

April 12, 1932.

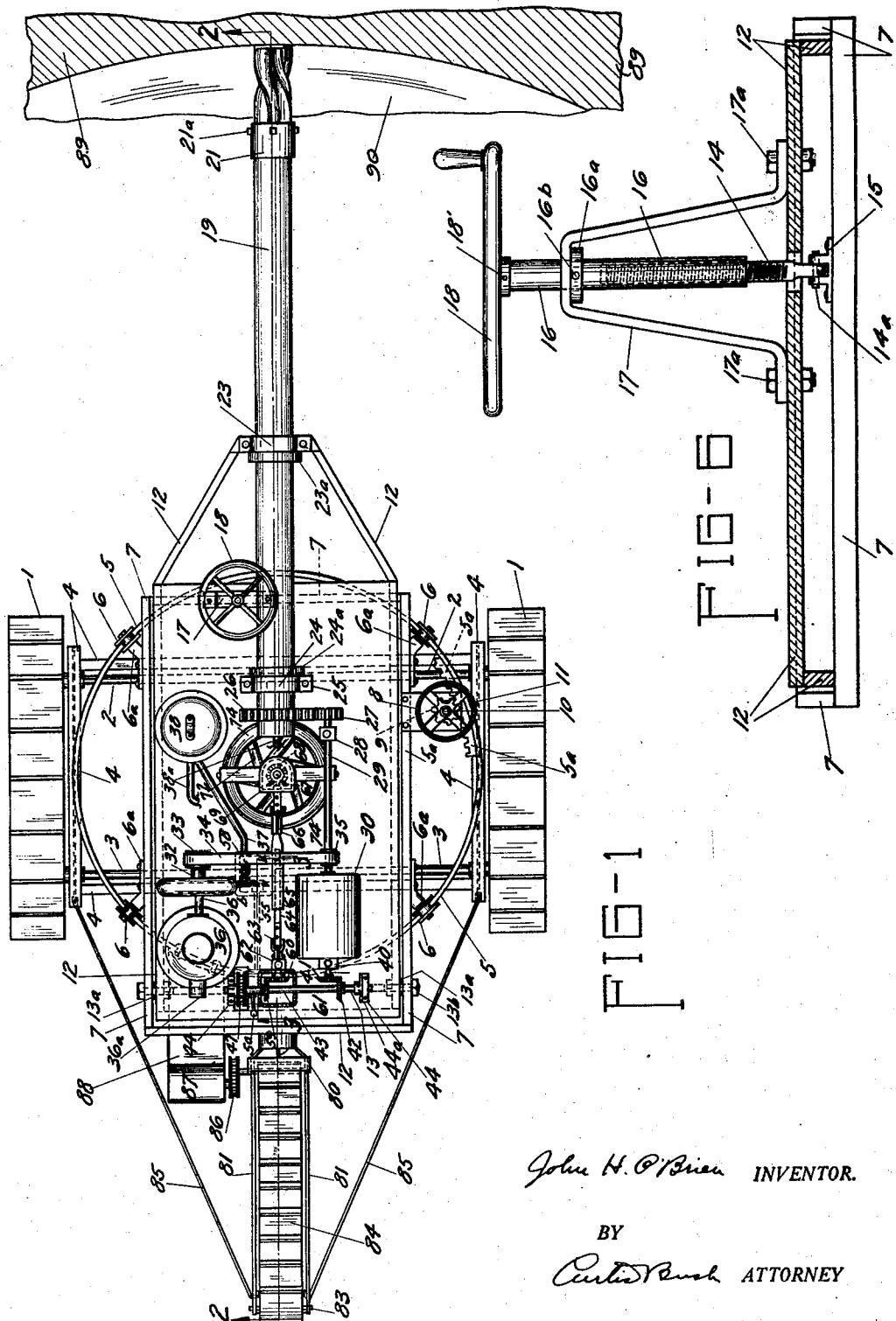
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1,853,923

