W. W. HARTSOUGH.

DITCHING MACHINE.

APPLICATION FILED JULY 12, 1920.

1,411,999.

Patented Apr. 4, 1922.

5 SHEETS—SHEET 1.

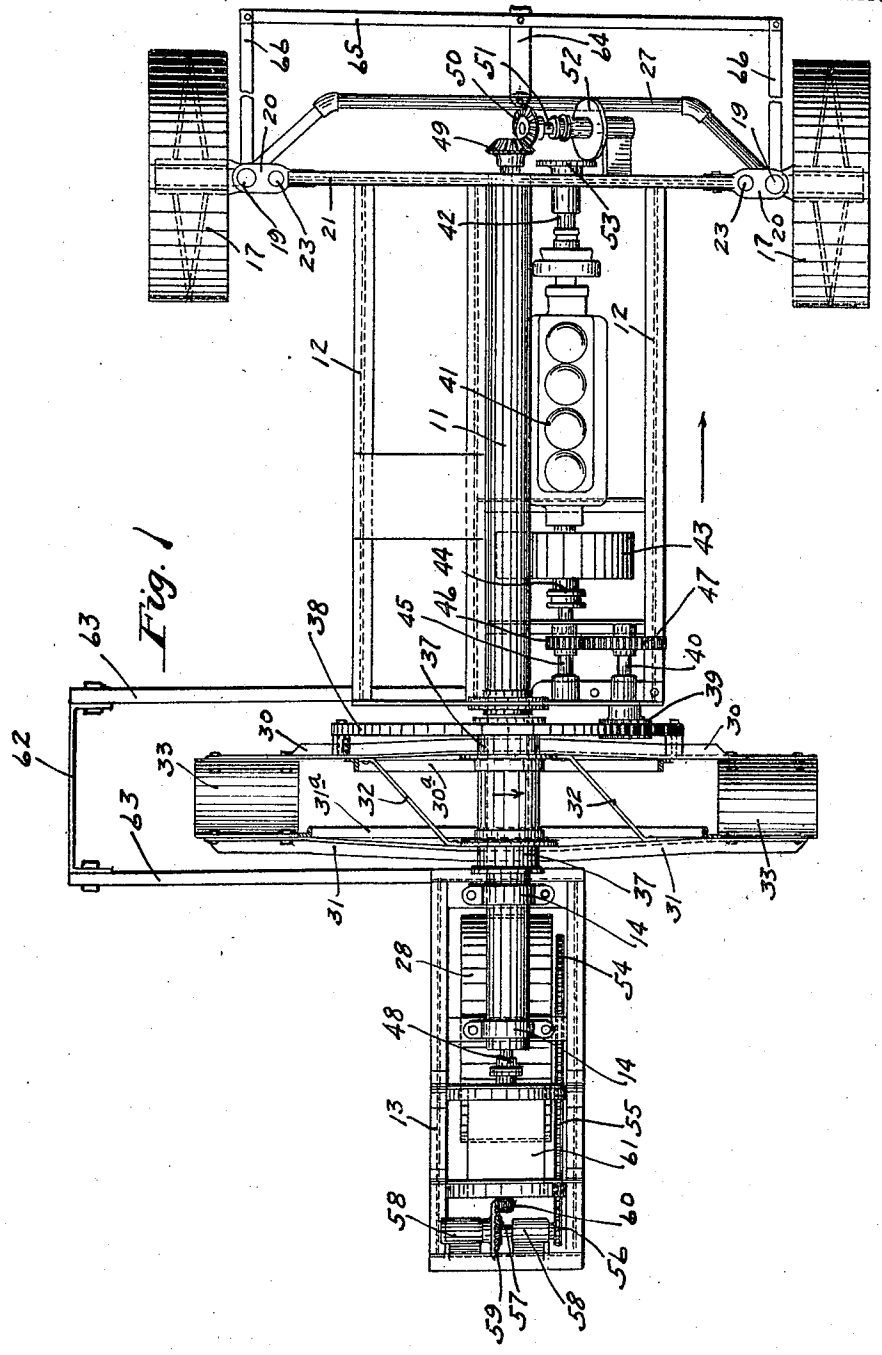


Fig. 1

Inventor
W. W. HARTSOUGH
By his Attorneys
William Woodward

W. W. HARTSOUGH.

DITCHING MACHINE.

