Jan. 14, 1969 V. S. PENOTE ET AL 3,421,235

EXCAVATING MACHINE

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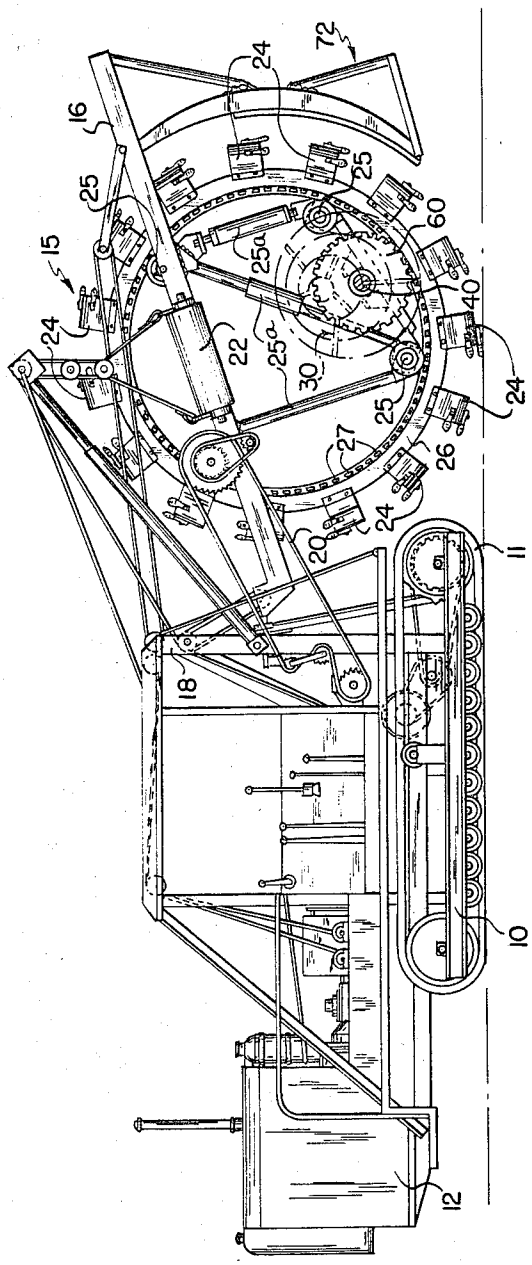

FIG. 1

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EXCAVATING MACHINE

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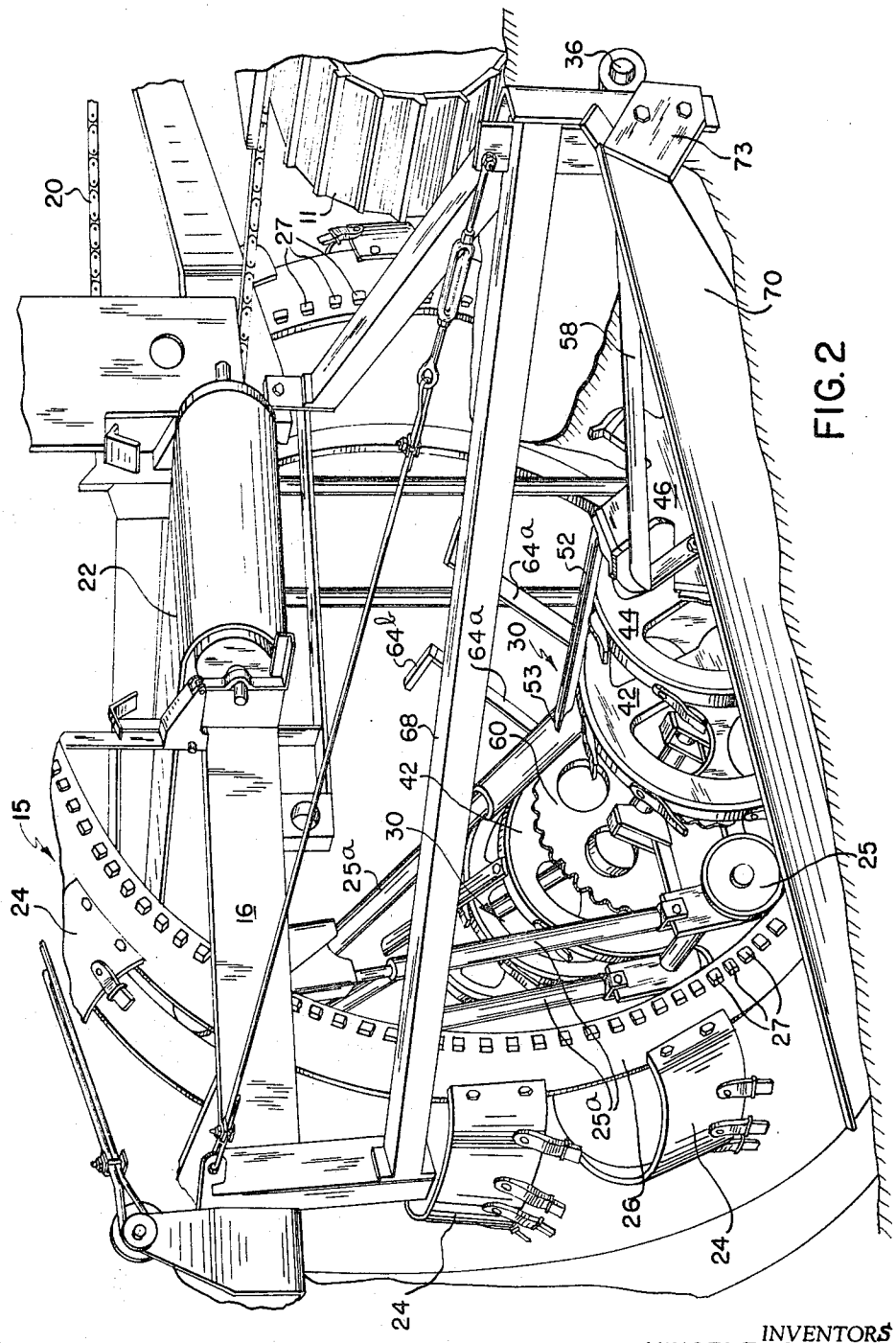

