United States Patent [19]

Blackwell

[11] **3,710,583**

[45] **Jan. 16, 1973**

[54] SELF-PROPELLED TILING MACHINE

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[73] Assignee: **Bymco Corporation,** Indianapolis, Ind.

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[21] Appl. No.: **159,850**

[52] **U.S. Cl.** .....**61/72.1,** 37/86, 37/90, 61/41 A, 61/72.5

[51] **Int. Cl.**.....**E02f 5/02,** E21d 5/00

[58] **Field of Search**.....61/72.1, 72.2, 72.5, 72.7, 61/72.6, 41 A; 37/86, 87, 88, 90, 91, 92, 93

[56] **References Cited**

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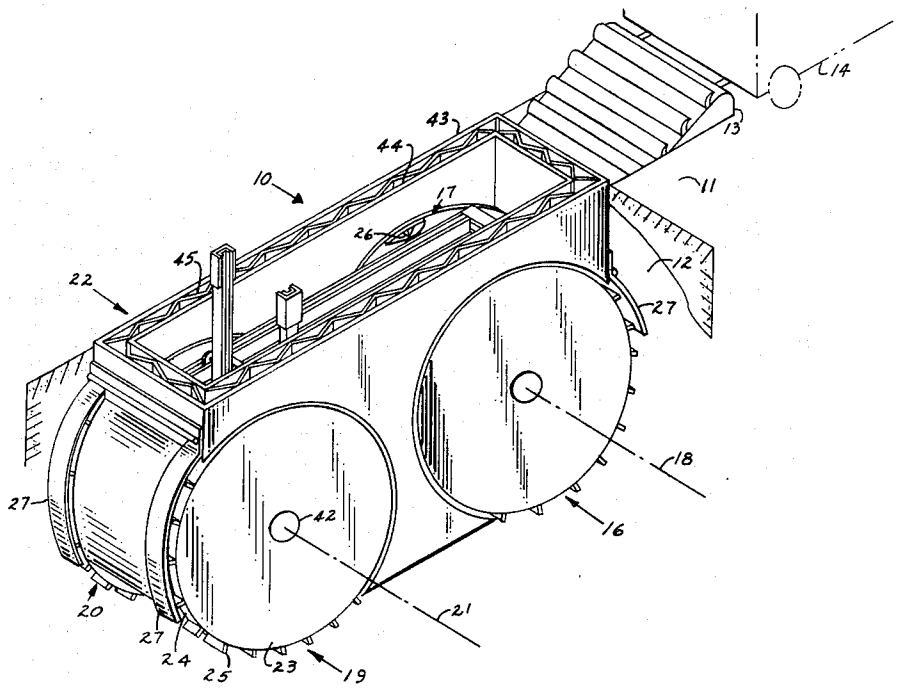
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[57] **ABSTRACT**

A tile laying machine which is adapted to roll on the bottom of a pre-cut trench. The machine is self-propelled and has a pair of front wheels and a pair of rear wheels rotatably mounted to a frame. The wheels are spaced from the frame and are supported by bearing means mounted to the frame. Power cylinders mounted to the frame are operable to rotatably drive the wheels. The power cylinders apply a downward force increasing the traction of the wheels when the machine sticks in the trench. A double walled enclosure in cooperation with the wheels protect the operator within the machine from cave-in dangers during the tile laying sequence. The digging means positioned on the frame is operable to dig a tile channel in the bottom of the trench. The tile dispensing means mounted to the frame is operable to position tile sections in the channel in an interconnecting relationship.

