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EXCAVATING APPARATUS

2,599,042

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2 SHEETS—SHEET 1

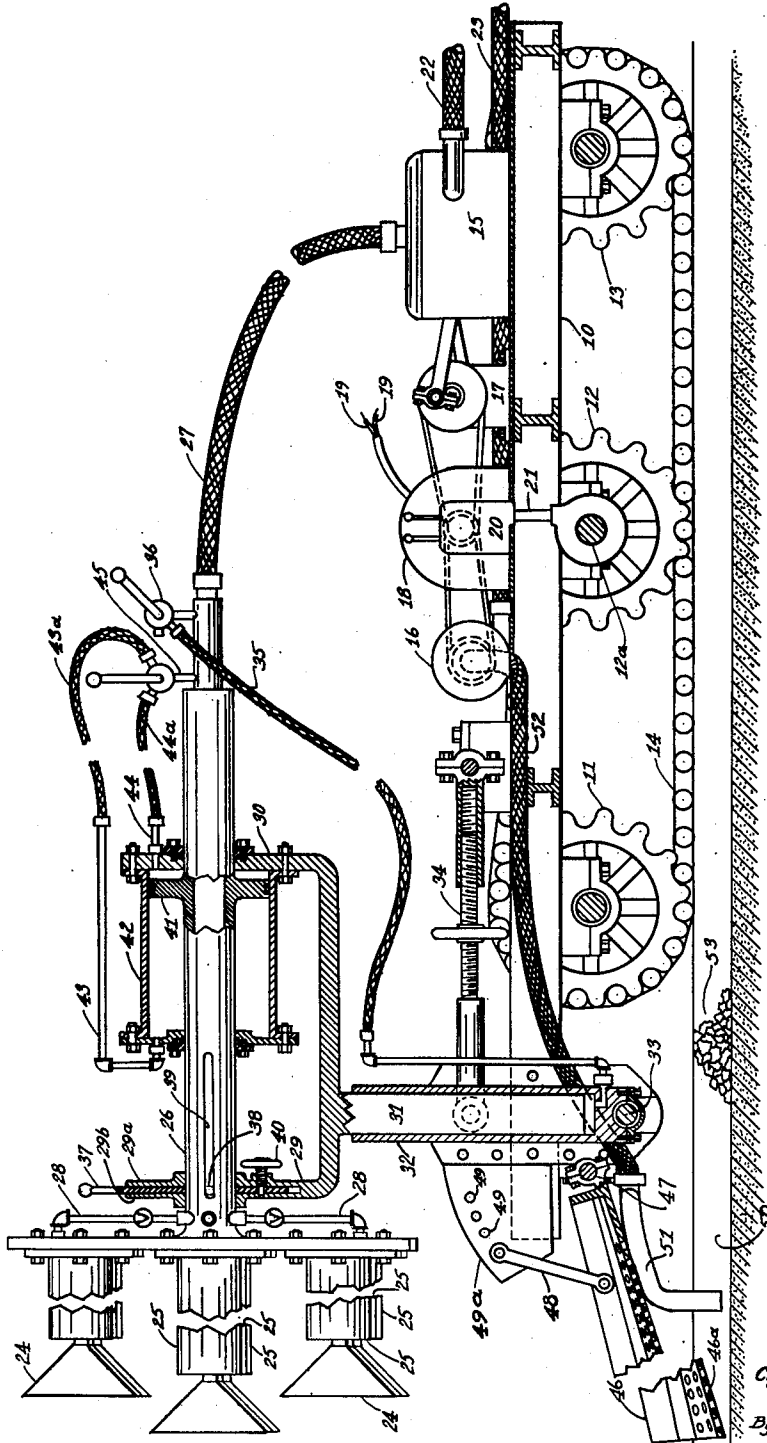


FIG. 1

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EXCAVATING APPARATUS

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4 Claims. (Cl. 262—7)

1

This invention relates to tunneling or excavating machines.

Its chief objects are to provide a machine having advantages of both mechanical and hydraulic excavation; to provide a unitary self-contained and preferably self-propelling machine adapted to perform both of the functions of excavating and of disposing of the excavated material; to provide economy of construction, operation and maintenance; and to provide for rapid excavation and ease of operation.