FIG. 2

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EXCAVATING MACHINE

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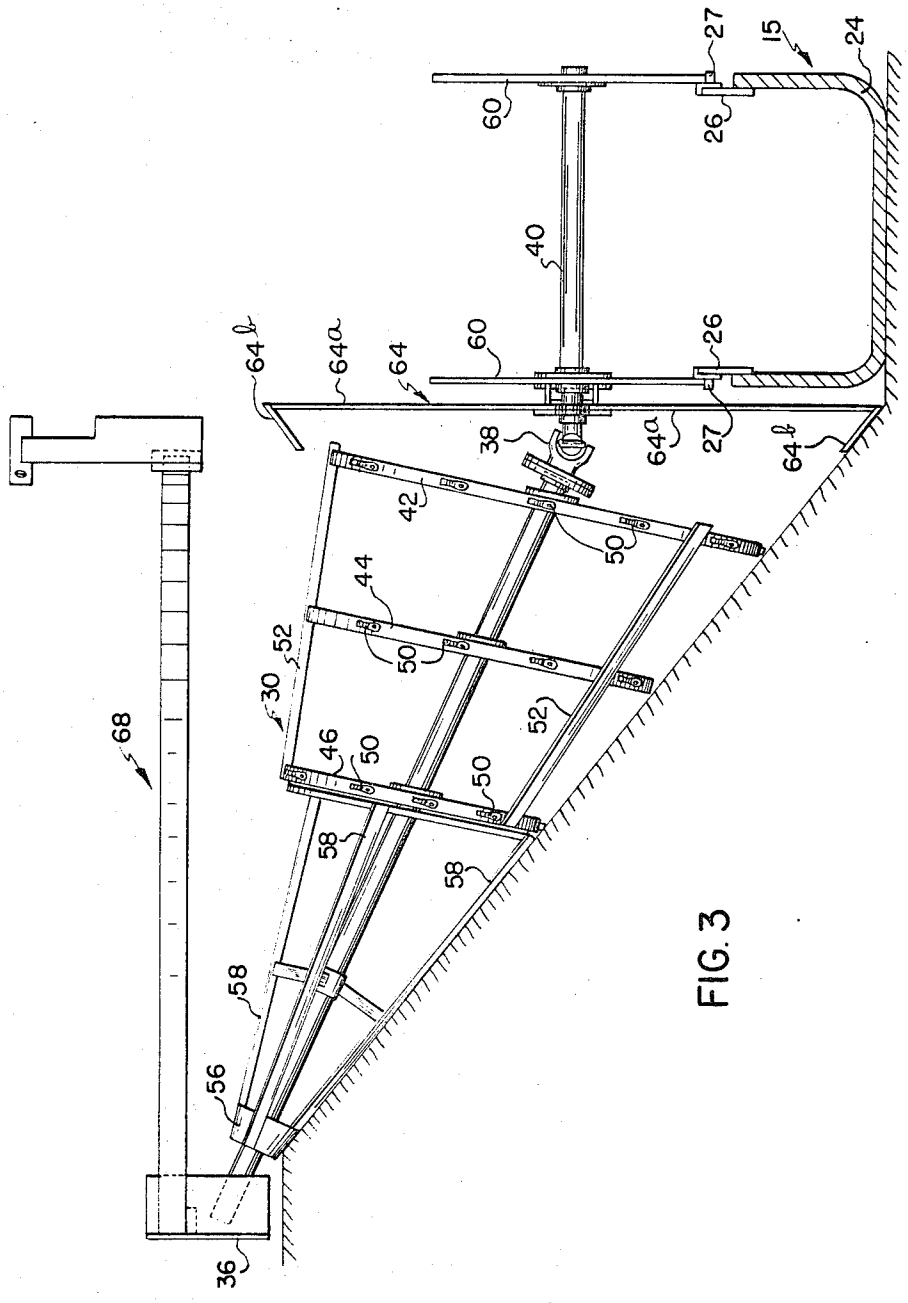