EXCAVATING MACHINE

Filed May 10, 1930

3 Sheets-Sheet 1



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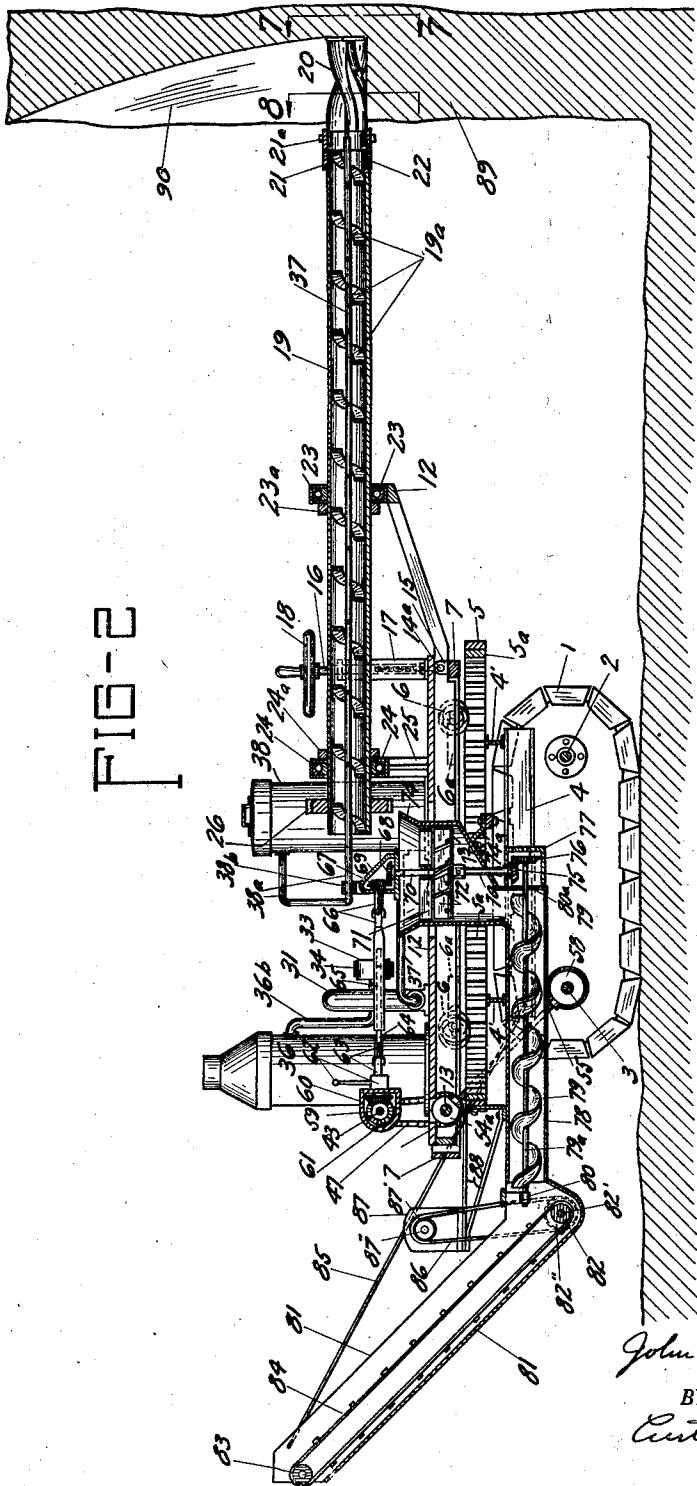
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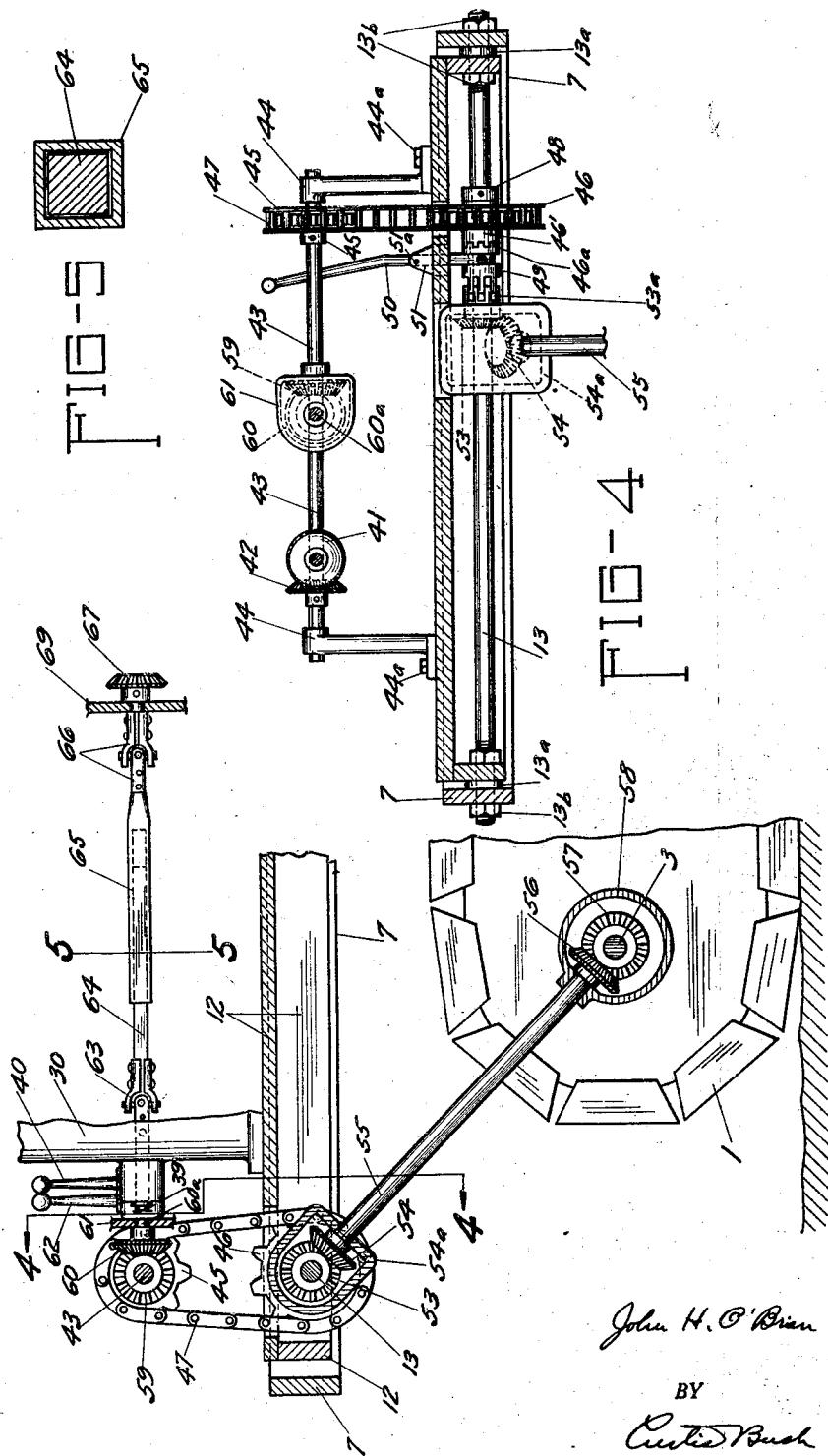
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UNITED STATES PATENT OFFICE