Fig. 1 of the accompanying drawing is a longitudinal middle section, but with some parts shown in elevation, of a machine embodying my invention in its preferred form.

Fig. 2 is a fragmentary front elevation of a scoop-shaped earth-screening member which is a part of the machine, with diagrammatic representation the bits ahead of it.

The machine comprises a frame 10 equipped at each side with sprocket-like supporting wheels such as the wheels 11, 12 and 13, the wheels at side being provided with a link-type self-laying track such as the track 14.

Mounted upon the frame are a high-pressure reciprocating pump 15 and a centrifugal pump 16 adapted to be driven through suitable drive connections, including a reduction gear 17 for the reciprocating pump, by an electric motor 18 fed by wires 19, 19 running to it from a remote source such as the mouth of a tunnel being excavated.

The pairs of end wheels 11 and 13 are loosely journaled whereas the axle 12a of the middle pair of wheels, 12, has drive connection from the motor 18 through a reduction gear 20 and a worm shaft 21, and means (not here shown, but familiar to those skilled in the art of vehicles equipped with self-laying tracks) preferably is provided for securing the two wheels 12 selectively to the axle, for steering or turning the machine, or both of them for straight driving.

A water-supply hose 22 extends from a remote source, beyond the mouth of a tunnel, for example, to the suction side of the pump 15, and a conveyor hose 23, for disposing of excavated material, leads in the opposite direction from the delivery side of the pump 16.

For mechanically and hydraulically breaking up the earth formation a gang of oscillating bits 24, 24, of any suitable size and number and in any suitable pattern, are mounted upon the shafts of respective fluid-actuated motors 25, 25, which preferably are of the shaft-oscillating type, because I have found that an oscillating bit is

2

more effective than a rotating bit. The motors are mounted in fixed relative positions upon the laterally extensive head of a large, hollow, fluid conducting shaft 26.

The large hollow shaft 26 is connected for reception of high pressure water from the pump 15 through a hose 27 and at its other end is provided with pipes, such as the pipes 28, provided with respective control valves, for conducting motive-fluid to the respective motors.

The motors are of the type in which the exhaust water is discharged through their oscillating shafts and through the bits, so that the water assists the cutting action of the bits and washes down and further disintegrates the dislodged material. Preferably the motors are of the type described and claimed in my U. S. Patent No. 2,254,641.

To provide for turning of the large shaft 25 on its own axis to change the rotative position of the gang of motor-and-bit assemblies, the shaft extends through and is rotatable in the two arms 29, 30 of an upwardly forked plunger 31 of a hydraulic lift, of which the cylinder 32 is pivotally mounted at its lower end on a transverse shaft 33 fixed in the frame. The middle part of the cylinder 32 is connected with the frame by a turn-buckle link 34 for holding the gang of bits in different angular positions and at different elevations, and they are adapted to be raised and lowered without change of attitude by means of the hydraulic lift, which is adapted to be actuated by pressure fluid conducted through a hose 35 leading from the high-pressure hose 27 and having a three-way control valve 36.

For holding the large fluid-conducting and motor-supporting shaft 26 in different rotative positions about its own longitudinal axis, as for securing a square-pattern set of bits with a side of the square pattern in a vertical plane or, alternatively, with a diagonal of the square pattern in a vertical plane, so that a corner bit of the pattern being of a salient of the pattern, will be lower than the others, the shaft has mounted thereon, between fork-arms 29a, 29b of the fork-arm 29, a turning arm 37 having a plate-like hub from which studs such as the stud 38 project into respective longitudinal grooves such as the groove 39 formed in the opposite sides of the shaft. A locking bolt 40 is threaded through the fork-arm 29a and has a reduced end portion adapted to enter, selectively, spaced holes in the plate 37, for locking the gang of bits in different attitudes.

The slots 39 permit axial movement of the shaft and its bits while their attitude is thus main-

3

tained, and for maintaining a yielding cutting pressure upon the bits the shaft 26 at a position between the fork arms 29, 30 is externally formed with a radial flange 41 serving as a piston in co- 5 action with a cylinder 42 which is fixed to the fork-arm 30 and provided at its ends with inlet-outlet pipes 43, 44 connected through respective hoses 43a, 44a with a four-way control valve 45 for supplying pressure fluid from the high-pres- 10 sure hose 27.