FIG. 3

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EXCAVATING MACHINE

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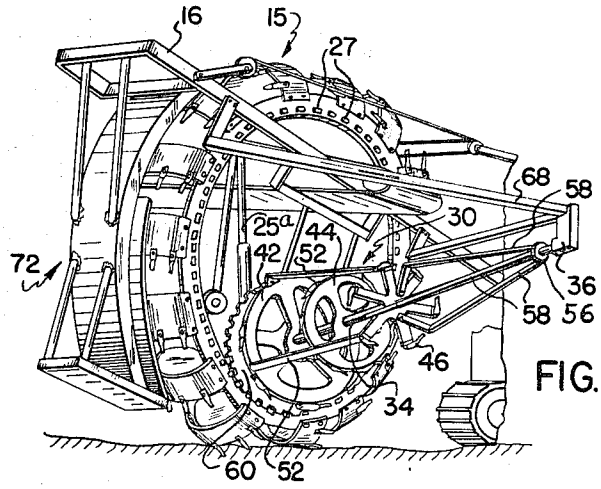

FIG. 4

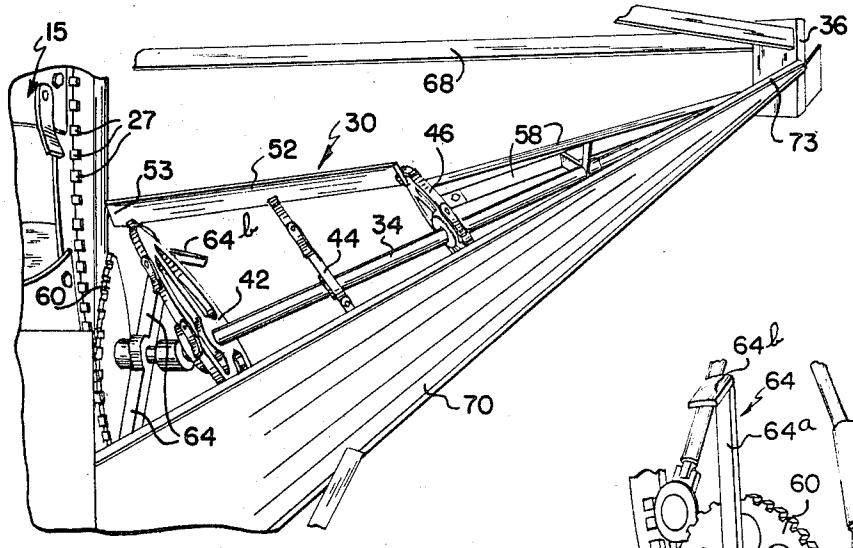

FIG. 5

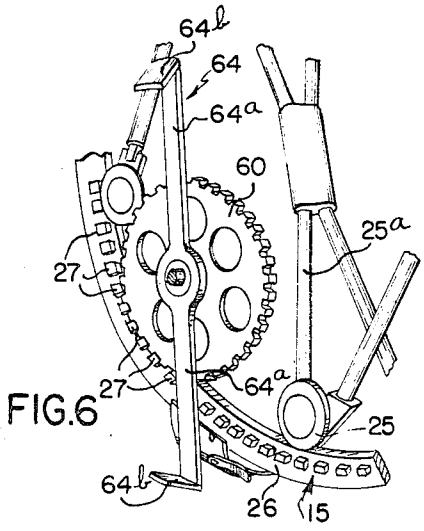

FIG. 6

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EXCAVATING MACHINE

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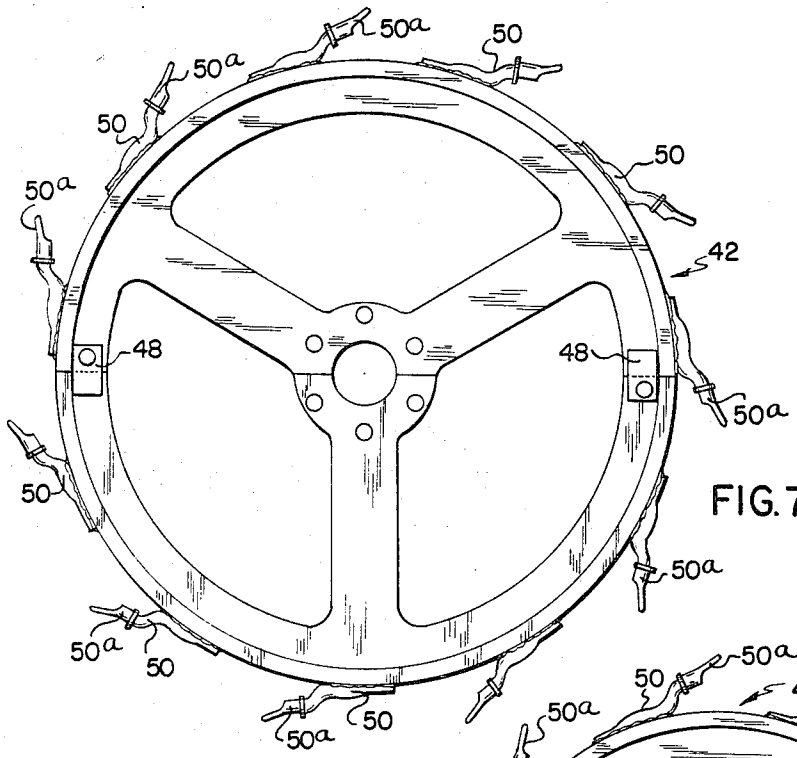

FIG. 7

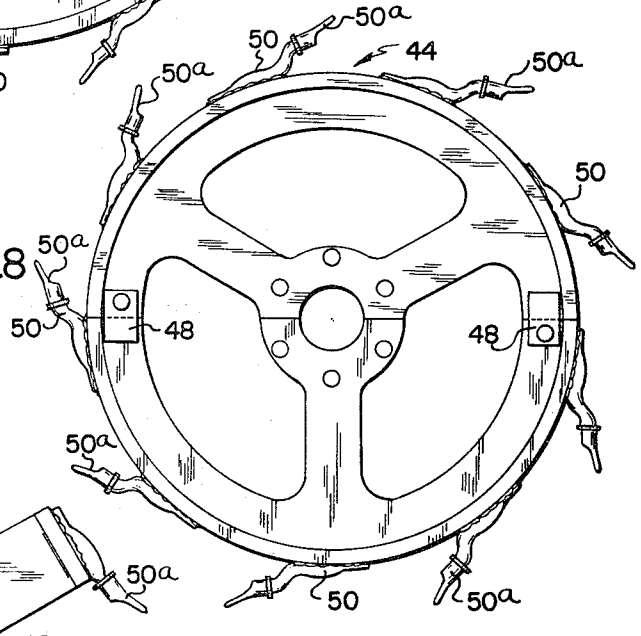

FIG. 8

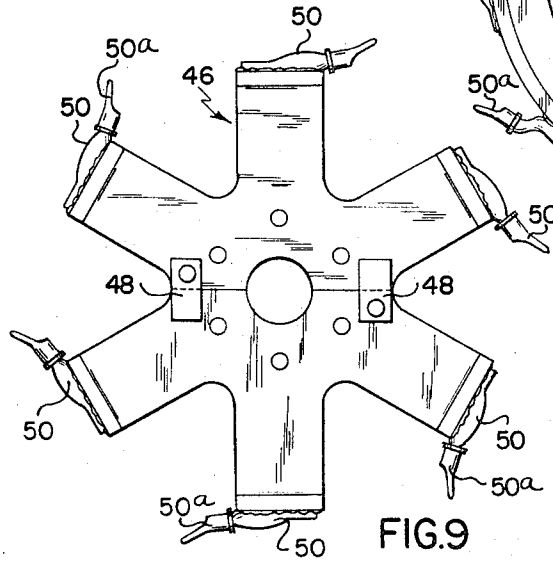

FIG. 9

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3,421,235

Patented Jan. 14, 1969

3,421,235

EXCAVATING MACHINE

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Filed July 21, 1965, Ser. No. 473,695

U.S. Cl. 37—86 16 Claims

Int. Cl. E02f 5/02

ABSTRACT OF THE DISCLOSURE

A sloper mechanism adapted for mounting on an excavating machine for sloping the side of an excavation including a rotary shaft adapted for operable connection at one end to the excavating machine, a plurality of laterally spaced, wheel-like members mounted on and for rotation with the shaft, the wheel-like members disposed in oblique relationship with respect to the longitudinal axis of the shaft, and cutting members associated with the wheel-like members adapted for oscillatory movement upon rotation of the sloper mechanism.