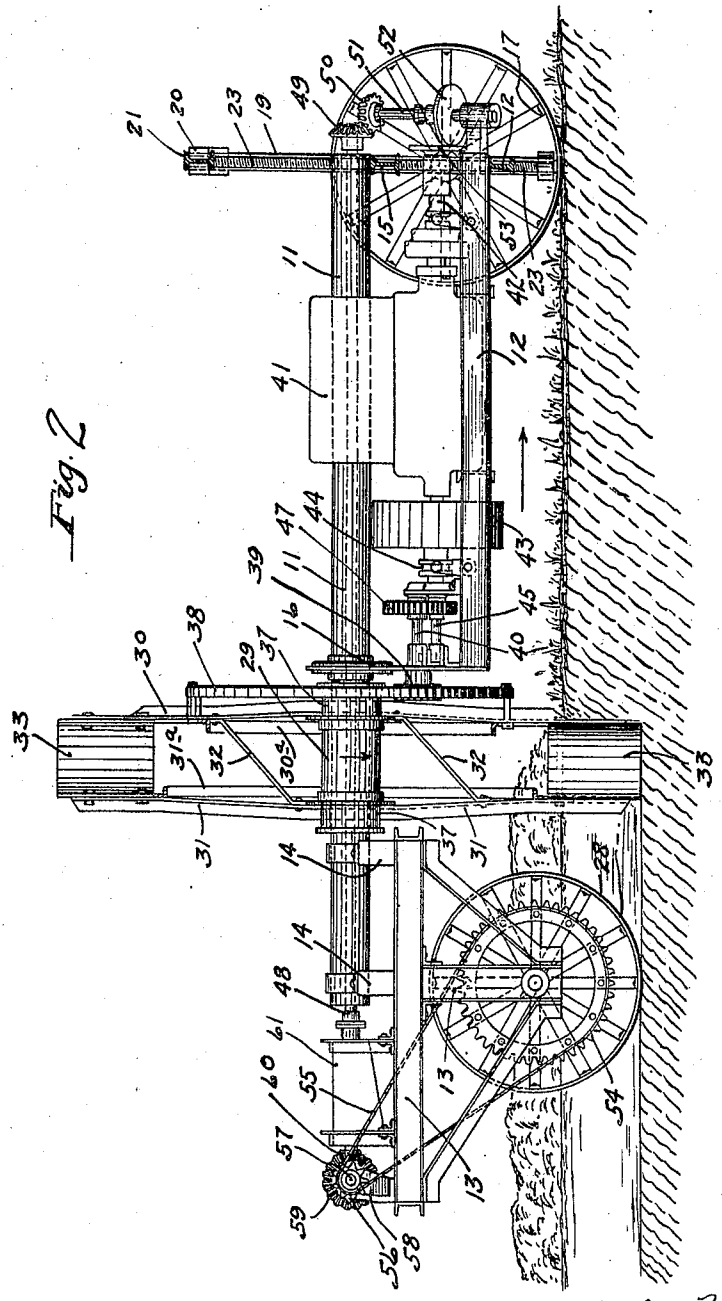
APPLICATION FILED JULY 12, 1920.

1,411,999.

Patented Apr. 4, 1922.

5 SHEETS—SHEET 2.

Fig. 2



Inventor

W. W. HARTSOUGH

By his Attorneys

Williamson & Merchant

W. W. HARTSOUGH.

DITCHING MACHINE.

APPLICATION FILED JULY 12, 1920.

1,411,999.

Patented Apr. 4, 1922.