Below the gang of bits, in position to catch earth material dislodged by the bits, is an inclined scoop or pan 46 which at its rear end is pivoted 15 to the frame at 47, on an axis transverse to the assembly. At a position farther forward the scoop is adjustably connected, by a pair of links, such as the link 48, with respective plates such as the plate 49a having a series of holes 49, 49 for supporting the scoop in differently inclined 20 positions.

By setting the gang of bits in such rotative position about the longitudinal axis of the shaft 26 that a corner bit of the set is lower than the others, as above described, and as shown in Fig. 2 the floor of the tunnel or the like being excavated 25 can be formed with a relatively low middle portion or sump trench 50, and the pan is so formed, with a downwardly bayed middle zone 46a, that its front edge at least approximately conforms to a floor so formed.

At least a part of the floor of the scoop, such as the middle downwardly bayed portion 46a is formed with a multiplicity of holes, so that ex- 30 haust water from the motors, falling upon earth material upon the scoop, will wash the finer particles through the holes into the sump trench 50; and disintegrate larger particles so that they also will be washed through.

For disposing of the earth material thus pass- 35 ing through the scoop, the scoop has secured to its under face a suction pipe 51 having its suction mouth in the sump trench and having its other end connected by a hose 52 with the intake side of the pump 16, which is thus adapted to impel the waste water and earth material through the hose 23 to a remote place, beyond the mouth of a tunnel, for example.

To retain the water in the vicinity of the suction nozzle the sump trench can be temporarily or permanently filled, back of the scoop, with earth material 53.

The mode of operation, for clearness, has been described in conjunction with the description of structure.

Modifications are possible within the scope of the invention as defined in the appended claims.

I claim:

1. An excavating machine comprising a vehicle, bit means mounted thereon in position for dis- 40 placing earth material in advance of the vehicle, power means on the vehicle for actuating the bit means, and means on the vehicle for deliver- ing water to the earth material being operated

4

upon by the bit means, the bit means comprising a gang of bits, a mounting common to the bits, and means for so supporting the mounting that it can be fixedly held selectively in different rota- 5 tive positions about a vertical axis, about a horizontal axis transverse to the vehicle, about an axis extending fore-and-aft of the vehicle, and at different elevations, in relation to the vehicle.

2. An excavating machine comprising a vehicle 10 adapted for horizontal travel, a support adjustably mounted on said vehicle for movement of its front end both vertically and horizontally along the face of earth material to be excavated, a gang of bits and respective water-actuated 15 motors therefor mounted on the front end of said support for operation of said bits upon said face, the motors being constructed and arranged to deliver their exhaust water to the material being cut by their respective bits, a pump mounted on 20 said vehicle for supplying water under pressure for actuating the said motors, another pump mounted on said vehicle for pumping away the mixture of water and cuttings resulting from the operation of said bits, prime mover power means 25 mounted on said vehicle for actuating said pumps, a conduit leading from a remote position for supplying water to the first said pump, and a conduit leading from the second said pump to a remote position for conducting the said mixture.

3. A machine as defined in claim 2 in which the gang of bits are arranged in a pattern having a salient positionable for cutting in the floor of the excavation a sump trench of less width than the then existing horizontal cutting span of the 30 gang of bits.

4. A machine as defined in claim 2 in which a screening pan is mounted on the recited vehicle in position to have deposited upon it by gravity the recited mixture of exhaust water and cut- 40 tings.

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REFERENCES CITED

The following references are of record in the 45 file of this patent:

UNITED STATES PATENTS

Number	Name	Date
Re. 19,397	Bannister	Dec. 18, 1943
50 794,877	McDougall	July 18, 1905
825,857	Moran et al.	July 10, 1906
873,056	Lake	Dec. 10, 1907
874,603	Lee et al.	Dec. 24, 1907
1,201,097	Proctor	Oct. 10, 1916
55 1,276,249	Morgan	Aug. 20, 1918
1,465,372	Starr et al.	Aug. 21, 1923
1,467,513	Starr et al.	Sept. 11, 1923
1,569,510	Lidke	Jan. 12, 1926

FOREIGN PATENTS

Number	Country	Date
60 336,247	Germany	Apr. 29, 1921