This invention relates in general to excavating machines, and is more particularly directed to a moblie excavating machine for cutting a ditch in a ground surface to a desired depth while at the same time expeditiously sloping the sides of the ditch throughout the latter's extent.

It is oftentimes desirable in the digging of trenches or ditches, to slope the sides of the ditch so that they diverge outwardly with respect to one another, and this is particularly true in the excavation of trenches or ditches for irrigation or like purposes.

Various mechanisms have been devised in the past to slope the sides of a trench, but these prior art arrangements generally leave much to be desired in that they generally do not satisfactorily and effectively with minimum application of force, bevel the sides of the trench, nor do they slope the trench all the way to the bottom thereof, but oftentimes leave a ridge or area of unexcavated material between the mechanism which slopes the trench sides and the main excavating or digging unit.

The present invention provides a mobile excavating machine which is able to cut a trench or ditch into a ground surface and with a minimum utilization of power is effective to smoothly slope the sides of the ditch from the bottom thereof to the top of the ditch.

Accordingly, an object of the invention is to provide a novel mechanism for sloping the sides of a trench.

Another object of the invention is to provide a mobile excavating machine having an endless main bucket equipped digging unit mounted thereon and including laterally disposed generally conical shaped side digging units for sloping the sides of a trench coincident with the digging thereof by the main digging unit, and wherein such side units operate to slope the trench throughout the extent of the sides thereof and from the buckets of the main digging unit up to the top of the ground surface being excavated.

Another object of the invention is to provide a novel mobile excavating machine which includes an endless, wheel-type, bucket equipped digging unit and laterally disposed, generally conical shaped rotary sloper units, and with the sloper units being operative to slope the sides of the trench being excavated throughout the extent of the sides of the trench, and with such sloper units including toothed means for cutting and also elongated blade means for slicing the sides of the trench to the desired slope.

Another object of the invention is to provide an excavating machine of the latter mentioned type wherein the sloper units include wheel-like digger members driven by a shaft, with the wheel-like digger members being disposed in non-perpendicular relation with respect to the shaft, and with the elongated blade means extending between said wheel-like digger members possessing generally oscillating slicing motion during rotary movement of the sloper units.

Another object of the invention is to provide a novel mobile excavating machine which includes an endless rotary bucket equipped main digging unit and rotary sloper units disposed on the opposite sides of said main digging unit and being driven from said main digging unit, and with the machine being operative to expeditiously excavate a trench to a desired depth and one having sloped sides expeditiously formed by the sloper units.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a side elevational, somewhat diagrammatic illustration, of an excavating machine embodying the instant invention;

FIG. 2 is an enlarged, fragmentary generally perspective view of the main digging unit and the lateral sloper units which are adapted to slope the sides of the excavation, in digging position;

FIG. 3 is a sectional, fragmentary, generally diagrammatic illustration of one of the lateral sloper units showing in particular the angled condition of the rotary wheel-like digger members of the sloper unit with respect to the mounting shaft thereof, and also illustrating diagrammatically the slicer blades attached to the rotary digger members of the sloper unit;

FIG. 4 is a fragmentary generally perspective vew of the main digging unit of the machine raised out of the trench and showing in somewhat greater detail the construction of the conical shaped rotary sloper units;

FIG. 5 is a fragmentary rear end view illustrating one of the sloper units and also showing the sweep cutters on one of the driving sprockets of the sloper units, which sweep cutters are adapted to cut out material between the buckets on the main digging unit and the sloper unit;

FIG. 6 is a fragmentary, elevational view showing in greater detail the sweep cutters as attached to the driving sprocket of the respective sloper unit, the latter having been removed in the interest of clarity;

FIGS. 7, 8 and 9 are enlarged side elevational views of the cutter wheel members of a sloper unit.

Referring now again to the drawings, there is illustrated a mobile excavating or trenching machine comprising a chassis frame **10** supported by tractor treads **11**. A motor **12** mounted at one end of the chassis frame **10** may be operably connected to the tractor treads by any suitable or conventional means.

The excavating or main digging unit **15** illustrated is a bucket equipped, endless, rotary wheel type of digging unit well-known in the excavating art, and supported on a lengthwise extending boom frame **16**, which may be movably mounted on mast structure **18** on the machine chassis, for movement of the boom and associated digging wheel as a unit in a generally vertical plane.

