# United States Patent [19]

**Schmahl**

[11] **3,782,480**

[45] **Jan. 1, 1974**


[54] **SLIT TRENCH FORMING APPARATUSES**


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[52] **U.S. Cl.** ..... **172/110,** 172/699, 61/72.6

[51] **Int. Cl.** ..... **A01b 35/00**

[58] **Field of Search** ..... 172/699, 40, 84, 172/85, 93–95, 98, 110, 710; 61/72.6; 74/47, 48



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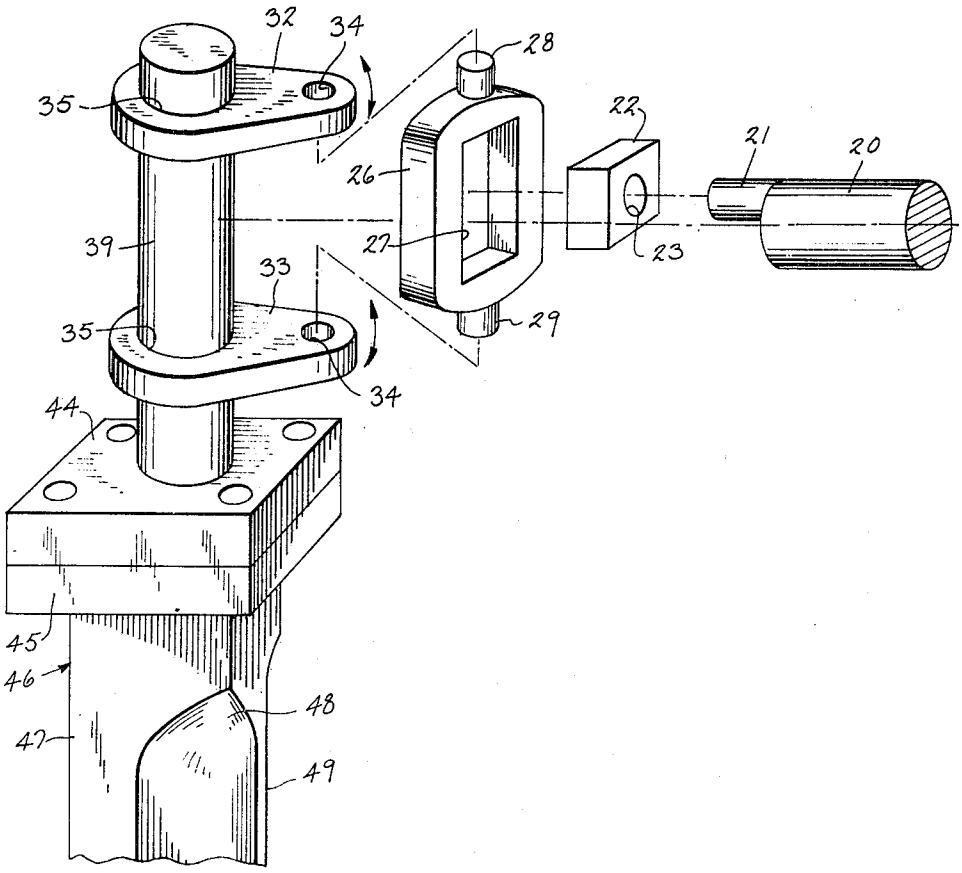
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[57] **ABSTRACT**

A device adapted to be pulled by a tractor or the like including a trench-forming blade and featuring a novel blade driving mechanism connectible to the power take-off shaft of the pulling vehicle, or to a separate prime mover, adapted to impart lateral oscillating motion to said blade to form a slit trench in the earth into which underground cables or pipes, etc. can be laid by a guide device associated with said apparatus, said novel drive mechanism producing a minimum of vibrations of the type characterizing conventional trench formers, which vibrations cause wear and rapid deterioration not only of the structural components of the apparatus, but which constant vibrations are detrimental to the human operator as well as to the cables or pipes being installed.