9 Claims, 5 Drawing Figures



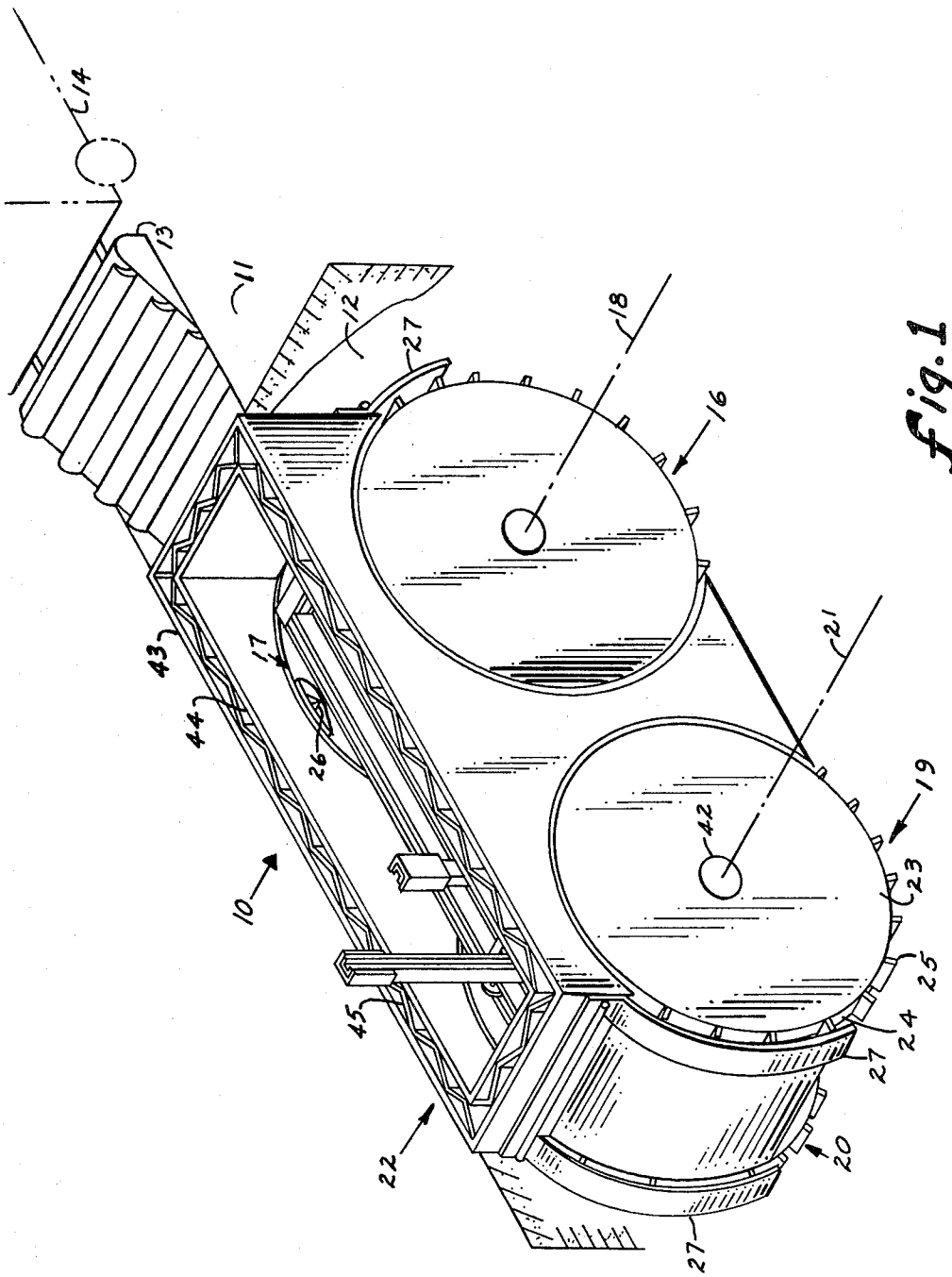


Fig. 1

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