The digging wheel **15** may be rotatably driven for digging operations by means of a conventional chain and sprocket drive arrangement **20**, and there may be provided a powered conveyor mechanism **22** extending transversely through the digging wheel **15**, for receiving the excavated material from the buckets **24** of the digging wheel as the wheel rotates, whereupon the material excavated by the buckets drops down by gravity onto the conveyor mechanism **22**, for discharge laterally of the machine.

The excavating wheel **15** may be supported for rotation on boom frame **16** by rotatable wheels **25** mounted on ad-

justable framework **25***a* and may comprise laterally spaced side plates or rings **26** (FIG. 3) having teeth or lugs **27** on the exterior sides thereof. Lugs **27** are adapted to coact with a driven gear member (not shown) actuated by the aforementioned drive mechanism **20** for rotating the digging unit **15**, and in the conventional manner.

Now in accordance with the invention, there are provided laterally extending sloper units **30** on opposite sides of the main digging unit **15**. Sloper units **30** may be of the generally conical exterior configuration illustrated. Since both sloper units **30** are of identical construction, only one will be described in detail. Each such sloper units may comprise an elongated mounting shaft **34** rotatably mounted at one end thereof, in bearing structure **36**, and operably coupled by means of a universal joint **38** at the other end thereof, to a transverse drive shaft **40** extending through the main digging unit **15**, and rotatably supported on framework **25***a*. Shaft **34** is angularly disposed with respect to the horizontal (at approximately 25° in the embodiment illustrated) and has a plurality of cutter wheels or members **42**, **44** and **46** mounted thereon (in the embodiment illustrated, three) for rotation therewith.

Reference is made to FIGS. 7, 8 and 9 for a more detailed illustration of each of the cutter wheels **42**, **44** and **46**. As can be seen, each of the cutter members **42**, **44**, **46** is preferably of sectional construction, subsequently attached together as at **48**, into an integral unit. Each of the cutter members has a plurality of rooter teeth **50** mounted about the periphery of the respective rotary cutter member, and secured thereto as by means of welds, and with such rooter teeth preferably having detachable blade portions **50***a* for replacing of the tooth points as the latter wear in service. The rotary cutter members are secured to the respective mounting shaft **34** at an angle to the lengthwise axis of the shaft; in the embodiment illustrated, such angle is approximately 78°. It will be understood however, that other angular arrangements can be provided but for best results an angle within the range of approximately 74° to 82° is preferred.

Extending between the rotary cutter members **42**, **44** and **46** and secured thereto by any suitable means are preferably detachable slicer blades **52**. Slicer blades **52** are of generally sharpened, flat elongated configuration, and are adapted to extend inwardly as at **53**, of the cutter member **42**, as shown for instance, in FIG. 5. In the embodiment illustrated, there are three such slicer blades provided, extending between the wheel-like cutter members **42**, **44** and **46**.

Also extending between the outer cutter member **46** and a hub **56** fixed adjacent the outer end of shaft **34** are another set of slicer blades **58** of generally sharpened, elongated flat configuration, similar to the blades **52**. Blades **58** are preferably off-set in a circumferential direction with respect to blades **52**, and operate in a somewhat similar manner as the blades **52**. The sloper units **30** may be driven by means of the aforementioned shaft **40** via the universal joint **38**, with such shaft **40** being driven by sprockets **60** secured to the shaft **40** and coacting with the lugs **27** on the main digging unit **15**. Thus it will be seen that the rotation of the main digging unit **15** causes rotation of the sprockets **60**, thus causing rotation of shaft **40** and mounting shafts **34**, and rotating the cutter members **42**, **44** and **46** and associated cutter bades **52** and **58** of the sloper units.

Since the conical sloper units **30** are disposed generally exteriorly of the main digging unit **15**, which exterior disposition materially facilitates the simplicity and driving of the sloper units, ordinarily there would be left a ridge of unexcavated material between the inner most cutter member **42** and the confronting sides of the buckets **24** of the main digging unit. In order to dispose of this ridge, sweep cutters **64** may be provided. Each sweep cutter may comprise an arm **64***a* secured to the associated drive sprocket **60** and a generally obliquely disposed sharpened and flattened blade **64***b* secured to the arm, so that upon rotation of the sprocket the sweeper cutter **64** rotates with the sprocket and cuts out material between the cutter member **42** and the adjacent side of the bucket. In the embodiment illustrated, two sweep cutters disposed at approximately 180° with respect to one another are provided. Thus, the trench is sloped throughout its sidewise extents to provide an expeditiously and evenly sloped arrangement.