JOHN H. O'BRIEN, OF OSAGE, WYOMING

EXCAVATING MACHINE

Application filed May 10, 1930. Serial No. 451,321.

My invention relates to excavating machines.

The objects of my invention are:

1. To provide a machine which will economically mine clay and other earthy minerals;
2. To provide an apparatus which will successfully operate upon clay and similar earthy minerals carrying a large moisture content;
3. To provide a machine which will mine moist clay and similar earth minerals, and grind, disintegrate or comminute the excavated material;
4. To provide a machine which will mine moist clay and similar earthy minerals, and grind, disintegrate, comminute and dry out the excavated material;
5. In a machine for mining moist clay, to provide means for conveying the clay to an elevator and preventing the sticking of it while being conveyed;
6. To provide a mining machine with a cutter head movable both horizontally and vertically and laterally;
7. To provide a mining machine for the purposes mentioned which can move about under its own power;
8. To provide a mining machine which will be capable of progressing and cutting both forwardly and laterally.

I attain these objects by the means illustrated in the accompanying drawings, in which,—

Figure 1 is a plan view of my machine, but having a portion of the pipe, 38a, and bearing, 38b omitted to prevent interference;

Figure 2 is a longitudinal section on the line 2—2 of Figure 1;

Figure 3 is an enlarged sectional detail of the driving mechanism for the treads and the rear cutters on the line, 3—3, of Figure 1;

Figure 4 is an enlarged sectional detail showing the jack-shaft and tread drive on the line, 4—4, of Figure 3;

Figure 5 is an enlarged detail of the square shaft and slip joint on the line 5—5 of Figure 3;

Figure 6 is an enlarged detail of the elevating screw;

Figure 7 is an enlarged end view of the forward cutter;

Figure 8 is a cross-sectional view on the line, 8—8, of Figure 2.

Similar numerals refer to similar parts throughout the several views.