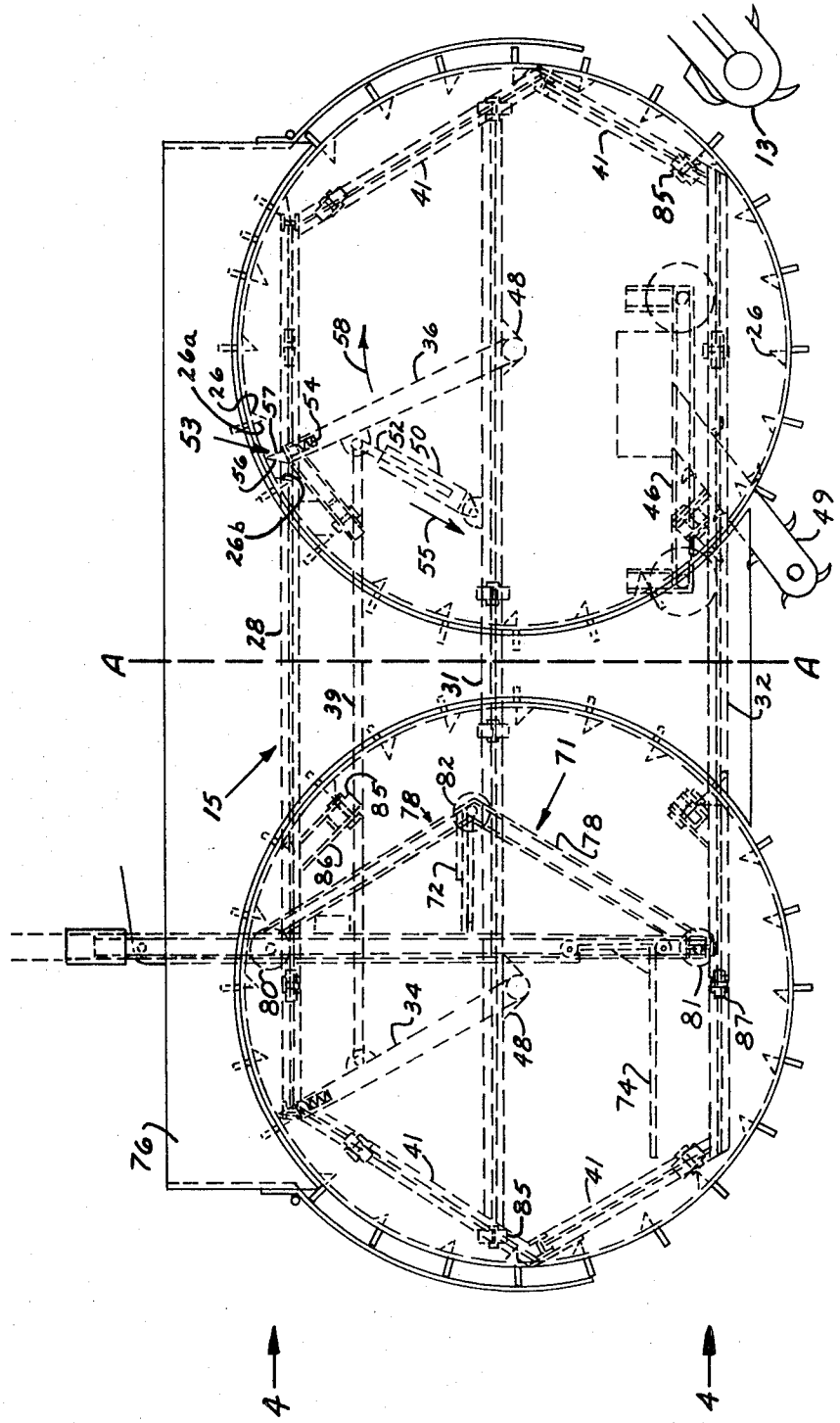


Fig. 2

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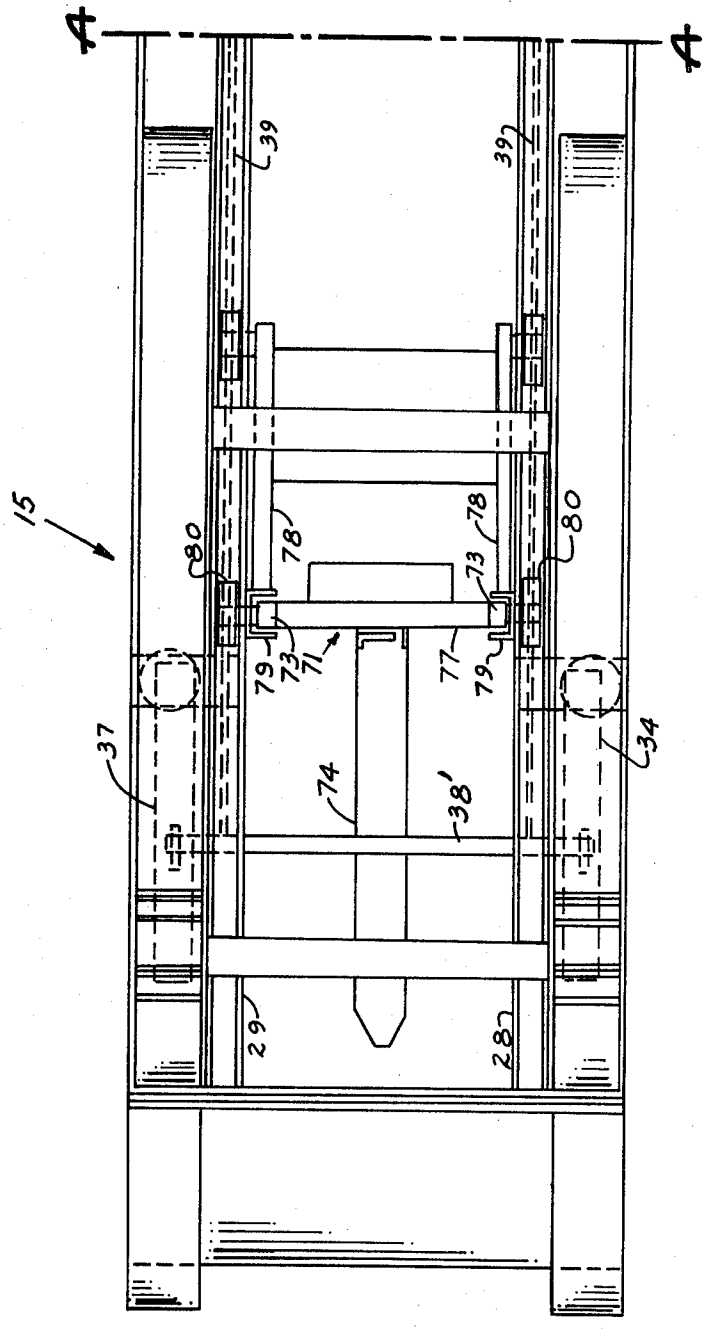