Generally triangular shaped framework **68** may be provided extending laterally from the boom frame **16** for supporting the outer end of the respective sloper unit **30**. In this connection wings **70** may also be provided extending outwardly from the crumbing shoe **72**, for scraping the sides of the ditch behind the cutting action of the sloper units **30**. Such wings **70** may be secured at their inner ends to the crumbing shoe and secured at their outer ends and as at **73**, to the framework **68**, and in a generally rigid arrangement, to make a clean-cut slope sided trench with one pass of the excavating machine.

As the digging wheel **15** rotates and the excavating buckets thereon form the desired depth of trench, the sloper mechanisms **30** are also rotated, and the wheel-like cutting members **42**, **44** and **46** thereof cut into the sides of the ditch while the elongated blade members **52** and **58** cut into the material that is not cut by the wheel members. It will be understood that the slicer bars or blades **52** slice the earth rather than bulldoze it, since the cutter wheels are mounted at an angle with respect to the mounting shaft **34**, and thus a generally side-to-side oscillating motion is imparted to the slicer blades **52**. Since the slicer bars **52** extend inwardly from cutter wheel **42** as can be seen from FIG. 5, their inner ends actually pass generally interiorly of the main digging unit during the rotary movement of the slicer unit and then move out of the interior of the main wheel, while the sweep cutters **64** cut the material not cut by the slicer bars **52**. These sweep cutters are so arranged on the respective sprocket **40** so that when the associated sloper mechanism oscillates inwardly at the top of its rotation, the sweep cutter is out of the way and in non-interferring relationship therewith. As the sides of the trench are cut, due to the oscillating motion of the sloper arrangement, the cut material is agitated in an inward direction toward the center of the main digging unit, and thus enters the sides of the buckets and the opening in the main digging unit, thereby causing the buckets to pick up the excavated material and deliver it to the discharge conveyor. Behind the sloper units, the wings **70** scrape the sides of the trench in conjunction with the crumbing shoe **72** which scrapes the bottom of the trench, and a very clean cut ditch is provided.

From the foregoing discussion and accompanying drawings, it will be seen that the invention provides novel sloper mechanism for sloping the sides of a trench and including a novel mobile excavating machine comprising a main endless digging unit and laterally spaced, generally conical shaped digging units for sloping the sides of the trench coincident with the digging thereof by the main digging unit, and wherein the sloper units are operable to slope the trench throughout the extent of the sides thereof. The invention also provides an excavating machine of the latter mentioned type which utilizes minimum power to slope the sides of the trench and embodies novel mechanism thereon which slices through the side wall material of the trench to slope the same rather than bulldozing it.

The terms and expressions which have been used are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of any of the features shown or described, or portions thereof, and it is recognized that various modifications are possible within the scope of the invention claimed.

We claim:

1. In an excavating machine including an endless main digging unit mounted thereon for digging operations in a generally vertical plane, the combination therewith of rotary sloper mechanism for sloping a side of the excavation coincident with the digging thereof, said sloper mechanism extending laterally outwardly from a side of said main digging unit at an upwardly extending angle with respect to the horizontal, said sloper mechanism including cutting means which oscillates during rotation of said sloper mechanism, and wherein said sloper mechanism is of generally conical exterior configuration and includes a generally centrally oriented mounting shaft disposed at an upwardly extending angle with respect to the horizontal, and said cutting means including a plurality of wheel-like cutter members disposed in lengthwise spaced relation along the shaft, said cutter members being disposed in nonperpendicular relation with respect to the lengthwise axis of said shaft.

2. An excavating machine in accordance with claim 1 wherein each of said wheel-like cutter members is disposed at an angle within the range of approximately 74 to 82 degrees with respect to said shaft.

3. An excavating machine in accordance with claim 1 including elongated blade means extending between said cutter members in the general direction of extension of said shaft.

4. An excavating machine in accordance with claim 1 including sweep cutter means mounted for rotation on said main digging unit, and in a plane disposed substantially parallel to the plane of rotation of said main digging unit.

5. An excavating machine in accordance with claim 4 wherein said main digging unit comprises a wheel type unit having a pair of side plates with buckets extending transversely between said side plates, lugs on said side plates adapted for rotating said main digging unit, a sprocket mounted for coaction with said lugs to cause rotation of said sprocket upon actuation of said main digging unit, and said sweep cutter means being coupled to said sprocket and being driven thereby upon rotation of said sprocket, said sweep cutter means comprising a generally radially extending arm and a cutter blade extending outwardly from said arm.

6. An excavating machine in accordance with claim 1 including a wing member projecting laterally of the main digging unit and disposed rearwardly of said sloper mechanism for scraping the sloped side of the excavation after the sloping thereof.

7. An excavating machine in accordance with claim 1 including means coacting between said main digging unit and said sloper mechanism for actuating said sloper mechanism upon actuation of said main digging unit.