**14 Claims, 7 Drawing Figures**



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SHEET 1 OF 2

Fig. 1

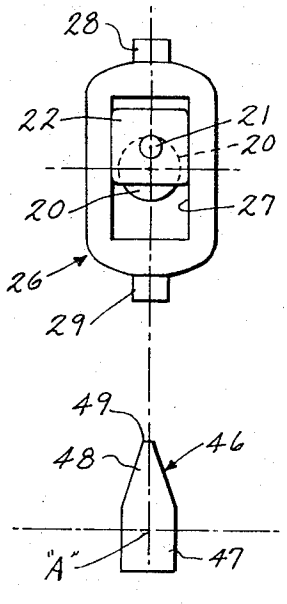



Fig. 2

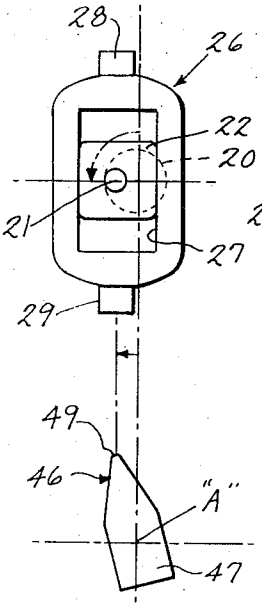



Fig. 3

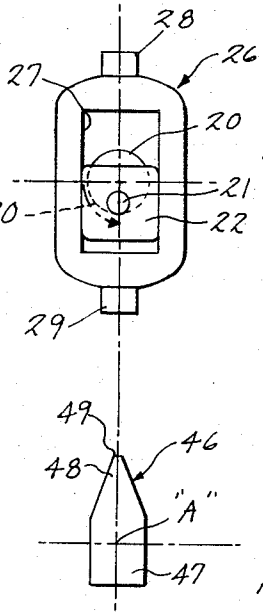



Fig. 4

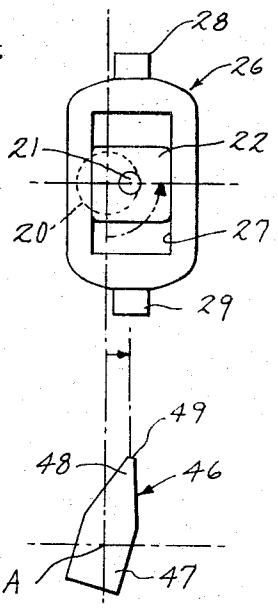



Fig. 6

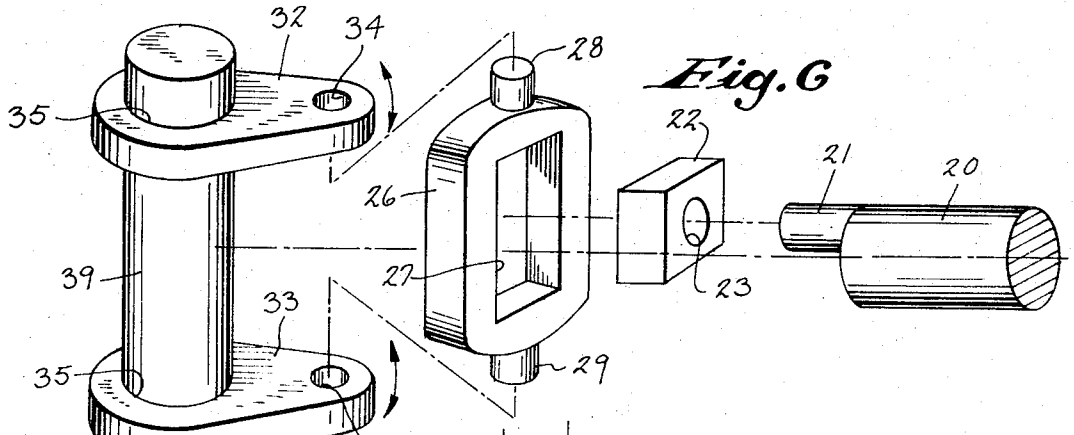
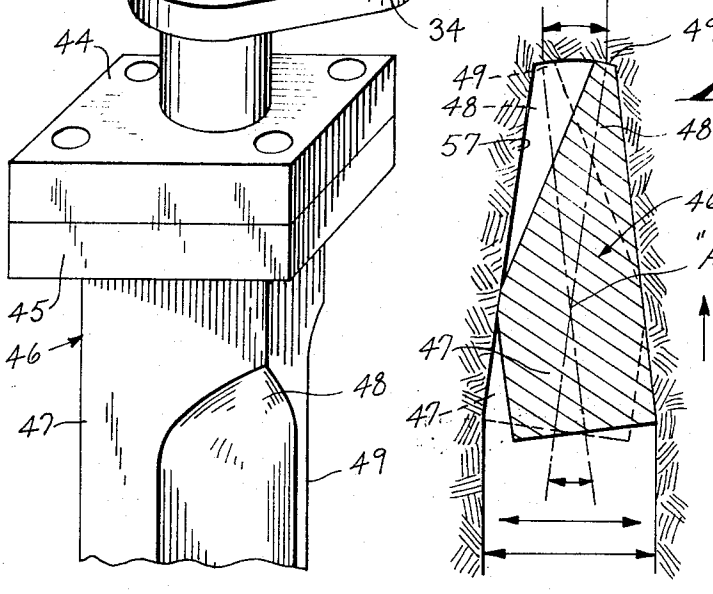