Fig. 3A

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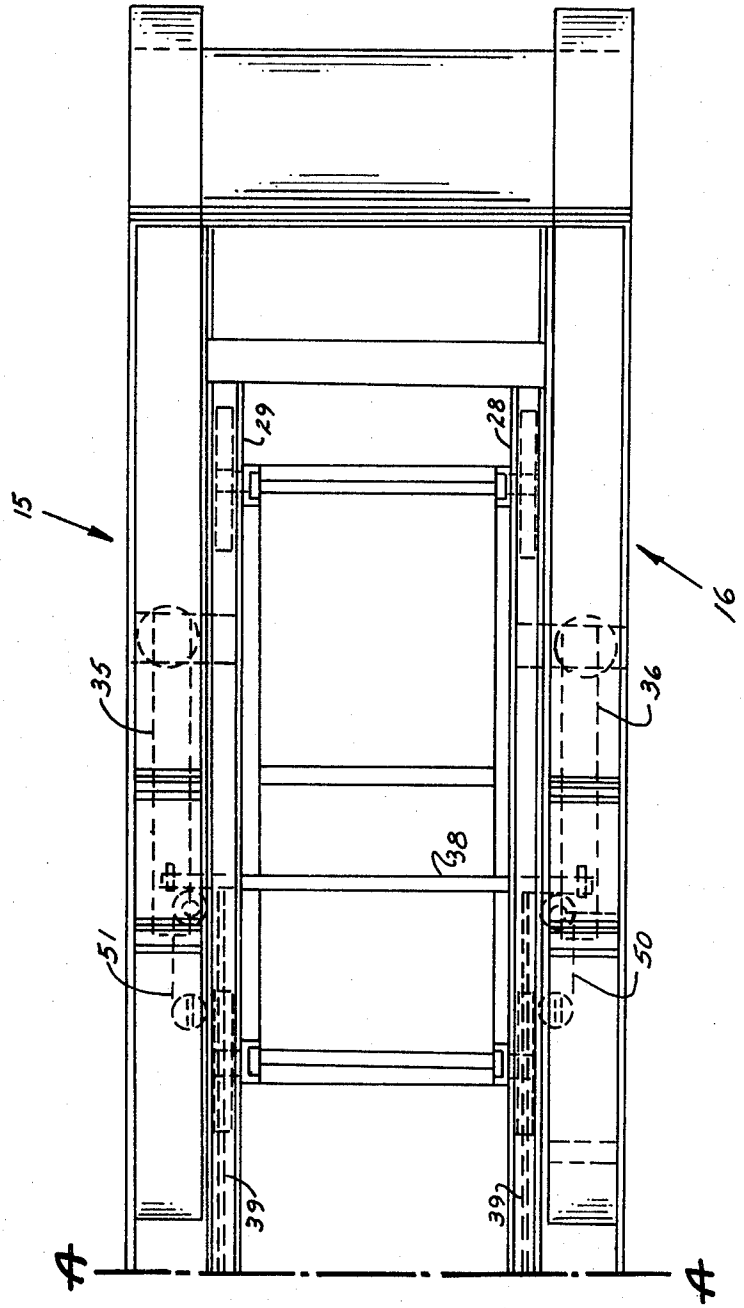