5 SHEETS—SHEET 3.

Fig. 4

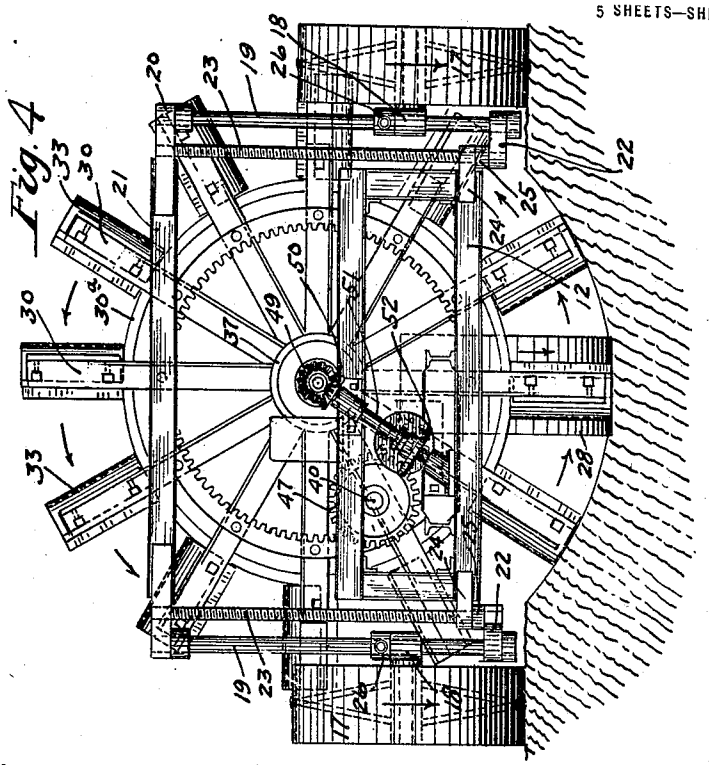
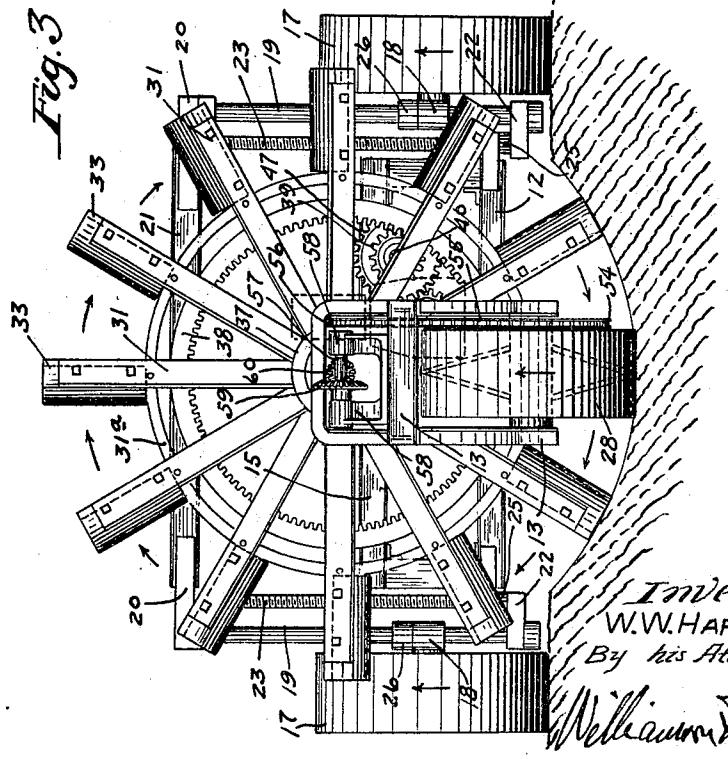


Fig. 3



Inventor
W. W. HARTSOUGH
By his Attorneys
Williamson & Merchant

W. W. HARTSOUGH.

DITCHING MACHINE.

APPLICATION FILED JULY 12, 1920.

1,411,999.

Patented Apr. 4, 1922.