My apparatus comprises a main frame composed of longitudinal frame members, 4, and cross-frame members, 4', suitably mounted upon the front axle, 2, and rear axle, 3. Caterpillar treads, 1, are provided mounted upon wheels which in turn are revolvably mounted upon the axles, 2 and 3, in the usual way.

Rigidly secured to the main frame is a fixed circular track, 5, of iron or other suitable material, and having an internal ring gear, 5a, united thereto. A rotatable frame, 7, is mounted upon the fixed circular track, 5, and is revolvably thereon upon channeled traversing wheels, 6, which are mounted upon brackets, 6a, rigidly secured to the rotatable frame, 7.

A tilting platform, 12, preferably comprising framing members with planking suitably secured thereto, has its rear end pivotally mounted upon a pivot shaft, 13, which extends transversely of the rotatable frame near the rear end thereof, with spacers, 13a, interposed upon the shaft, 13, between the side frame members of the rotatable frame, 7, and the tilting platform, 12. The shaft, 13, may be secured by nuts, 13b, or any other suitable means.

The front end of the platform, 12, rests normally upon the front cross-members of the rotatable frame, 7. A screw, 14, has its lower end pivotally secured by a pivot, 14a, to a bearing bracket, 15, which is secured to the front cross-member of the rotatable frame, 7. A yoke, 17, of band-iron or other suitable material, is secured to the tiltable platform, 12, by bolts, 17a, and has an opening in its upper portion in which a sleeve, 16, is revolvably mounted. The sleeve, 16, is internally threaded to correspond to the screw, 14, and has a collar, 16a, rigidly secured thereto by a pin, 16b, or other suitable

means. A hand-wheel, 18, is rigidly secured to the top of the sleeve, 16, by a pin, 18', or other suitable means, by means of which the sleeve, 16, may be rotated. As the sleeve, 16, 5 rotates in one direction upon the screw, 14, it will carry the front of the tilting platform upwardly away from the rotatable frame, 7, and as it is rotated in the other direction, it will lower the tilting platform, 12, until it 10 rests upon the rotatable frame, 7.

As the front end of the tilting platform is raised by the sleeve, 16, and the screw, 14, the screw, 14, can move upon its pivot, 14a, to allow the tilting of the screw necessary to 15 compensate for the movement of the tilting platform, 12.

The front end of the tilting platform, 12, carries a ball bearing, 23, and a corresponding bearing, 24, is rigidly mounted upon the 20 tilting platform, 12, somewhat to the rear of the elevating screw, 14.

Within these ball bearings, I mount a rotatable tube, 19, which is secured against longitudinal movement by collars, 23a and 24a, 25 united to the tube adjacent the ball bearings, 23 and 24.

At the rear of the tube, 19, I mount a gear, 26, which is rigidly secured to the tube and adapted to be driven by a pinion, 27, mounted 30 upon and clutched to a motor shaft, 29, by a throw-out clutch, 28, which motor shaft extends forwardly from the motor, 30, and may be mounted in suitable bearings of any desired type, secured to the tilting platform, 12.

35 I thread the front end of the tube, 19, with threads, 22, and mount thereon a cutter collar, 21, to which spiral cutting members, 20, are secured by bolts, 21a. The cutting members, 20, have their advancing edges, 20', sharpened and inclined slightly outwardly.

The front ends of the spiral cutting members are reenforced and braced by transverse cutters, 20a, which have semi-circular edges, 20b, extending slightly forwardly. The 45 spiral cutters, 20, and the cutters, 20a, are all united to a central shaft, 20c, and the spiral members, 20, have their rear ends secured by bolts, 21a, to the collar, 21, so that as the tube, 19, revolves, it carries with it the cutting member, 20 and 20a.

Inside of the tube, 19, and rigidly secured thereto, I mount a spiral flange, 19a, which may be continuous or composed of successive and interrupted flights.

55 A hot air blast pipe, 37, is mounted in the center of the tube, 19, the front end of which is supported by the shaft, 20c, the rear end of which is secured in a suitable support, 38b, and is connected with a pipe, 38a, to a dust bin, 38.

This dust bin, 38, is connected by suitable piping, 37, to a blower, 31, in which a fan is mounted upon the shaft, 32, driven by a belt, 34, and belt wheel, 33, from a pulley, 35, 60 mounted upon the motor shaft, 29.