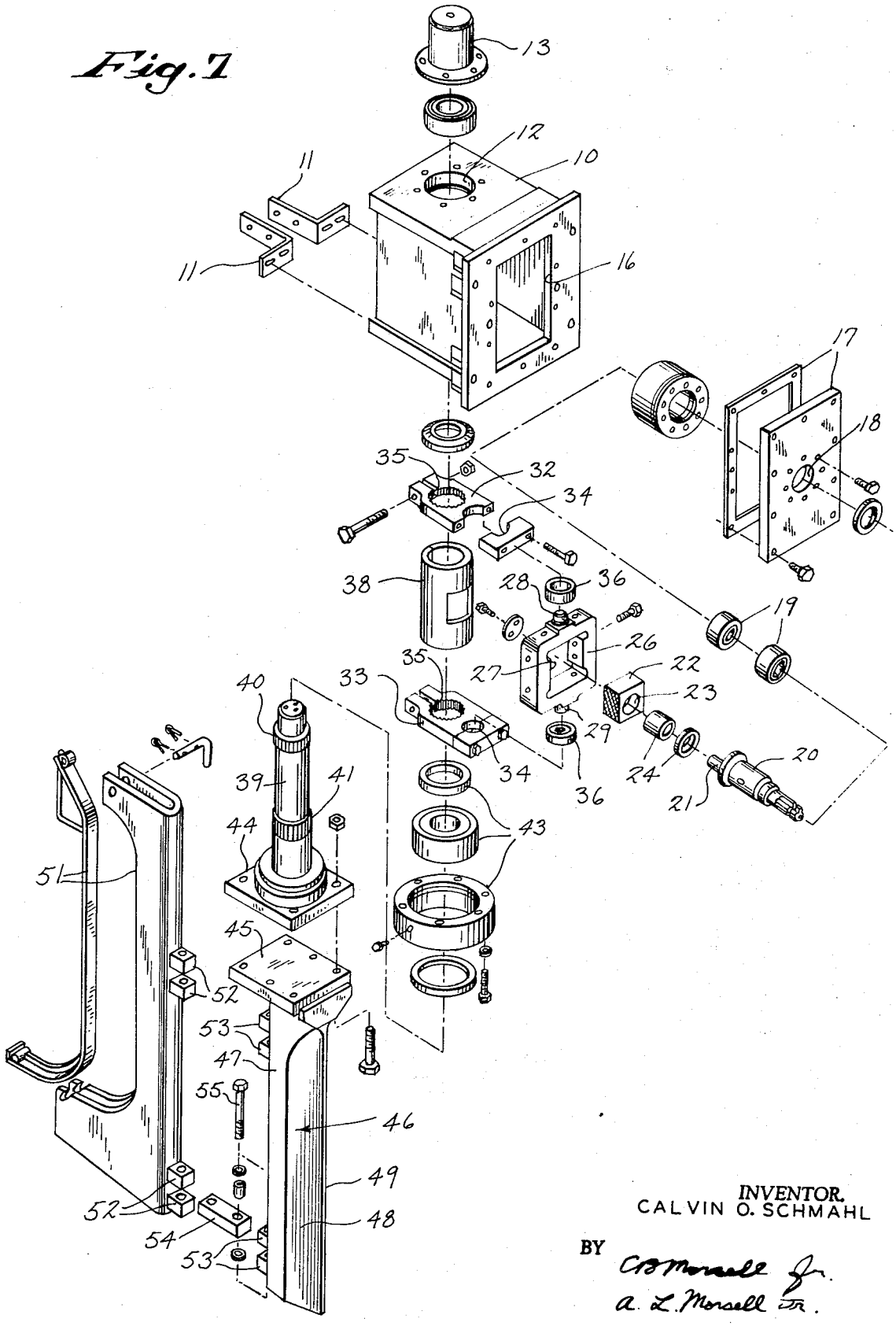

Fig. 5




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Fig. 7




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# SLIT TRENCH FORMING APPARATUSES

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to excavating equipment and more particularly to machines for forming slit trenches into which underground wires, cables, or pipes, or the like, are laid.

2. Description of the Prior Art

Heretofore most slit trench-forming devices have been of the type that depend almost entirely on the forward movement of the vehicle on which they are supported to forcibly urge an excavating blade through the earth, which is unsatisfactory for the reasons that it not only requires considerable power, but results in frequent breakage and a relatively short life span for the blade and other structural components.

In an effort to overcome the deficiencies of such conventional trench diggers attempts have been made in the past to provide means for reciprocating or vibrating the trench-forming blade, or so-called sabre, in a vertical plane in order to facilitate and promote the digging action of said blade. Unfortunately, however, such devices have not proven entirely satisfactory.