5 SHEETS—SHEET 4.

Fig. 7

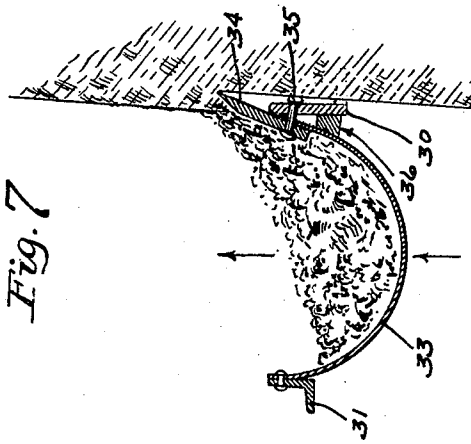


Fig. 8

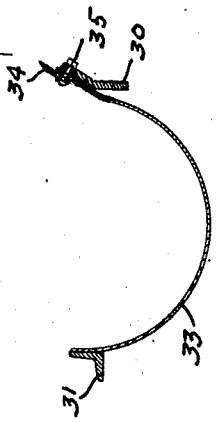


Fig. 6

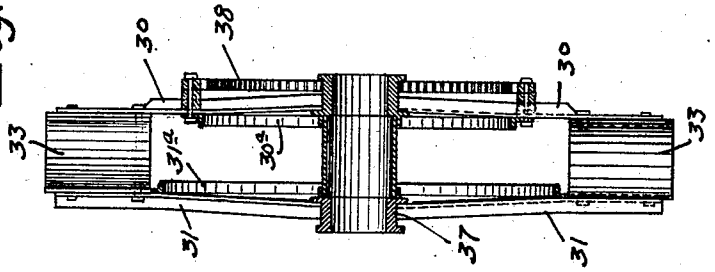
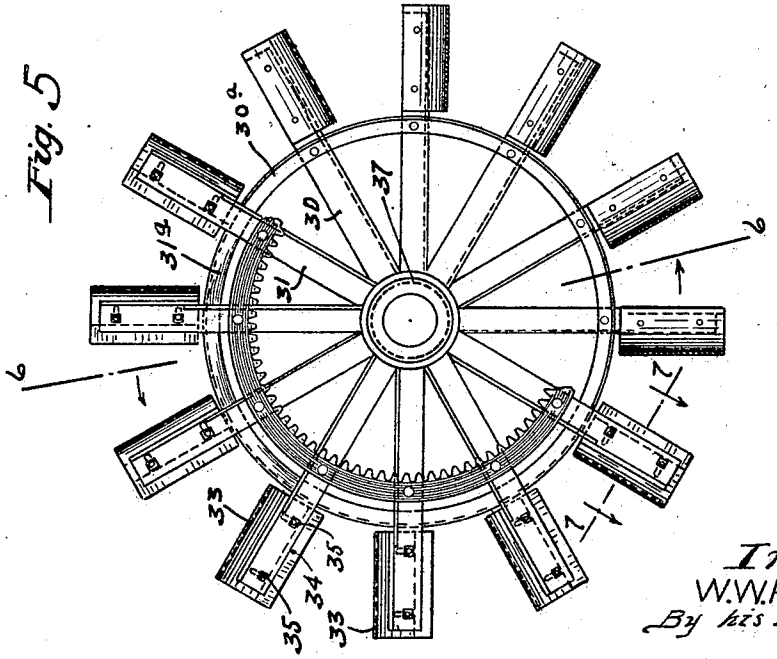


Fig. 5



Inventor
W.W. HARTSOUGH
By his Attorneys

William & Merchant

W. W. HARTSOUGH.

DITCHING MACHINE.

APPLICATION FILED JULY 12, 1920.

1,411,999.

Patented Apr. 4, 1922.

5 SHEETS—SHEET 5.

Fig. 10

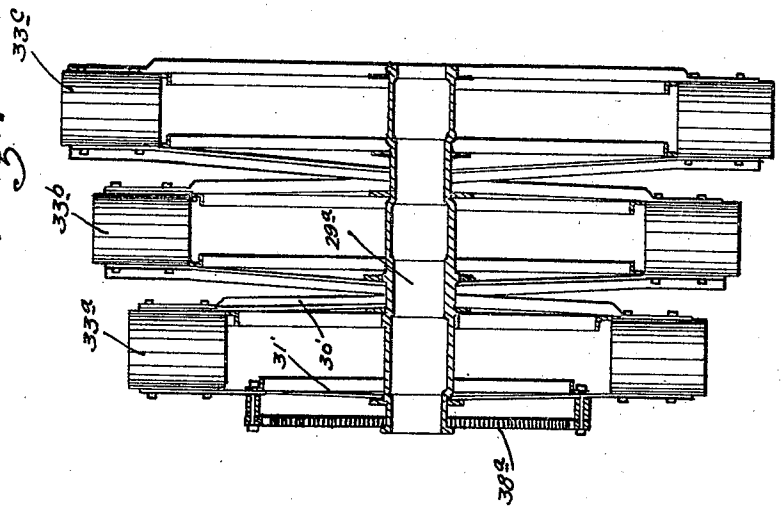
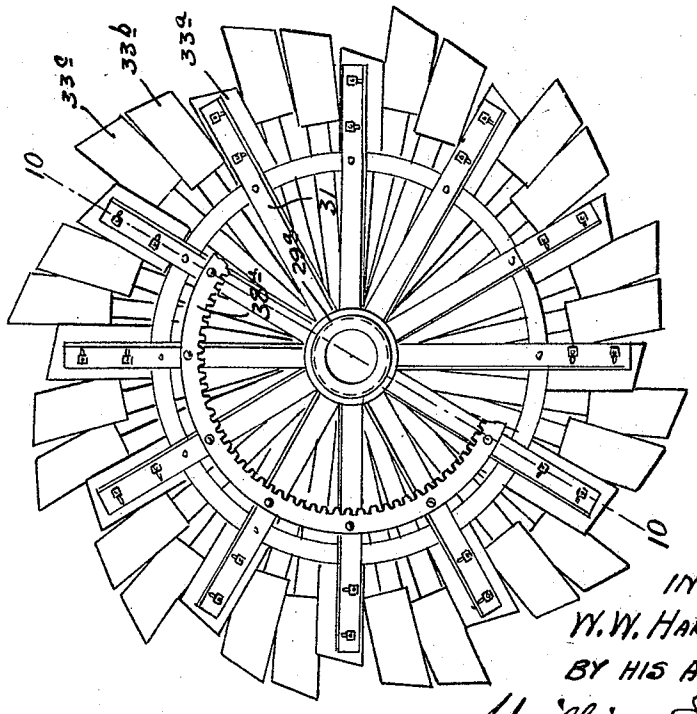