An air heater, 36, is mounted upon the rear of the tilting platform, 12, which may be heated by any suitable means, and an outlet pipe, 36b, leads from the heater, 36, to the blower, 31. Dust material of any suitable kind may be deposited in the dust bin and this material and the bin are arranged in such a way that the air passing therethrough will carry a small quantity of dust as it passes through the hot air pipe, 37, into the tube, 19, so that the clay passing through the revolving tube, 19, will not only be dried to some extent by the hot air, but will also be coated to some extent by the dust and the inside of the tube, 19, will likewise be coated by the dust so as to prevent sticking and clogging therein. 70

To the rear of and under the tube, 19, I mount a hopper, 74, upon suitable supports, 74a, united to the fixed frame members, 4, 85 which hopper is adapted to receive the clay as it comes from the tube, 19. In this hopper, I mount a series of baffles, 71. In the center of the hopper I provide a cutter shaft, 70, the upper end of which extends into a gear case, 69, and has rigidly mounted thereon a bevel gear, 68, which meshes with a corresponding gear, 67, mounted upon the front member of a universal joint, 66, which in turn is united to a square sleeve, 65, which surrounds a square shaft, 64, and provides a slip joint therewith. The rear end of the square shaft, 64, is united to the front member of a universal joint, 63, and to the rear member of the universal joint, 63, is united a shaft, 60a, 90 which carries a bevel gear pinion 60, which in turn meshes with a corresponding pinion, 59, united to the jack-shaft, 43, and the jack-shaft, 43, is mounted in suitable bearings formed in supports, 44, secured to the tilting platform, 12, by bolts, 44a, or other suitable means. 95

A throw-out clutch, 62, is mounted upon the shaft, 60a. The lower end of the cutter shaft, 70, extends through the bottom plate of the hopper, 74, and into a gear case, 77, and has rigidly mounted thereon a bevel gear, 75, which meshes with and drives a corresponding gear 76, mounted upon the spiral conveyor shaft, 79a, which is revolvably mounted in suitable bearings, 80 and 80a, united to the frame member, 4, in any suitable manner. A spiral conveyor plate, 79, which may be continuous or of separate interrupted flights, is united to the conveyor shaft, 79a, within a tube, 78. An opening in the bottom of the hopper, 74, is provided which leads into the front end of the tube, 78, and is adapted to conduct the material from the hopper, 74, into the conveyor. 110

Upon the shaft, 70, I mount a spider, 73, which is rigidly secured to the shaft, 70, and carries cutter blades, 72, adapted to revolve with the shaft, 70. 120

As the material passes into the hopper, 74, 130

it is detained by the baffles, 71, and cut or further comminuted by the blades, 72, after which it passes out of the opening in the bottom of the hopper, 74, and into the conveyor tube, 78. At the rear of the conveyor tube, I mount an elevator housing, 81, having a belt elevator, 84, traveling therein over rolls, 82 and 83, which are revolvably mounted in the elevator housing, 81, and from which the finished product may be delivered to a wagon, bin or any other desired receptacle.

Brace rods, 85, to brace the elevator, are provided having their upper ends connected to the elevator housing, 81, and their lower ends suitably connected to the main frame members, 4. The elevator is driven by a drive or sprocket chain, 86, which passes over a sprocket wheel mounted upon the shaft, 82, of the roll 82, and is in turn driven by a pulley 20 or sprocket wheel, 87', mounted upon the shaft, 87", of the motor, 87. The motor, 87, is mounted upon a bracket, 88, united to the main frame, 4, and the circular track, 5.

The caterpillar treads are driven by the motor, 30, as follows: The motor shaft, 29, extends to the rear of the motor and there carries a bevel gear pinion, 41, which meshes with a corresponding pinion, 42, mounted upon the jack-shaft, 43, which is heretofore 30 described as mounted in suitable supports, 44. The jack-shaft, 43, has rigidly mounted thereon a sprocket wheel, 45, (see fig. 4) which drives a chain, 47, and this chain passes over and drives a wheel, 46, having a hub, 46', 35 formed integral therewith and loosely mounted upon the shaft, 13, with clutch teeth, 46a, formed on the hub, 46', and with a sliding clutch member, 49, mounted upon the shaft, 13, adjacent the hub, 46', with throw-out 40 lever, 50, pivotally mounted upon a bracket 51, and having a fork formed upon its lower end as shown in Figure 4, which embraces the clutch member, 49.

A bevel gear driving pinion, 53, is mounted 45 upon the shaft, 13, with teeth, 53a, adapted to mesh with corresponding teeth formed upon the clutch member 49.