Fig. 3B

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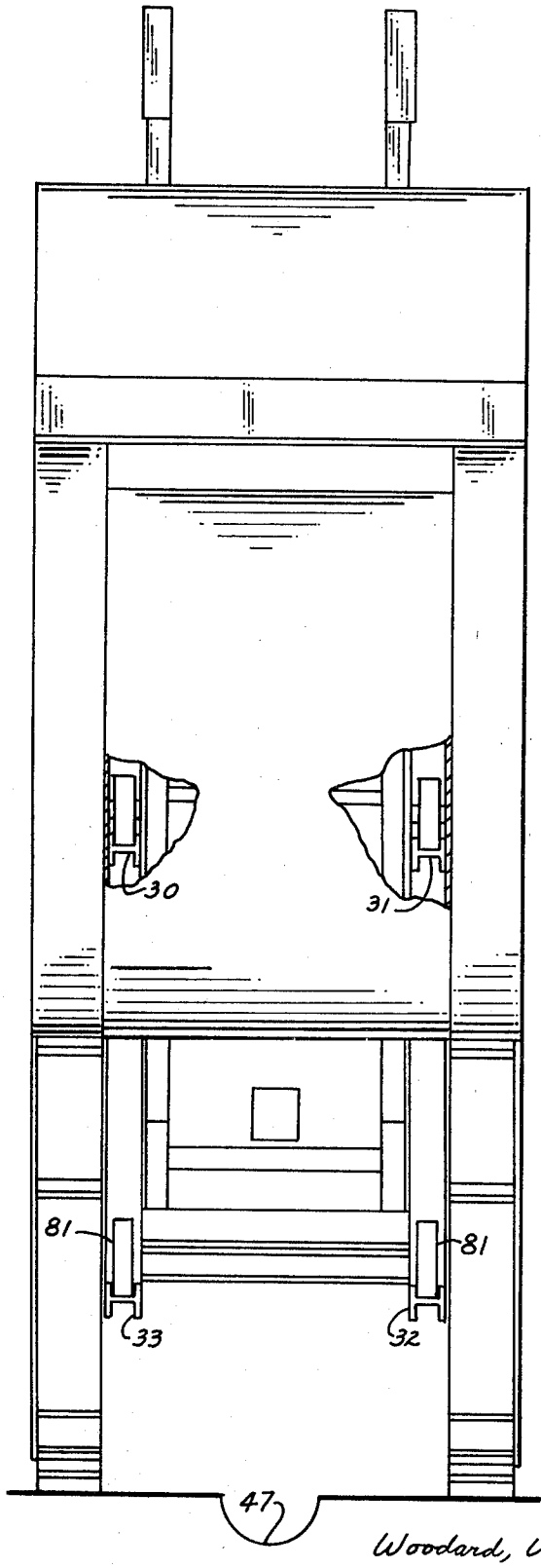


Fig. 4

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SELF-PROPELLED TILING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a self-propelled machine which is adapted to roll in a pre-cut trench and lay tile sections therein.

2. Description of the Prior Art

In my U.S. Pat. No. 3,521,456 entitled TILE LAYING MACHINE, I have disclosed a machine which renders continuous protection from cave-in dangers to a worker laying tile in a trench. The machine disclosed therein is designed to work with an automatic trenching machine so as to automatically lay drainage tile. In order to utilize the tile laying machine, the machine must be pulled through the trench by a vehicle such as a tractor which is positioned on the ground outside of the trench. It is therefore necessary to coordinate the activity of the operator of the vehicle positioned outside of the trench with the operator of the tile laying machine positioned in the trench. It is desirable to provide a tile laying machine which is self-propelled therefore eliminating the necessity for the previously mentioned coordination and allowing a single operator to control the movement of the machine through the trench and the dispensing of the tile. Disclosed herein is such a self-propelled machine with tile dispenser.

SUMMARY OF THE INVENTION

One embodiment of this invention is a self-propelled tile trenching machine providing continuous protection from cave-in danger comprising: a frame; a pair of opposing front wheels rotatably mounted about a first axis to the frame; a pair of opposing rear wheels rotatably mounted about a second axis to the frame; bearing means mounted to the frame and engaging and supporting the front wheels and the rear wheels away from the frame; and, power means to propel the machine mounted on the frame and being constructed to apply a downward fore increasing the traction of the wheels when the machine sticks in a trench.

One object of this invention is to provide a new and improved tiling machine.

Another object of this invention is to provide a new and improved self-propelled shoring machine.

Yet another object of this invention is to provide a self-propelled shoring machine with tile dispenser.

Related objects and advantages of the present invention will be apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the machine of this invention positioned in a trench.