Fig. 9



INVENTOR
W. W. HARTSOUGH.
BY HIS ATTORNEYS
Williamson & Merchant

UNITED STATES PATENT OFFICE.

WALTER W. HARTSOUGH, OF SAN FRANCISCO, CALIFORNIA.

DITCHING MACHINE.

1,411,999. Specification of Letters Patent. Patented Apr. 4, 1922.

Application filed July 12, 1920. Serial No. 395,439.

To all whom it may concern:

Be it known that I, WALTER W. HARTSOUGH, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Ditching Machines; and I do hereby declare the following to be a full, clear and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention is directed particularly to the provision of an improved ditching machine and is in the nature of an improvement on, or modification of, the ditching machine disclosed and broadly claimed in my prior United States patent 1,225,327, of date May 8, 1917.

Generally stated, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

A commercial form of the ditching machine, embodying my several features of improvement, is illustrated in the accompanying drawings, wherein like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a plan view of the machine;

Fig. 2 is a side elevation of the machine;

Fig. 3 is a rear elevation of the machine;

Fig. 4 is a front elevation of the machine;

Fig. 5 is a detail of the excavating wheel, some parts being broken away;

Fig. 6 is a section taken approximately on the line 6—6 of Fig. 5;

Fig. 7 is an enlarged section taken on the line 7—7 of Fig. 5;

Fig. 8 is a view corresponding to Fig. 7, but illustrating a slightly modified construction;

Fig. 9 is a view corresponding to Fig. 5, but illustrating a multi-section excavating wheel; and

Fig. 10 is a section taken approximately on the line 10—10 of Fig. 9, some parts being broken away.

The machine illustrated in Figs. 1 to 7, inclusive, comprises as follows:

As a novel and important feature, I provide front and rear trucks, connect the front and rear truck frames by a reach beam in the form of a heavy tube, and mount the excavating wheel to rotate on the intermediate portion of this reach, between the front and rear truck frames.

The tubular reach 11 is preferably a large iron or steel pipe. The frame of the front truck is indicated by the numeral 12, and the frame of the rear truck is indicated by the numeral 13. The reach 11, at its rear end, is rigidly secured to the rear truck frame 13 by suitable clamps 14 (see particularly Figs. 1 and 2). The front truck frame 12 comprises a bolster 15, to which the reach 11 is rigidly connected at its front end. The rear portion of the front truck frame 12 is rigidly connected to the intermediate portion of the reach 11 by a vertically disposed metal hanger plate 16, as best shown in Fig. 2. Thus, the front frame 12 is rigidly secured to the reach 11.

The front frame 12 is carried from laterally spaced front wheels 17, but is vertically adjustable in respect thereto, and the said front wheels are mounted to oscillate so as to steer the machine, the said arrangement being preferably accomplished as follows: Said wheels 17 are journaled on stub axles 18 pivoted on vertical guide rods 19, which, at their upper ends, are rigidly connected to short projecting arms 20 of a horizontally disposed secondary bolster 21. Short arms 22 are rigidly secured to the lower end of the guide rods 19, and vertically disposed screw threaded rods 23 are rigidly secured to the arms 20 and 22.

The frame 12, at its front end, has short arms 24 that are perforated so that they will freely slip over the threads of the respective adjacent screw rods 23. Nuts 25 work on the screw rods 23, directly engage the arms 24 and thus support the front truck frame 12 for independent vertical adjustments at its opposite sides. Collars 26, on the guide rods 19, limit the downward movements thereof through the vertical sleeves of the stub axles 18. The two collars 26 are preferably cross connected by a tie-bar 27, shown as connected pipe sections in Fig. 1, the same being removed from Figs. 2 and 4.

The rear truck frame 13 is a narrow structure and is carried by a single wide-faced traction wheel 28 journaled thereto and arranged to run on the bottom of the ditch which will be formed as hereinafter described.