A corresponding bevel gear, 54, is mounted 50 upon the upper end of the shaft, 55, in mesh with the gear, 53. A gear housing, 54a, is provided to enclose the gears, 53 and 54. The lower end of the shaft, 55, is mounted in a suitable bearing mounted upon the housing, 58, surrounding the shaft, 3, and bears a bevel 55 gear pinion, 56, which meshes with a corresponding bevel gear pinion, 57, which is rigidly secured to the axle-shaft, 3, to which the rear wheels for driving the treads, 1, are suitably united.

In order to move the rotatable frame, 7, upon the circular track, 5, I provide a traversing pinion, 9, mounted upon the lower end of the shaft, 10, which is revolvably mounted in a bracket, 8, which bracket is rigidly secured to the rotatable frame 7. Upon

the upper end of the shaft, 10, I fashion a hand-wheel, 11, by which the same can be manually turned.

In the operation of my machine, it can be driven up to the clay bank, 89, by starting the motor, 30, and throwing in the clutches, 40 and 49. When it has reached the desired position, the clutch, 49, may be thrown out and the clutches, 63 and 28, thrown into engagement. The clutch, 28, will cause the tube, 19, and the cutters, 20, to revolve and the rotatable frame, 7, may then be turned by the hand-wheel, 11, the shaft, 10, and gearing connected thereto so as to carry the cutters through the arc described in Figure 1. As the clay is cut in thin ribbons by these cutters it is carried backward by the spiral flights of the tube, 19, to the hopper, 74, in the meantime being dried out by the air blast and to some extent coated by the dust coming through the pipe, 37, and as it passes through this conveyor, it will be broken up by being tossed around therein. After it passes into the hopper, 74, it will be still further comminuted by the cutters and baffles and the process will continue as it moves through the spiral conveyor housing, 78, to the elevator. At the same time that the motor is started, the blower, 31, is started by the belt, 34, so as to produce a blast of air through the heater, 36, and to the dust bin, 38.

When one horizontal cut has been given through the bank, 89, the wheel, 18, may be turned and the tilting platform, 12, raised. The cutters thereby will be raised so as to bite into a new path through the clay bank and this process may be continued until all of the clay available to a single setting of the machine has been mined.

When desired, the cutter may be started at one end of the arc, 90, shown in the bank, 89, in Figure 1 or if desired, the clutches to drive the cutters and the caterpillar treads may be operated simultaneously and the cutter head driven directly into the bank. In such cases, the cutting edges and the front blades of the cutters will cut a circular opening right into the bank for the full length of the head. The treads may then be stopped and the cutter 115 swung from side to side by the hand-wheel, 11, as heretofore described.

When the cutter has been in operation long enough for the clay to be carried back to the foot of the elevator, 81, the elevator motor, 87, should be started and the hopper wagon driven up to receive the clay as it passes from the elevator.

In the machines heretofore used for mining clay and earthy minerals such as bentonite, great difficulty has been experienced when the material contained a large percentage of moisture because of the tendency to stick and it has been found very difficult to pulverize such moist material by any of the means commonly in use for that purpose.

My machine has not only the advantage of cutting the clay initially in thin shavings or ribbons which can be much more readily reduced than material mined in chunks, but 5 provides means for dusting the material and the conveyors with dry dust to prevent sticking and concurrent means for drying out the material as it passes through the conveyors. The material will accordingly reach 10 the discharge end of the machine in fine particles from which a large percentage of the moisture content has been removed. It will therefore be very much more suitable for further reduction in ball or roller mills or such 15 other machines as may be used for further pulverizing it.

Any suitable form of motor or engine may be used to drive the cutters, blower, spiral conveyor, elevator and caterpillar treads and 20 a single motor or engine or a plurality of motors and engines may be used for this purpose. So, also, any desired form of heater may be used for heating the air.

I do not limit my claims to any precise 25 form of motor, heater, cutters or conveyors, for it is obvious that many of these parts may be varied by the substitution of well-known equivalents without departing from the spirit of my invention.

When desired, serrated or indented cutting edges may be provided for the spiral cutters which will be well adapted for certain 30 classes of work, but for such materials as the bentonite found in South Dakota, I prefer to use the form of cutters illustrated, as being 35 the best adapted to that particular kind of material.