For one thing, with vertically-reciprocating blades of the type described there is a tendency for a combination of earth, roots, and weeds to accumulate in front of the blade at the point where said blade emerges from the ground, which necessitates periodically stopping the vehicle to remove said mass of packed debris.

An even more important shortcoming of vertically-reciprocating trench-forming blades of the type described is that the continuous vigorous vibrating motion characterizing such machines not only results in wear and tear on both the machine and the operator, but it imparts corresponding vibrations to the pipe or cable as it is being laid, which can cause said pipe or cable to bend or kink, and sometimes break. Moreover, the inevitable abrasion caused by said vertically-reciprocating blades on electric cables and the like frequently wears through or damages the insulation covering said cables with the result that the wires are exposed and likely to short circuit or be otherwise seriously damaged when contacted by water or other foreign matter. This has been a particularly serious problem in the laying of telephone cables.

In order to eliminate or minimize the shortcomings of such vertically vibrating-type slit trench diggers a unique trench-forming apparatus featuring a laterally-oscillating blade or sabre was designed by one Albam M. Vik and is the subject matter of pending United States patent application Ser. No. 732,970, filed May 29, 1968, now abandoned, and a later-filed streamlined continuation application dated Aug. 6, 1970, Ser. No. 61,828, now U.S. Pat. No. 3,638,399. The assignee of the present patent application is the exclusive licensee under said co-pending application.

The general object of the invention disclosed in said prior co-pending application is to provide a unique slit trench-forming apparatus wherein the trench-forming blade is designed to alternately oscillate leftwardly and rightwardly about a generally vertical axis in a manner whereby said blade creates lateral pressure which literally compresses the earth on each side of the blade to form the trench. With said novel trench-forming action it has been found that there is less damaging vibration than with the vertically-reciprocating blades of the type described above, and, in addition, the unit can be drawn forwardly through the earth more easily and with less power consumption than is required with said prior trench formers.



A further advantage of the trench-forming device disclosed in said co-pending application is that the novel lateral oscillating motion of the blade, and resulting compacting of the earth against the trench side walls, forms relatively hard, smooth trench walls which remain firmly intact while the pipe or cable is being laid in said trench, which is highly desirable.

Further advantages of the novel trench-forming apparatus disclosed in said co-pending application, as hereinabove mentioned, are that the somewhat reduced vibration lessens the tendency of the cable to kink, break, or abrade, as well as lengthening the useful life of the structural components of said apparatus in comparison to the vertically-reciprocable diggers previously used.

Unfortunately, while the novel trench-forming apparatus disclosed in said co-pending application is a definite improvement upon its predecessors and creates less harmful vibration, as described, it still produces substantial vibrations, with some of the damaging effects hereinabove enumerated. Consequently, one of the principal objects of the present invention is to provide an improved drive assembly for such laterally-oscillating trench formers which practically eliminates said harmful vibrations.

In addition to the above-identified co-pending patent application, and continuation application, excavating devices of the general type herein involved are disclosed in the following U.S. Pat.: No. 2,613,582; No. 1,948,167; No. 2,032,382; No. 2,178,077; No. 2,270,309; No. 2,373,430; No. 2,379,763; No. 3,396,579; No. 2,410,273; No. 2,416,401; and No. 2,425,655.

## SUMMARY OF THE INVENTION

As hereinabove described, the present invention provides a new slit trench-forming apparatus of the type utilizing a blade adapted to oscillate in a lateral arc about its vertical axis, the present invention being an improvement upon the trench former disclosed in co-pending application Ser. No. 732,970, and the streamlined continuation application substituted therefor dated Aug. 5, 1970.

More specifically, the principal object of the present invention is to provide a new and unique blade-oscillating mechanism which can be aligned with and attached directly to the power take-off shaft of the tractor or other pulling vehicle, in contrast to the complex, offset chain drive mechanism used in said prior oscillating-type trench former, or which improved drive assembly can be readily operatively connected to a separate power means such as a gas, electric, or hydraulic motor. The present assembly is not only more efficient and durable than said earlier oscillating trench former, but provides a mechanism wherein destructive vibrations are reduced to a minimum, thereby substantially lessening the wear on the structural components as well as promoting the comfort of the operator and reducing the possibility of damage to the pipe or cable being laid.