The excavating wheel, as preferably de-

signed, comprises a flanged hub 29 and radial front and rear arms 30 and 31, said arms being made from angle bars and being tied together by truss straps 32. The arms 30 and 31 are further shown as connected by tie-rings 30^a and 31^a, and they afford parallel pairs of arms, which carry the excavating scoops or shovels. These scoops are preferably made of sheet metal bent into semi-cylindrical form and indicated by the numeral 33. Said scoops 33 are radially disposed in respect to the hub of the wheel and they are riveted, bolted or otherwise rigidly secured to the corresponding front and rear arms 30 and 31, and thence, are open at their outer ends for an important reason presently to be further considered.

As best shown in Figs. 2 and 7, the forwardly projecting flanges of the front arms 30 are cut away at places where they are bolted to the scoops 33, and shaving knives 34 are secured to the front edges of said scoops and to the outer portions of said arms 30, by nut-equipped bolts 35, or otherwise. The numeral 36 indicates wedge strips interposed between the scoops and the arms 30 to assist in holding the shaving knives 34, with their cutting edges projecting forwardly of the plane of movement of the reduced outer end portions of the arms 30. This is important because it prevents the outer ends of the arms 30 from running in frictional contact with the earth bank that is being cut into by the knives 34. At the outer extremities, the knives project radially a short distance, say half an inch beyond the outer extremities of the scoops, so that in the excavating action, the earth will be loosened up always to points below those reached by the scoops.

The arrangement illustrated in Fig. 8 is substantially like that as illustrated in Fig. 7, except that the forwardly projecting flanges of the arms 30 are in line with the scoops, instead of being cut away or simply turned backward so that they will not engage the earth bank.

The excavating wheel just described is, as already stated in a general way, arranged to work between the front and rear truck frames, and its hub 29 is journaled on the tubular reach 11 and is held against axial movements thereon by fixed thrust collars 37 or other suitable devices. Rigidly secured to the front arms 30, of the said excavating wheel, is an internal gear 38, which, as shown, runs in mesh with the pinion 39 on the rear end of a short shaft 40 journaled in suitable bearings on the front truck frame 12.

The numeral 41 indicates a motor, shown as a multi-cylinder internal combustion engine carried by the truck frame 12, with its crank shaft 42 disposed longitudinally of the machine. On the rear end of the crank shaft 42 is a fly wheel 43, which, by a suitable clutch 44 (shown in part), is adapted to be coupled, at will, to a short transmission shaft 45 that carries a pinion 46 that meshes with a spur gear 47 on the shaft 40. Means has just been described whereby the scoop-equipped excavating wheel may, at will, be driven from the engine and rotated in the direction of arrows marked on Figs. 3, 4 and 5.

Engine-driven means is also provided for rotating the traction wheel 28 to thereby impel the machine forward at the proper or desired speed. This means includes the novel feature of utilizing the tubular reach 11 as a support and enclosing casing for a transmission shaft that transmits the power from the engine on the front truck, axially through the excavating wheel, to the rear truck where it is connected to the rear traction wheel. This arrangement is very important where the engine is on the front truck, and in a machine of this character, with laterally spaced front wheels and a single rear traction wheel, it is important that the engine be located on the front truck, not only to distribute the weight but to get a proper laterally stable support for the engine.

The manner in which the above feature is carried out is as follows:

The numeral 48 indicates a long transmission shaft extended axially through and journaled in the tubular reach 11 and provided, at its front end, with a bevel gear 49 that meshes with a bevel gear 50 on the upper end of the oblique shaft 51 journaled in suitable bearings on the front end of the front truck frame 12. Keyed to rotate with and to slide on the shaft 51, is a peripheral friction wheel 52 that runs in frictional contact with a face friction wheel 53 secured to the front end of the engine crank shaft 42.

The rear single traction wheel 28 carries a large sprocket wheel 54, and a sprocket chain 55 runs over this wheel and over a small sprocket 56 carried by one end of a short countershaft 57 journaled in suitable bearings 58 on the truck frame 13 and provided with a bevel gear 59 that meshes with a bevel pinion 60. This pinion 60 may be driven directly or indirectly from the rear end of the long transmission shaft 48. In some instances, said pinion 60 may be directly applied to the rear end of said shaft 48, but, in other instances, it will be connected to or driven from said shaft 48 through transmission mechanism either of the worm and gear type or of the type used in automobiles, and such transmission mechanism may be located in a casing 61 secured on the truck frame 13 (see Figs. 1 and 2).