FIG. 2 is an enlarged side view of the machine of FIG. 1.

FIG. 3A is a top view of the portion of the machine to the left of line A—A of FIG. 2

FIG. 3B is a top view of the portion of the machine to the right of line A—A of FIG. 2.

FIG. 4 is a fragmentary end view of the machine of FIG. 2 viewed in the direction of arrows 4—4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiment illustrated in the drawing and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention are illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Referring now more particularly to FIG. 1, there is illustrated a self-propelled shoring machine **10** positioned partially beneath ground level **11** in trench **12**. Trench **12** is dug by a conventional trench digging machine **13** which is connected to a vehicle **14** such as a tractor. Machine **10** is lowered into the trench after the digging machine **13** has dug the length of the trench sufficiently to receive shoring machine **10**. As trench digging machine **13** proceeds to dig the trench, shoring machine **10** follows and digs a channel in the bottom of the trench to receive tile sections. In addition, a tile dispensing apparatus mounted within machine **10** lowers tile sections into the channel in an interconnecting relationship. The wheels of machine **10** are rotatably driven by power cylinders mounted on the frame of machine **10**. The front pair of wheels **16** and **17** are rotatably mounted about axis **18** which is parallel with the axis of rotation **21** extending through the center of the rear wheels **19** and **20**. A double walled enclosure **22** extends around the frame and is flush with the exterior surface of the wheels. The double walled enclosure prevents dirt from entering between the wheels where the operator of the machine is positioned. Frame **15** has a pair of lower horizontally extending beams **32** and **33** (FIG. 4) connected to a pair of horizontally extending top beams **28** and **29** (FIGS. 3A and 3B). Angle beams **41** (FIG. 2) connect the top and bottom beams at both ends of the machine. In addition, a Pair of middle beams **30** and **31** (FIG. 4) extend the length of the machine being joined to the angle beams **41** at a position approximately located at one-half the height of the machine. Each beam is H-shaped so as to define channels for receiving roller wheels to be described later.

Rear wheel **19** will now be described it being understood that a similar description applies to wheels **16**, **17** and **20**. Wheel **19** has a ⅜ inch thick steel plate **23** (FIG. 1) formed in the shape of a disc. A circular rim **24** is welded or fastened to the disc by suitable means extending completely around the outer periphery of the disc. Disc **19** is attached to axle **42** with axis **21** extending therethrough. Appropriate bearings (not shown) are provided for mounting of the disc **23** to axle **42**. Each wheel rim has outer protrusions **25** extending radially outward from the rim so as to provide a traction gripping surface. Protrusions **25** extend through the rim and are secured thereto by suitable fastening means such as by welding. The inner portions of protrusions **25** form inner protrusions **26** as shown in the fragmented area of wheel **15**. Protrusions **26** extend radially inward toward the axis of rotation of the wheel. Dirt shields **27** are mounted to enclosure **22** behind the

wheels 19 and 20 and in front of wheels 15 and 16. Shields 27 extend downward beneath the axes of rotation thereby preventing dirt from flying upwardly as the machine is propelled through the trench. The double walled enclosure 22 has an outer wall 43 which is flush with the exterior surface of each wheel and an inner wall 44 which is connected to wall 43 by suitable structural braces 45. The inner wall 44 is spaced from outer wall 43 a distance approximately equal to the width of the wheel rims.

Mounted to the middle beams 30 and 31 are, respectively, power hydraulic cylinders 51 and 50 (FIG. 3B). The bottom end of each cylinder is pivotally mounted to the middle beams so as to allow the cylinder to pivotally swing. The front and rear axles of the wheels are rotatably mounted to middle beams 30 and 31 by brackets 48 (FIG. 2) having suitable bearings therein. A pair of drive arms 35 and 36 (FIGS. 2 and 3B) are rotatably mounted to the front axle adjacent respectively, wheels 16 and 15. Each power cylinder 50 and 51 has an extendable piston rod 52 which is pivotally connected to the adjacent drive arm. For example, drive arm 36 is pivotally connected to piston rod 52 of power cylinder 50. The top distal ends of arms 35 and 36 each have spring loaded ratchets mounted therein. For example, arm 36 has ratchet 53 mounted in the distal end of the arm with a spring 54 forcing the ratchet radially outward against the rim of wheel 15. The back surface 56 of ratchet 53 is tapered whereas the front surface 57 of the ratchet extends radially inward towards the wheel axis of rotation. As a result, when arm 36 is moved in the direction of arrow 58, surface 57 will abut against the parallel surface 26*a* of an inner protrusion 26 thereby forcing wheel 16 to rotate in the direction of arrow 58. On the other hand, if arm 36 is rotated in a direction opposite of arrows 58, surface 56 will contact sloping surface 26*b* of a protrusion 26 thereby forcing ratchet 57 to depress inward allowing the arm to rotate in the direction opposite of arrow 58 while the wheel remains in a static position. The pivotal motion of arm 36 is controlled by extending and withdrawing the piston rods of the power cylinders. The power cylinders are mounted between the axes 18 and 21 with the piston rods extendable upwardly. Arms 35 and 36 are positioned at all times between axis 18 and axis 21. In the event that machine 10 becomes stuck in the trench so as to retard the rotation of the wheels, then by extending the piston rods of the power cylinders, force will be applied in the downward direction of arrow 55 thereby increasing the wheel traction. Eventually, the wheels will rotate when sufficient friction develops between the wheels and the trench bottom thereby allowing the machine to continue through the trench. Arms 35 and 36 are interconnected by link 38 so as to move in unison.