I claim:

1. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a circular track rigidly secured upon the fixed frame, a rotatable frame rotatably mounted upon the circular track, co-acting means united to the rotatable frame and to 40 the circular track respectively adapted to revolve the rotatable frame upon said track, a platform mounted on the rotatable frame, a plurality of bearings united to the platform, a tube revolvably mounted in said bearings and extending forwardly therefrom, a cutter-head united to the front end of the tube, means mounted upon the platform adapted to rotate the tube and the cutter-head carried thereby, a hopper secured 45 to the fixed frame under the rear end of the tube, a revolving cutter mounted in the hopper, and a conveyor mounted upon the fixed frame adjacent the hopper and adapted to carry away the material from the hopper.

2. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a circular track rigidly secured upon the fixed frame, a rotatable frame rotatably mounted upon the circular track, co-acting means united to the rotatable 50

frame and to the circular track respectively adapted to revolve the rotatable frame upon said track, a platform mounted on the rotatable frame, a plurality of bearings united to the platform, a tube revolvably mounted in said bearings and extending forwardly therefrom, a cutter-head united to the front end of the tube, means mounted upon the platform adapted to rotate the tube and the cutter-head carried thereby, a hopper secured to the fixed frame under the rear end of the tube, a plurality of baffles and a revolving cutter mounted in the hopper, and a conveyor mounted upon the fixed frame adjacent the hopper and adapted to carry away 55 the material from the hopper.

3. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a circular track rigidly secured upon the fixed frame, a rotatable frame rotatably mounted upon the circular track, co-acting means united to the rotatable frame and to the circular track respectively adapted to revolve the rotatable frame upon said track, a platform mounted on the rotatable frame, a plurality of bearings united to the platform, a tube revolvably mounted in said bearings and extending forwardly therefrom, a cutter-head united to the front end of the tube, means mounted upon the platform adapted to rotate the tube and the cutter-head carried thereby, a hopper secured to the fixed frame under the rear end of the tube, a plurality of baffles and a revolving cutter mounted in the hopper and a spiral conveyor mounted upon the fixed frame adjacent the hopper and adapted to carry away 60 the material from the hopper.

4. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a circular track rigidly secured upon the fixed frame, a rotatable frame rotatably mounted upon the circular track, co-acting means united to the rotatable frame and to the circular track respectively adapted to revolve the rotatable frame upon said track, a platform mounted on the rotatable frame, a plurality of bearings united to the platform, a tube revolvably mounted in said bearings and extending forwardly therefrom, a cutter-head united to the front end of the tube, means mounted upon the platform adapted to rotate the tube and cutter-head carried thereby, a pipe secured centrally of the tube and having ports opening into the tube, a dust bin, a connecting pipe from the bin to the pipe in the tube, and means to blow dust from the bin through the pipes and into the tube.

5. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a circular track rigidly secured upon the fixed frame, a rotatable frame rotatably mounted upon the circular track, co-acting means united to the rotatable frame 125

and to the circular track respectively adapted to revolve the rotatable frame upon said track, a platform mounted on the rotatable frame, a plurality of bearings united to the platform, a tube revolvably mounted in said bearings and extending forwardly therefrom, a cutter-head united to the front end of the tube, means mounted upon the platform adapted to rotate the tube and the cutter-head carried thereby, an air heater mounted upon the platform and means for conducting heated air therefrom into the tube.

6. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a circular track rigidly secured upon the fixed frame, a rotatable frame rotatably mounted upon the circular track, co-acting means united to the rotatable frame and to the circular track respectively adapted to revolve the rotatable frame upon said track, a platform mounted on the rotatable frame, a plurality of bearings united to the platform, a tube revolvably mounted in said bearings and extending forwardly therefrom, a cutter-head united to the front end of the tube, means mounted upon the platform adapted to rotate the tube and the cutter-head carried thereby, a pipe secured centrally of the tube and having ports opening into the tube, a dust bin, a connecting pipe from the bin to the pipe in the tube, an air heater mounted upon the platform and means for conducting heated air therefrom to the dust bin and thence into the pipes and tube.

7. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a circular track rigidly secured upon the fixed frame, a rotatable frame rotatably mounted upon the circular track, co-acting means united to the rotatable frame and to the circular track respectively adapted to revolve the rotatable frame upon said track, a platform mounted on the rotatable frame, a plurality of bearings united to the platform, a tube revolvably mounted in said bearings and extending forwardly therefrom, a cutter-head united to the front end of the tube, means mounted upon the platform adapted to rotate the tube and the cutter-head carried thereby, a hopper secured to the fixed frame under the rear end of the tube, a revolving cutter mounted in the hopper, a conveyor mounted upon the fixed frame adjacent the hopper and adapted to carry away the material from the hopper, a pipe secured centrally of the tube and having ports opening into the tube, a dust bin, a connecting pipe from the bin to the pipe in the tube, and means to blow dust from the bin through the pipes and into the tube.

8. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a circular track rigidly secured upon the fixed frame, a rotatable frame rotatably mounted upon the circular track, co-

acting means united to the rotatable frame and to the circular track respectively adapted to revolve the rotatable frame upon said track, a platform mounted on the rotatable frame, a plurality of bearings united to the platform, a tube revolvably mounted in said bearings and extending forwardly therefrom, a cutter-head united to the front end of the tube, means mounted upon the platform adapted to rotate the tube and the cutter-head carried thereby, a hopper secured to the fixed frame under the rear end of the tube, a revolving cutter mounted in the hopper, a conveyor mounted upon the fixed frame adjacent the hopper and adapted to carry away the material from the hopper, an air heater mounted upon the platform and means for conducting heated air therfrom into the tube.

9. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a circular track rigidly secured upon the fixed frame, a rotatable frame rotatably mounted upon the circular track, co-acting means united to the rotatable frame and to the circular track respectively adapted to revolve the rotatable frame upon said track, a platform mounted on the rotatable frame, a plurality of bearings united to the platform, a tube revolvably mounted in said bearings and extending forwardly therefrom, a cutter-head united to the front end of the tube, means mounted upon the platform adapted to rotate the tube and the cutter-head carried thereby a hopper secured to the fixed frame under the rear end of the tube, a revolving cutter mounted in the hopper, and a conveyor mounted upon the fixed frame adjacent the hopper and adapted to carry away the material from the hopper, a pipe secured centrally of the tube and having ports opening into the tube, a dust bin, a connecting pipe from the bin to the pipe in the tube, an air heater mounted upon the platform and means for conducting heated air therefrom to the dust bin and thence into the pipes and tube.

10. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a circular track rigidly secured upon the fixed frame, a rotatable frame rotatably mounted upon the circular track, co-acting means united to the rotatable frame and to the circular track respectively adapted to revolve the rotatable frame upon said track, a platform mounted on the rotatable frame, a plurality of bearings united to the platform, a tube revolvably mounted in said bearings and extending forwardly therefrom, a cutter-head united to the front end of the tube, means mounted upon the platform adapted to rotate the tube and the cutter-head carried thereby, a hopper secured to the fixed frame under the rear end of the tube, a plurality of baffles and a revolving cutter

mounted in the hopper, a conveyor mounted upon the fixed frame adjacent the hopper and adapted to carry away the material from the hopper and an elevator adapted to receive and discharge at a height, the material carried from the hopper by the conveyor.

11. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a tiltable platform united to the fixed frame, bearings united to the platform, a conveyor tube revolvably mounted in said bearings and extending forwardly therefrom, a rotary cutter united to the front end of the tube, and means mounted upon the platform adapted to rotate the tube and the rotary cutter carried thereby.

12. The process of mining bentonite and earthy materials containing a considerable proportion of moisture, comprising cutting same from the bank in thin ribbons or shavings, conveying the cuttings through a tube and subjecting them to a blast of hot air while passing through the tube.

13. The process of mining bentonite and earthy materials containing a considerable proportion of moisture, comprising cutting same from the bank in thin ribbons or shavings, conveying the cuttings through a tube and subjecting them to a blast of hot air carrying dry dust, while passing through the tube.

14. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a movable platform rotatably and tiltably mounted upon the fixed frame, a plurality of bearings united to the movable platform, a conveyor tube revolvably mounted in said bearings and extending forwardly therefrom, a cutter-head united to the front end of the conveyor tube and adapted to excavate the desired material in thin ribbons or shavings, means to rotate the tube and cutter-head and means to subject the excavated material to the action of a blast of hot air while passing through the conveyor tube.

15. An excavating machine comprising a fixed frame mounted upon suitable supporting means, a movable platform rotatably and tiltably mounted upon the fixed frame, a plurality of bearings united to the movable platform, a conveyor tube revolvably mounted in said bearings and extending forwardly therefrom, a cutter-head united to the front end of the conveyor tube and adapted to excavate the desired material in thin ribbons or shavings, means to rotate the tube and cutter-head, means to subject the excavated material to the action of a blast of hot air while passing through the conveyor tube, and auxiliary means for comminuting or pulverizing the excavated material after it leaves the conveyor tube.

In testimony whereof he affixes his signature.

65 JOHN H. O'BRIEN.