A more specific object of the present invention is to provide an improved oscillating blade drive mechanism characterized by a rotatable shaft aligned with and connected directly to the power take-off shaft of the pull-

ing vehicle (or to a separate prime mover) and having an eccentric stud or pin on the end thereof affixed to a block carried in and adapted to laterally reciprocate a scotch yoke assembly during the rotation of said driven shaft and block members, there being connecting means associated with said yoke designed to transmit said lateral reciprocating motion to the trench-forming blade to cause the latter to oscillate within a prescribed arc, and with a minimum of vertical movement and undesired vibration.

Further objects of the present ivnention are to provide a slit trench-forming apparatus featuring a new and improved drive mechanism, as described, which apparatus is more rugged and durable than its predecessors, which is more efficient and reliable in operation, which is relatively simple in design and construction, and which is otherwise particularly well adapted for its intended purposes.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, wherein the same reference numerals designate the same or similar parts in all of the views:

FIG. 1 is a simplified diagrammatic view of the trench-forming blade and blade-oscillating yoke mechanism illustrating the rotatable yoke actuating block in its normal, raised and centered position, and showing said blade in a corresponding straight, centered position, said diagrammatic view showing the yoke assembly in front elevation and the blade therebelow in top plan view in order to clearly demonstrate the coaction and corresponding positions of said members;

FIG. 2 is a similar simplified diagrammatic view showing said yoke shifted to the left of its centered position, and illustrating the corresponding laterally-pivoted position of the trench-forming blade;

FIG. 3 is a similar diagrammatic view illustrating the rotatable yoke-actuating block in its lowered, centered position, and with the blade in a corresponding straight position;

FIG. 4 is another diagrammatic view illustrating the yoke-actuating block rotated to shift said yoke laterally to the right of the center line, and showing the blade in a corresponding laterally-pivoted position;

FIG. 5 is a transverse sectional view of the trench-forming blade, looking downwardly toward the ground, showing said blade pivoted to its extreme lateral positions and showing the slit trench formed thereby;

FIG. 6 is a simplified fragmentary exploded perspective view of the blade and the principal components of the blade oscillating mechanism; and

FIG. 7 is a more complete and detailed exploded perspective view of the blade and drive mechanism featured in the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly first to FIG. 7 of the drawings, illustrating the complete drive assembly comprising the present invention, the numeral **10** designates a housing which is designed to be mounted on a chassis (not shown) connectible to a tractor or other suitable power-driven pulling vehicle. Said housing includes an opening **12** in its top and an upwardly-projecting cylindrical bearing housing **13** mounted thereover adapted to accommodate the upper end of a vertically-disposed driven shaft **39** employed in the present structure, as will be more fully described hereinafter.

The housing **10** also has an opening **16** in its forward wall adapted to be covered by a plate assembly **17** bolted thereto having a circular central opening **18.** Carried within said housing and projecting through said front plate opening **18** is a shaft **20** having a plurality of rings, bearings, and sealing members **19,** etc. encircling the same. In accordance with the present invention said shaft **20** is adapted to be aligned with and connected to the power take-off shaft of the pulling vehicle (not shown) or to a separate prime mover such as a gas, electric, or hydraulic motor, and the inner end of said rotatably-driven shaft **20** has an eccentric pin or stud **21** of lesser diameter projecting from the inner end thereof at a point spaced radially outwardly from the longitudinal axis of said shaft. Said stud **21** is fitted within a circular opening **23** in a block **22,** there being lubricating sealing rings, bearings, etc. **24** interposed therebetween.

Said block **22** is closely vertically slidably fitted within the rectangular opening **27** in a scotch yoke member **26** carried in the housing **10,** and extending from the top and the bottom of said yoke are cylindrical studs **28, 29,** respectively, projected into openings **34** formed in upper and lower bracket-like arm members **32, 33,** which arm members are designed to swing or oscillate in a horizontal arc in response to sideways motion of said yoke member, as will be more fully described. Said stubs **28, 29** on the top and bottom of the yoke are rotatably journalled in said bracket arm openings **34** by means of bushings **36** or the like so that as said arm members oscillate, as described, said yoke will not turn therewith, but, rather, remains in a fixed plane relative to the rigid block **22** carried therein.

Interposed between said upper and lower arm members or brackets **32, 33** is a spacer sleeve **38** through which the aforementioned vertical shaft **39** projects, said shaft being provided with upper and lower serrated portions **40, 41** encircling the same and designed to fit within and mesh with corresponding serrated openings **35** in the aforementioned arm members **32, 33** in a manner whereby the horizontal swinging motion of said bracket arms is imparted directly to and oscillates said vertically-disposed shaft **39.** There are a plurality of sealing and lubricating rings, nuts, bushings, O-rings, and lock washers **43,** etc. surrounding said vertical shaft **39,** as well as the rings **24** etc. surrounding the above-described horizontal drive shaft **20,** but it is to be understood that the exact number, form, location, and function of said elements is not a critical feature of the inventive concept comprising the present invention, and the invention is by no means to be limited or confined to the number and arrangement of said elements as illustrated.