8. In a mobile machine including a chassis and means for moving said chassis lengthwise along the ground, the combination therewith of rotary sloper mechanism for sloping a side of a trench, said sloper mechanism projecting laterally of said machine at an upwardly extending angle with respect to the horizontal, and including cutting means which oscillates during rotation of said sloper mechanism, and wherein said sloper mechanism comprises a mounting shaft extending angularly upwardly with respect to the horizontal and spaced wheel-like members mounted on said mounting shaft, said wheel-like members being disposed in nonperpendicular relation with respect to the axis of said mounting shaft, and said cutting means comprising blade means mounted adjacent the periphery of said wheel-like members in the general direction of extension of said shaft.

9. A mobile machine in accordance with claim 8 wherein said wheel-like members progressively diminish in size from the innermost to the outermost of said wheel-like members, and rooter teeth mounted on the peripheries of said wheel-like members.

10. A mobile machine in accordance with claim 8 wherein said blade means extends inwardly of the innermost of said wheel-like members.

11. A mobile machine in accordance with claim 8 wherein said wheel-like members are oriented at an angle within the range of approximately 74 to 82 degrees with respect to said shaft.

12. In an excavating machine including a digging unit mounted for digging operations in a generally vertical plane comprising, a sloper mechanism extending laterally outwardly from one side of said machine for sloping the side of an excavation, said sloper mechanism including an elongated shaft operably connected at its inner end to said machine, a plurality of laterally spaced, wheel-like members mounted on and for rotation with such shaft, said wheel-like members being disposed at an oblique angle with respect to the longitudinal central axis of said shaft for oscillatory movement upon rotation of said shaft, cutting means associated with said wheel-like members and disposed outwardly of said shaft for cutting movement upon rotation of said shaft, said cutting means including an inner set of elongated cutter blades mounted in circumferentially spaced relationship about said wheel-like members, and wherein said cutting means includes an outer set of elongated cutter blades mounted in circumferentially spaced relationship about said shaft and outwardly in a lengthwise direction with respect to said inner set of cutter blades, and said outer set of cutter blades being alternately disposed in a generally circumferential direction with respect to said inner set of cutter blades.

13. In an excavating machine including a digging unit mounted for digging operations in a generally vertical plane comprising, a sloper mechanism extending laterally outwardly from one side of said machine for sloping the side of an excavation, said sloper mechanism including an elongated shaft operably connected at its inner end to said machine, a plurality of laterally spaced, wheel-like members mounted on and for rotation with such shaft, said wheel-like members being disposed at an oblique angle with respect to the longitudinal central axis of said shaft for oscillatory movement upon rotation of said shaft, cutting means associated with said wheel-like members and disposed outwardly of said shaft for cutting movement upon rotation of said shaft, said cutting means including an inner set of elongated cutter blades mounted in circumferentially spaced relationship about said wheel-like members, and wherein said wheel-like members progressively diminish in transverse dimension in a direction from the inner end of said shaft toward the outer end of said shaft, and wherein the inner set of said cutter blades extend in a lengthwise direction inwardly of the innermost of said wheel-like members, whereby certain of said cutter blades are adpted to be disposed interiorly of said excavating machine while certain others of said cutter blades are adapted to be disposed exteriorly of said machine upon rotation of said sloper mechanism.

14. In an excavating machine including a digging unit mounted for digging operations in a generally vertical plane comprising, a sloper mechanism extending laterally outwardly from one side of said machine for sloping the side of an excavation, said sloper mechanism including an elongated shaft operably connected at its inner end to said machine, a plurality of laterally spaced, wheel-like members mounted on and for rotation with such shaft, said wheel-like members being disposed at an oblique angle with respect to the longitudinal central axis of said shaft for oscillatory movement upon rotation of said shaft, cutting means associated with said wheel-like members and disposed outwardly of said shaft for cutting movement upon rotation of said shaft, a sweep cutter member mounted for rotation on said excavating machine adjacent the innermost of said wheel-like members for excavating operations between said digging unit and said sloper mechanism, said sweep cutter mem-

ber including an elongated arm disposed for rotary movement in a generally vertical plane, said arm including a pair of oppositely disposed blades extending outwardly therefrom in a general direction toward said sloper mechanism.

15. In an excavating machine in accordance with claim **14**, including a wing member projecting laterally outwardly from said excavating machine and rearwardly of said sloper mechanism for scraping the sloped sides of an excavation after the sloping operations by said sloper mechanism.

16. In an excavating machine in accordance with claim **14**, including a pair of said sloper mechanisms extending laterally outwardly from opposed sides of said digging unit.

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