Whether the transmission mechanism is provided within the casing 61 or whether the

pinion 60 is directly carried by the shaft 48, nevertheless the co-operating friction wheels 52 and 53 afford a variable speed transmission device, and reversing device if desired, whereby the speed of rotation of the traction wheel 28 may be varied in respect to the speed of rotation of the excavating wheel; and this arrangement is highly important because in different kinds of soil, more or less rapid advance of the machine will not only be permitted but desired. It is evident that the machine, while excavating, can advance more rapidly in sandy or soft soil than in clay, gravel or harder soil. Moreover, the rate of advance of the machine, in any particular soil, will depend on the depth of the cut.

The depth of the cut may be varied by adjustment of the front truck frame 12 on the front wheels; and this, as already noted in the construction illustrated, is accomplished by adjustments of the nuts 25. Under rotation of the excavating wheel in the direction of the arrows marked on Figs. 1, 2 and 3, the scoops will, of course, be brought into action in succession. When the excavator is started into action, with the rear wheel 28 on the surface of the ground, the front truck will be lowered until the scoops of the excavating wheels commence to cut a ditch. The depth of this ditch may be regulated by adjustments of the front truck and front end of the reach 11. The maximum depth of a ditch, for any vertical adjustment of the front truck will be the depth cut by the excavating wheel, when its scoops are working in a vertical plane; and as the rear wheel runs on the bottom of the ditch, it acts as a gauge wheel to limit the depth of the cut to the above noted position of the excavating wheel with its scoops operating in a vertical plane. With the excavator thus working, vertical upward adjustments of the front truck will produce a shallower ditch and vertical downward adjustments of the front truck will produce a deeper ditch. Attention is further called to the fact that since the gauge wheel works on the bottom of the frame, the depth of the ditch will not be effected to any appreciable extent by slight irregularities in the surface of the ground traveled by the front wheels 17.

In the excavating action, the scoops (see particularly Fig. 7) shave off or cut the earth in a vertical plane, and with a drawing action which tends to cause the shaving knife 34 to dig into the bank and draw the machine forward and, hence, to very greatly decrease the power otherwise required to drive the machine forward.

The machine should be so designed that, when at work, as shown in Fig. 2, the outer portions of the scoops 33 will cut to the level of the bottom of the traction wheel 28, and the knives 34 should work to the lowest depth so that they will soften up the bottom of the ditch. This latter action provides softened ground, through which the outer portions of the scoops travel in picking up their load.

The earth picked up by the scoops will be thrown by centrifugal force and gravity to one side of the ditch, and the distance to which it will be thrown may be varied by varying speed or rotation of the excavating wheel. As the scoops throw the dirt from the outer ends under the action of centrifugal force, it, of course, follows that these scoops must have open outer ends free from obstruction.

It is sometimes desirable to deposit the dirt in an embankment closely confined to the side of the ditch, and for this purpose (see Fig. 1), I may employ a vertically disposed stop plate 62, against which the dirt will be thrown from the scoops. This stop plate is shown as supported from the truck frames 12 and 13 by bars 63, shown only in Fig. 1.

For stearing the machine, a long pole or lever 64 may be pivotally connected to the front tie-bar 27 and to a cross steering rod 65 that is connected to arms 66 that project forwardly from the stub axles 18, so that the wheels 17 may be oscillated.

In Figs. 9 and 10, I have illustrated a multi-section or plural arrangement of excavating wheel. In this wheel, the scoops 33^a, 33^b and 33^c are carried from common hub 29^a by arms or spokes 30′ and 31′, and the common hub has an internal gear 38^a. The scoops 33^a are located in advance, and the scoops 33^b and 33^c are located in different planes at the rear of the plane of the scoops 33^a. Moreover, said scoops 33^a, 33^b and 33^c are located progressively further and further from the axis of rotation of the wheel, so that the three series of scoops, under advance movement of the machine, will cut the ditch progressively deeper and deeper. Moreover, in a direction circumferentially of the wheel, the scoops of the three series are offset so that they will not be brought into initial contact at exactly the same time, thus distributing the cutting strain very evenly throughout the rotation of the wheel. This arrangement of the excavating wheel is especially adapted for digging quite deep trenches with a single cut of the machine.

What I claim is:

1. In a machine of the kind described, the combination with front and rear wheel-equipped trucks and a reach connecting the two trucks, of a scoop-equipped excavating wheel journaled on said reach between said front and rear trucks, an engine on one of said trucks, a traction wheel on the other truck, and transmission mechanism for driving said traction wheel on the one truck

from the engine on the other truck, including a shaft extended through said reach.