It will be observed that the lower end of the vertical, oscillating shaft **39** is provided with a flat base member **44,** and the latter is rigidly bolted to a plate element **45** forming the top of the elongated trench-forming blade **46,** or so-called sabre, featured in the present invention. Said blade or sabre **46** includes a back or body portion **47** which is substantially rectangular in cross section, and a forwardly-tapered front portion **48** terminating in a leading vertical edge **49,** the pivot axis of said oscillating blade member being located at the position designated A in FIGS. **1–5.**

With reference again to FIG. 7 of the drawings, connected to the back of said blade **46** in the illustrated form of the present invention is a cable chute or guide assembly **51** which is adapted to direct the cable, pipe, or wire, etc. being laid into the trench formed by said blade when the apparatus is in operation. Said cable chute assembly is conventional in design and well known in the art, with the exception that in the present invention in addition to having its upper end secured by bracket elements **11** said cable chute is attached to the elongated blade **46** by a pair of novel and improved connecting devices located adjacent the upper and lower ends of said blade. As will be seen, each of said connecting assemblies includes a pair of spaced, apertured lugs **52** projecting outwardly from said chute member and aligned, spaced lugs **53** projecting from the back face of the blade, there being a connecting bar **54** adapted to fit between said lugs and having apertures therethrough alignable with said lug apertures through which bolts **55** or the like are projected to join said members. The result is a non-rigid connection which permits a certain amount of movement or "play" between said cable chute and blade members in order to minimize the transmittal of vibrations from the blade to said chute, thus reducing the possibility of the pipe or cable being damaged during installation. In lieu of the illustrated cable chute mounting it is also possible to rigidly or pivotally affix the chute to the housing **10**, or other portion of the chassis, and allow said chute to extend downwardly into the trench behind the blade **46** without any connection to said blade, thereby eliminating even the minimal vibration transmitted through the connecting bars **54**. In other words, the exact mounting arrangement of the cable chute **51** relative to the trench-forming blade **46** is not a critical feature of the present invention and can be varied as desired without departing from the spirit and intended scope of said invention.

The operation of the novel and improved blade-oscillating mechanism featured in the present trench-forming apparatus will now be described.

Referring to FIGS. **1–4** of the drawings, when the rotatable input shaft **20** which is operatively connected directly to the power take-off shaft of the tractor or other pulling vehicle or to a separate engine or the like, as described, is in its normal position the offset or eccentric pin **21** thereon, together with the block **22** journaled on said pin, is in a raised, centered position relative to the scotch yoke member **26** within which said block **22** is vertically slidably fitted. As is illustrated in FIG. **1** (which, like FIGS. **2–4**, is a simplified diagrammatic view showing said yoke and drive shaft assembly in front elevation and the trench-forming blade **46** in top plan view in order to clearly illustrate the relative positions of said members during the operation of the machine) when said eccentric **21** and attached block **22** are in said centered position within the yoke **26** the blade **46** is also in a straight, centered position, siad blade being connected to said yoke by means of the vertical shaft **39** and interconnected plate members **44, 56** (FIGS. **6** and **7**), as hereinabove described.

With reference now to FIG. **2**, the driven shaft **20** rotates in a counterclockwise direction in the illustrated form of the invention (although it can, of course, be designed to rotate in either direction), and as said input shaft turns 90° the eccentric stud **21** projecting therefrom assumes the laterally offset position shown, relative to the longitudinal axis of said shaft, thereby causing the block **22** thereon to rotate in a corresponding laterally offset manner relative to the axis of the drive shaft **20**. The result is that said block **22** forcibly urges the yoke **26** laterally to the left of its original, centered position, which shifting or movement of said yoke is permitted by the horizontally swingable bracket arm members **32, 33** in which the yoke top and bottom studs **28, 29** are mounted. As will be observed, as said yoke shifts laterally as illustrated in FIG. **2**, the blade **46** is caused to simultaneously swing a corresponding distance about its pivot point A.

As shown in FIGS. **3** when the drive shaft **20** rotates another 90° the pin **21** thereon is again centered, in a lowered position, and the block **22** thereon urges the yoke **26** back to its centered position relative to the axis of said drive shaft **20**, and the trench-forming blade **46** is pivoted therewith to the straight position illustrated.

