outlet fitting 64 leading to the associated flexible conduit 67. As will be presently described, the headers 52 and 53 are adapted to be connected to suitable supplies of compressed air and water which are thus furnished through the valves 56 to the respective nozzles 46, the relative proportions of the compressed air and water supplied to the nozzles being adjusted by suitably adjusting the rotors 59 of the manually controlled valve 56. As will be readily apparent from FIGURE 4, the valve 56 may be entirely closed by rotating the handle 60 approximately ninety degrees from the position thereof illustrated in FIGURE 4.

Rotatably supported on a bracket member 65 provided at the rear end of the frame of the tractor 11 are respective hose reels 66 and 67, said hose reels having hollow shafts communicating with respective flexible supply hoses 68 and 69 wound on the reels. Respective flexible hoses 70 and 71 are rotatably and sealingly connected to the outer ends of the hollow shafts of the hose reels by conventional rotatable conduit joints, the hoses 70 and 71 being respectively connected to the ends of the supply headers 52 and 53. The respective hoses 68 and 69 are connected to suitable sources of compressed air and water under sufficient pressure to cause the water to flow to its associated supply header. Thus, the water may be supplied through the hose 68 and thence by means of the hose 70 to the supply header 52. The water is thus furnished to the nozzles 46 through the flexible conduits 57, along with compressed air from the header 53, the air being furnished to header 53 by the hose 69 through the hose 71.

The nozzle members 46 may be adjusted to desired heights by securing the arms 12 in desired positions of elevation. Thus, the side arms 12 may be raised by elevating the longitudinal boom members 15, 15 by means of their associated hydraulic cylinders 17. The arms 12 may be fastened in elevated positions by engaging pins 70' through the arms and through selected apertures 71' provided in vertically extending bracket members 72 secured to the opposite sides of the tractor frame inwardly adjacent the arms 12, as is clearly shown in FIGURE 6. The inner ends of the pins 70' are provided with cotter pins 73 to hold the pins 70' in the selected apertures 71' in the depending vertical portions of the supporting brackets 72, as is clearly shown in FIGURE 6.

In operation, with the parts adjusted to their desired positions, for example, to the elevated positions of the arms 12 shown in dotted view in FIGURE 1, and with the nozzle elements 46 oriented to provide the desired direction of discharge of the mixture of water and compressed air, the tractor is moved into the tunnel, and the fluid is admitted through the hoses 68 and 69 to the headers 52 and 53. The valves 56 may then be opened to allow the desired mixture of fluids to discharge from the nozzle members 46 and engage the surfaces to be cleaned.

As will be readily understood, the force exerted by the discharging mixture of water and compressed air serves to loosen any free material which is present on the surfaces of the tunnel and to wash the free material downwardly and forwardly so that it may be readily and easily removed and whereby the newly dug tunnel surfaces are cleared of all loosely adhering material disturbed during the excavation of said newly dug tunnel portion. This eliminates the necessity of removing the loosely adhering material from the newly dug tunnel wall surfaces by human labor.

While a specific embodiment of an improved tunnel cleaning machine has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. A tunnel cleaning machine comprising a movable supporting vehicle provided with elevating means pivoted to said vehicle, a frame pivoted at one end thereof to the vehicle and supported on said elevating means, means to detachably secure said frame in an elevated position with respect to said vehicle, said frame including a horizontal transverse support at its free end, a plurality of nozzle members, sleeve means on the transverse support supportingly receiving said nozzle members, means to adjust said sleeve means angularly in vertical and horizontal planes, said sleeve means being arranged to support said nozzle members in positions projecting forwardly from said frame, a pair of horizontal header members transversely mounted on said frame, means to connect said header members respectively to a source of water and a source of compressed air, respective mixing valves mounted on spaced portions of the header members and having inlet conduits communicatively connected to the header members and having outlet ports arranged to communicate with the inlet conduits, and flexible conduit means connecting each of said outlet ports to one of the nozzle members.

2. A tunnel cleaning machine comprising a movable supporting vehicle provided with elevating means pivoted to said vehicle, respective side bars pivoted to the rear portions of the sides of the vehicle and extending forwardly of the vehicle, a horizontal transversely extending support member secured to the forward ends of the side bars, a plurality of spaced nozzle members, sleeve means on the transverse support member supportingly receiving said nozzle members, means to adjust said sleeve means angularly in vertical and horizontal planes, said sleeve means being arranged to support said nozzle members in positions projecting forwardly from the transverse support member, additional horizontal transverse support means connecting said side bars and supportingly engaged on said elevating means, a pair of horizontal transversely extending side-by-side header members mounted on said additional transverse support means, means to connect the ends of said header members respectively to a source of water and a source of compressed air, respective mixing

valves mounted on spaced portions of the header members and having inlet conduits communicatively connected to the header members and having outlet ports arranged to communicate with the inlet conduits, and flexible conduit means connecting each of said outlet ports to one of the nozzle members.

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