A pair of driving arms 34 and 37 (FIGS. 2 and 3A) are rotatably mounted to the rear axle and also have spring loaded ratchets positioned in the top distal ends thereof. A pair of tie bars 39 connect the forward driving arms 35 and 36 with the rear driving arms 34 and 37 thereby applying the rotating power provided by the power cylinders to the rear wheels as well as the front wheels. Link 38' connects arms 34 and 37 so the rear arms will operate in unison.

A carrying frame 46 (FIG. 2) has four wheels rotatably mounted thereto which ride atop the bottom pair of channel beams 33 and 32. Suitable power means is provided on frame 46 for rotatably driving the wheels of the carrying frame. A conventional endless chain scooptype of digger 49 rests atop the frame 46 and extends downward to the bottom of the trench. Operation of digger 49 results in a channel 47 (FIG. 4) being dug in the bottom of the trench to receive the tile sections. Operator controls are provided which allow frame 46 along with digger 49 to be moved horizontally along the beams 32 and 33 from a forward position located between wheels 16 and 17 to a rear position adjacent vertical frame 71.

Frame 71 (FIGS. 2 and 3A) has a pair of vertical beams 79 positioned adjacent the horizontally extending beams 28 through 33. Each vertical beam 79 has a pair of top rollers 80 and a pair of bottom rollers 81 rotatably mounted thereto. Rollers 80 are slidable atop the top beams 28 and 29 whereas rollers 81 are slidable atop the bottom beams 32 and 33. Suitable power means is provided so as to rotatably drive wheels 80 and 81 thereby allowing frame 71 to move horizontally from a forward position adjacent frame 46 to the rear position between rear wheels 19 and 20. A pair of angle beams 78 are fixedly fastened by welding or other suitable means to vertical beams 79 having rollers 82 rotatably mounted and centrally positioned so as to ride atop middle beams 30 and 31. An operator seat 72 is mounted to angle beams 78 with the controls for operating the machine being mounted between beams 79 so as to allow access for the operator sitting on seat 72.

A tongue 74 is mounted to member 77 which is vertically movable. Wheels 73 are rotatably mounted to member 77 and slidably fit within vertical beams 79. A suitable power means such as a pulley-chain arrangement is provided to raise and lower member 77 thereby allowing vertical control of tongue 74. The tile sections are stored in a convenient location 76 at the top rear of the machine. Suitable storage shelves (not shown) for the tiles may be provided at location 76. Thus, the operator sitting on seat 72 may control digger 49 thereby providing channel 47 in the bottom of the trench while also controlling the position of tongue 74. The operator by controlling the horizontal movement of frame 71 with respect to the machine and by controlling the vertical movement of tongue 74 may move the tongue into a stored tile section. The operator may then move the tongue so as to lift the tile section down into the trench and position the tile in channel 47 so as to engage the previous tile section.

Bearings 85 are rotatably mounted to brackets 86 which are fixedly secured to the horizontally extending beams and to beams 41. Bearings 85 extend interiorly into each wheel so as to contact and support the inner surface of the wheel disc. For example, bearing 87 is rotatably mounted to a bracket fixed to beam 32 and contacts the interior surface of disc 23 of wheel 19. The bearings rotatably mounted to angle beams 41 support the wheel between the horizontally extending beams. All four wheels 16, 17, 19 and 20 are contacted and are supported by bearings secured to the horizontally extending and angularly extending beams. The bearings space the front and rear wheels away from frame 15.