As said drive or input shaft **20** continues to rotate another 90°, as shown in FIG. **4**, the offset stud or pin **21** causes the block **22** thereon to forcibly urge the yoke **26** to a laterally offset position to the right of its normal center line, thus pivoting the blade **46** to the right a corresponding distance. The continued rotation of said shaft **20** to complete one full revolution returns said members to their original, centered positions, as illustrated in FIG. **1**. It is to be understood, of course, that during the operation of the machine said shaft **20** rotates at a high rate of speed, thus causing the rapid pivotal or oscillating movement of said yoke and connected blade members. As mentioned, the direction of rotation of said shaft **20** is not critical, and the rotation of said shaft in either direction will provide the same blade motion. In actual practice in the preferred form of the invention said blade is ordinarily designed to oscillate through an arc of about 17½° at speeds up to 400 cycles per minute, although this can be varied as desired, or as required for the particular machine, of course. Similarly the size of said blade **46** is dependent upon the particular type of cable or pipe being laid, and neither is the invention to be limited in this respect.

In the use of the present invention a hole is frequently initially dug in the earth by any suitable means to the depth of the desired slit trench and the blade or sabre **46** is inserted therein in a substantially vertical position, and the drive mechanism is actuated, although the blade in the present invention is capable of cutting into the earth to form a trench without the necessity of first digging a hole into which said blade is inserted, and the invention may be so employed. A variety of mechanisms can be utilized for raising and lowering said blade relative to the ground, as is well known in the art, and the invention is not to be confined in this respect.

As best appears in FIG. **5**, as said blade member **46** oscillates at high speed between the full and broken line positions illustrated in said view the forward blade portion **48** functions to loosen and urge the earth laterally relative thereto to form a trench **57**, and the continued action of said blade forward portion in conjunction with the simultaneous oscillation of the wider, rearward or heel portion **47** of said blade effectively compacts the dirt against the side walls of said trench **57** as the unit is drawn through the earth by the tractor or other pulling vehicle, said blade heel portion **47** functioning to increase the width of the trench to the desired size, and the uniform shape of said blade throughout its height ensuring that the earth is com-

pressed the same amount at every elevation within the trench. As described, one of the advantages of the present apparatus, as compared to prior trench formers of the type using a vertically-reciprocable blade, is that with the present invention the walls of the trench are so firmly compacted by said laterally-oscillating blade that there is virtually no likelihood of the same crumbling prior to the laying of the pipe or cable in said trench, thereby facilitating and promoting the proper installation of said cable or pipe or the like.

One of the principal advantages of the present mechanism, of course, in comparison to prior trench formers utilizing a vertical reciprocating action, and in comparison to the horizontally-oscillating blade assembly disclosed in the aforementioned co-pending patent application of Albam M. Vik, is that the present invention reduces vibrations to an absolute minimum. The result is that the invention not only promotes and extends the useful life of the structural components of said apparatus, but greatly increases the comfort of the human operator, as well as said vibration reduction minimizing the possibility of damage to the pipe or cable as it is installed in the trench.

From the foregoing detailed description it will be seen that the present invention comprises an improved slit trench-forming apparatus which is a definite advancement in the art. It is to be understood, of course, that while one preferred embodiment of the present invention has been illustrated and described herein, variations or modifications thereof may well occur to those having skill in this art. It is contemplated, for example, that in lieu of having said trench-forming apparatus conveyed over the ground, and powered by a tractor or other pulling vehicle as described, said trench-former could be mounted on its own mobile carriage and powered by a trailing prime mover of a suitable type, or other variations could be utilized to accomplish the same basic function. In short, what is intended to be covered herein is not only the illustrated form of the present invention but also any and all variations or modifications thereof as may come within the spirit of said invention.

What I claim is:

**1.** A slit trench-forming apparatus comprising: means for connecting said apparatus to a power-driven vehicle; a rotatable input drive shaft drivably connectible at its outer end to a power source and having an inner end; a block mounted eccentrically on the inner end of said input drive shaft; a laterally-movable scotch yoke having an opening in which said eccentric-mounted block is vertically movably mounted; an elongated trench-forming blade mounted for oscillation on a vertical axis and adapted to project downwardly into the ground; and means drivably connecting said scotch yoke to said trench-forming blade in a manner whereby when said input drive shaft rotates the eccentric-mounted block thereon causes lateral sideways reciprocating movement of said yoke which is transmitted to said blade to cause the latter to oscillate about a fixed axis in a predetermined lateral arc which compacts the earth on both sides thereof to form a trench as said blade is urged forwardly through the ground by said vehicle.

**2.** The slit trench-forming apparatus recited in claim **1** wherein said means drivably connecting said scotch yoke to said trench-forming blade comprises: bracket arm means connected to said yoke and adapted to oscillate in a horizontal arc in response to lateral reciprocating movement of said yoke; a substantially vertical driven shaft connected to said bracket arm means and adapted to oscillate therewith about a fixed axis; and rigid connecting means drivably connecting the upper end of said blade to the lower end of said driven shaft.