2. In a machine of the kind described, the combination with front and rear wheel-equipped trucks and a reach connecting the two trucks, of a scoop-equipped excavating wheel journaled on said reach between said front and rear trucks, an engine on one of said trucks, a traction wheel on the other truck, transmission mechanism for driving said traction wheel on the one truck from the engine on the other truck, including a shaft extended through said reach, and independent transmission mechanism for driving said excavating wheel from said engine.

3. In a machine of the kind described, the combination with front and rear wheel-equipped trucks and a reach connecting the two trucks, of a scoop-equipped excavating wheel journaled on said reach between said front and rear trucks, an engine on one of said trucks, a traction wheel on the other truck, transmission mechanism for driving said traction wheel on the one truck from the engine on the other truck, including a shaft extended through said reach, and independent transmission mechanism for driving said excavating wheel from said engine, one of said engine driven transmission mechanisms including a variable speed device, whereby the speed of said traction wheel may be varied in respect to the speed of said excavating wheel.

4. In a machine of the kind described, the combination with a front truck having laterally spaced steering wheels, and a rear truck having a traction wheel arranged to run in the ditch, of a reach connecting said front and rear trucks, a scoop-equipped excavating wheel journaled on said reach between said front and rear trucks, a motor on said front truck, transmission mechanism for rotating said excavating wheel from said motor, and transmission mechanism for driving said traction wheel from said motor, comprising a shaft extended through said reach.

5. In a machine of the kind described, the combination with a front truck having laterally spaced steering wheels, and a rear truck having a traction wheel arranged to run in the ditch, of a reach connecting said front and rear trucks, a scoop-equipped excavating wheel journaled on said reach between said front and rear trucks, a motor on said front truck, transmission mechanism for rotating said excavating wheel from said motor, and transmission mechanism for driving said traction wheel from said motor, comprising a shaft extended through said reach, said latter transmission mechanism also including a variable speed device whereby the speed of said traction wheel may be varied in respect to the speed of said excavating wheel.

6. In a machine of the kind described, the combination with an excavating wheel mounted to rotate in a plane transversely of the machine and provided with circumferentially spaced scoops that are open at their outer extremities and are provided with cutting edges at their front sides, of a motor carried by the machine and provided with connections for rotating said excavating wheel, said machine having a traction wheel arranged to run in a ditch at the rear of said excavating wheel, and independent transmission mechanism for driving said traction wheel from said motor.

7. In a machine of the kind described, the combination with front and rear wheel-equipped trucks and a reach connecting the two trucks, of a scoop-equipped excavating wheel journaled on said reach between said front and rear trucks, an engine on one of said trucks, a traction wheel on the other truck, transmission mechanism for driving said traction wheel on the one truck from the engine on the other truck, including a shaft extended through said reach, and means for vertically adjusting the front end of said reach.

8. In a machine of the kind described, the combination with an excavating wheel mounted to rotate in a plane transversely of the machine and provided with circumferentially spaced scoops that are open at their outer extremities and are provided with cutting edges at their front sides, of a motor carried by the machine and provided with connections for rotating said excavating wheel, said machine having a traction wheel arranged to run in a ditch at the rear of said excavating wheel, and independent transmission mechanism for driving said traction wheel from said motor, the scoops on said excavating wheel being arranged in a plurality of series, each series working in its own plane and the scoops of the rear series having greater radial projection from the axis of rotation than the scoops of a more forward series.

9. In a machine of the kind described, the combination with an excavating wheel mounted to rotate in a plane transversely of the machine and provided with circumferentially spaced scoops that are open at their outer extremities and are provided with cutting edges at their front sides, of a motor carried by the machine and provided with connections for rotating said excavating wheel, said machine having a traction wheel arranged to run in a ditch at the rear of said excavating wheel, and independent transmission mechanism for driving said traction wheel from said motor, the scoops on said excavating wheel being arranged in a plurality of series, each series working in its own plane and the scoops of the rear series having greater radial projec-

tion from the axis of rotation than the scoops of a more forward series and the scoops of the different series being circumferentially offset.

10. In a machine of the kind described, an excavating wheel arranged to rotate in a plane transversely of the machine and provided with radially projecting front and rear arms arranged in parallel pairs, and approximately semi-cylindrical scoops having their outer edges attached to the outer ends of said pairs of front and rear arms, said scoops at their front edges having knife blades that work in planes in advance or ahead of the outer portions of said front arm so as to prevent frictional contact between said arms and the earth.

In testimony whereof I affix my signature.

WALTER W. HARTSOUGH.