Use of bearings **85** allows a minimum thickness of steel plate to be used for disc **23**. That is, if the bearings were not used then the disc would bend inward in the event of a cave-in thereby endangering the operator. Thus, the bearings add support to the disc while allowing the disc to be made of a thinner material.

Many variations are contemplated and included in the present invention. For example, in the embodiment previously described, arms **35** and **36** are mounted about axis **18** being positioned at all times between and above the first and second axis. The top ends of the driving arms engage the inner rim periphery. It is understood that the top ends of the driving arms may be provided with suitable ratchet devices to engage the side surface of the wheel disc in lieu of the rim periphery.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

The invention claimed is:

1. A self-propelled tile trenching machine providing continuous protection from cave-in danger comprising:
- a frame having a pair of vertical walls positioned apart a fixed space;
- a pair of opposing front wheels directly engageable and contractable with the ground rotatably mounted about a fixed axis to said frame;
- a pair of opposing rear wheels directly engageable and contactable with the ground rotatably mounted about a second axis to said frame, said front wheels and said rear wheels are exteriorly flush with said side walls the cooperate with said side walls to protect said space from cave-in danger;
- bearing means mounted to said frame and engaging and supporting said front wheels and said rear wheels away from said frame; and,
- power means mounted on said frame to propel the machine.

2. The machine of claim **1** wherein:
- said power means rotatably drives said front wheels; and further comprising;
- digging means positioned on said frame and operable to dig a tile channel in said trench; and,
- tile dispensing means mounted on said frame in said space and operable to position tile sections in said channel in interconnecting relationship.

3. A self-propelled tile trenching machine providing continuous protection from cave-in danger comprising:
- a frame;
- a pair of opposing front wheels rotatably mounted about a first axis to said frame;
- a pair of opposing rear wheels rotatably mounted about a second axis to said frame;
- bearing means mounted to said frame and engaging and supporting said front wheels and said rear wheels away from said frame; and,
- power means mounted on said frame to propel the machine and constructed to apply a downward force increasing the traction of said wheels when the machine sticks in a trench; and wherein:
- said power means rotatably drives said front wheels; and further comprising:
- digging means positioned on said frame and operable to dig a tile channel in said trench; and,
- tile dispensing means mounted on said frame and operable to position tile sections in said channel in interconnecting relationship;
- said frame has a top pair and a bottom pair of horizontally extending channel beams spaced inwardly of said front and rear wheels; and,
- said tile dispensing means has a vertically extending frame with operator seat, said vertically extending frame has roller wheels and is movable thereon horizontally along said beams, said vertically extending frame has a tile engageable tongue vertically movable thereon.

4. The machine of claim **3** wherein:
- said front and rear wheels have interconnected drive arms with proximal ends rotatably mounted about said first axis and said second axis, said arms have distal ends with spring loaded ratchets therein engageable in ratchet fashion with said front and rear wheels;
- said arms mounted about said first axis being positioned at all times between and above said first and second axis; and,
- said power means is a power cylinder mounted between said first axis and said second axis with a piston rod connected to said arms mounted about said first axis and extendable upwardly therefrom.

5. The machine of claim **4** further comprising:
- carrying means movable along said bottom pair of channel beams and having said digging means resting thereon, said digging means being positioned forwardly of said tile dispensing means.

6. The machine of claim **5** and further comprising:
- a double walled enclosure mounted to and extending around said frame being flush interiorly and exteriorly with said rear wheels and said front wheels, said enclosure extending between said wheels preventing dirt from passing therein.

7. The machine of claim **6** and further comprising:
- a plurality of power cylinders operable to move said driving arms rotatably about said first axis.

8. The machine of claim **1** wherein:
- said front and rear wheels have interconnected drive arms with proximal ends rotatably mounted about said first axis and said second axis, said arms have distal ends with spring loaded ratchets therein engageable in ratchet fashion with said front and rear wheels;
  - said arms mounted about said first axis being positioned at all times between and above said first and second axis; and,
- said power means is a power cylinder mounted between said first and said second axis with a piston rod connected to said arms mounted about said first axis and extendable upwardly therefrom, said power means is operable by extending said piston rod to apply downward force increasing the traction of said wheels when the machine sticks in a trench.

9. The machine of claim **1** wherein:
- said frame has a pair of vertical walls positioned apart a fixed space;

said wheels are of large diameter and extend vertically to immediately beneath the bottom edge of said side walls to immediately below the top edge of said side walls.

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