**3.** The slit trench-forming apparatus recited in claim **2** wherein said driven shaft is provided with peripheral serrations and wherein said bracket arm means is provided with an opening through which said vertical shaft projects which bracket arm opening is provided with mating serrations adapted to mesh with and impart said oscillating motion of said bracket arm means to said vertical shaft.

**4.** The slit trench-forming apparatus recited in claim **3** wherein said bracket arm means comprises a pair of vertically spaced bracket arms, one being positioned above and connected to the top of said yoke member and the other being positioned below and connected to the bottom of said yoke member, said vertical, driven shaft extending through aligned openings in said spaced bracket arms.

**5.** The trench-forming apparatus recited in claim **4** wherein said yoke member is provided with studs projecting from the center portion of the top and bottom thereof which studs are rotatably journaled in said upper and lower bracket arm members in a manner whereby said bracket arms can oscillate in a predetermined arcuate path while said yoke member reciprocates in a lateral plane.

**6.** The slit trench-forming apparatus recited in claim **1** and having a cable chute member attached to said blade.

**7.** The slit trench-forming apparatus recited in claim **1** wherein said rotatable input shaft is alignable with and directly connectible to a power take-off shaft on said vehicle.

**8.** A slit trench-forming apparatus, comprising: a chassis; an input drive shaft carried by said chassis and rotatably drivably connected at its outer end to a power source and having an inner end; an eccentric pin projecting from the inner end of said rotatable input shaft, said pin being spaced radially outwardly from the longitudinal axis of said shaft; a block journaled on said pin; a laterally movable scotch yoke having an opening in which said eccentric block is closely vertically movably mounted; a stud projecting from the central portion of both the top and bottom of said scotch yoke; a substantially vertical driven shaft having spaced peripheral serrated portions; a pair of swingable bracket arms surrounding said driven shaft having a pair of serrated openings therein adapted to drivingly mesh with the serrations in said vertical shaft, and said bracket arms having openings therein within which said yoke upper and lower studs are rotatably journaled; and an elongated substantially vertical trench-forming blade rigidly secured to and extending downwardly from the lower end of said vertical shaft, said blade including a body portion of generally rectangular cross-section and a forwardly-tapered front portion terminating in a leading vertical edge, said blade being adapted to oscillate laterally about a fixed vertical axis to firmly compact the earth on both sides thereof to form a trench as said blade is urged forwardly through the ground, said oscillating blade motion resulting from the rotation of the block on said eccentric input shaft pin causing said scotch yoke to reciprocate back and forth and oscillate

said interconnected bracket arms, vertical shaft, and trench-forming blade.

**9.** The slit trench-forming apparatus recited in claim **8** and including an elongated cable chute member positioned in alignment behind said trench-forming blade.

**10.** The slit trench-forming apparatus recited in claim **9** and including means for attaching said cable chute to said blade, comprising: pairs of vertically-spaced lugs projecting forwardly from both the upper and lower portions of said chute member, said lugs having aligned apertures therethrough; pairs of similar, aligned apertured lugs projecting rearwardly from the back face of said trench-forming blade; a straight bar member extending between each of said pairs of spaced lugs, said bar members having apertures therethrough in registration with said lug apertures; and bolt-like elements projected through said aligned lug and bar apertures to secure said chute member to said blade in a manner permitting a degree of movement therebetween.

**11.** The slit trench-forming apparatus recited in claim **9** wherein said chute member is not attached to said blade.

**12.** In a slit trench-forming apparatus adapted to be transported over the ground and having a vertically disposed elongated trench-forming blade adapted to extend down into the earth mounted for lateral oscillation about a generally vertical axis within the blade and said apparatus having a rotatable input drive shaft, the improvement comprising means between said input drive shaft and blade which includes scotch yoke mechanism for causing said lateral oscillatory movement of the blade in a manner minimizing vibration, there being a stem projecting upwardly from the blade having vertically spaced horizontally-disposed arms rigidly connected thereto, and the scotch yoke mechanism including a yoke pivotally mounted on an upright pivot axis between outer portions of said arms, said scotch yoke mechanism also including a slot in said yoke and a block slideably mounted in said slot, and there being means between the input drive shaft and block for causing orbital movement of the block in a generally upright plane.

**13.** A slit trench-forming apparatus as defined in claim **12** in which there is an eccentric pin on the input drive shaft rotatably engaged with said block for causing said orbital movement of the block.

**14.** The slit trench-forming appratus as defined in claim **13** in which said pin projects from an end of the input drive shaft and is eccentric with respect to the axis of rotation of the shaft.

* * * * *