United States Patent

Neff

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[45] **June 13, 1972**

[54] APPARATUS FOR MOUNTING AND POSITIONING OF EXCAVATING DEVICES

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 786,343, Dec. 23, 1968, abandoned, which is a continuation-in-part of Ser. No. 670,039, Sept. 25, 1967, abandoned.

[52] **U.S. Cl.** .....**214/138 C,** 214/131

[51] **Int. Cl.** **E02f 3/74**

[58] **Field of Search**.....214/131, 138, 138 B, 138 C

[56] **References Cited**

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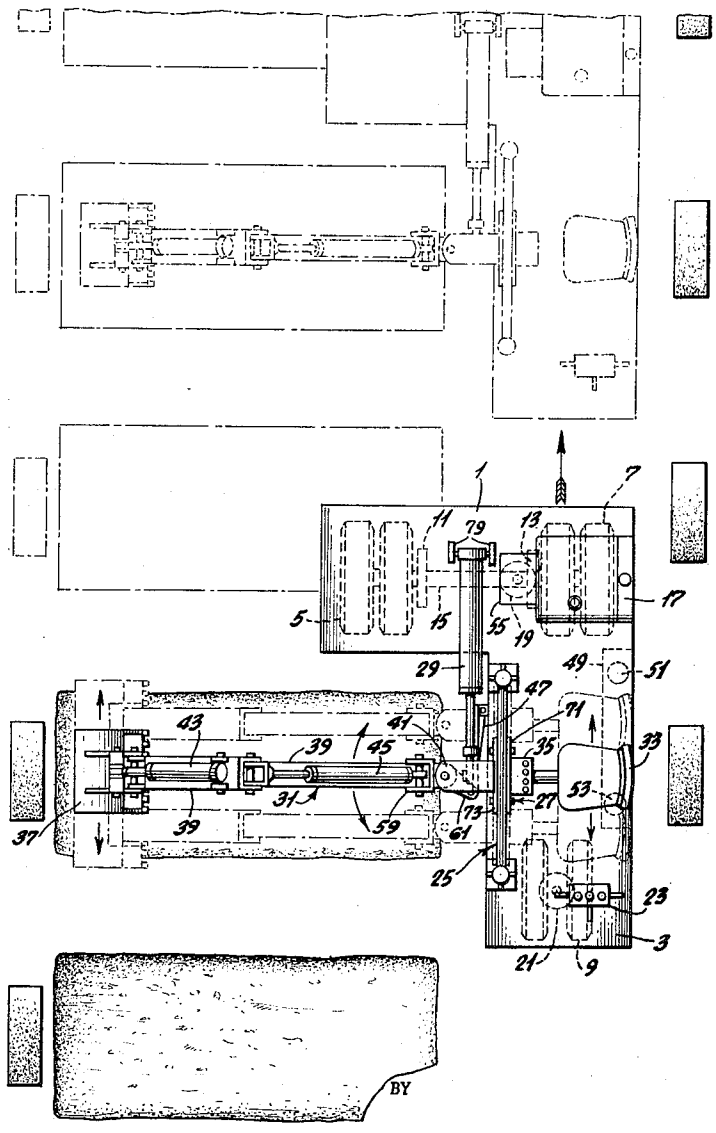
[57] **ABSTRACT**

The invention is an apparatus for operably mounting excavating devices, such as backhoe assemblies, especially adapted to facilitate excavating in limited spaces. The device is a wheel-mounted L-shaped frame having a front transverse leg and a rearwardly extending leg. Along the rearwardly extending leg is affixed a support adapted to receive an excavating assembly, such as a backhoe, to extend operably into the angle formed by the legs of the L-shaped frame.

10 Claims, 6 Drawing Figures



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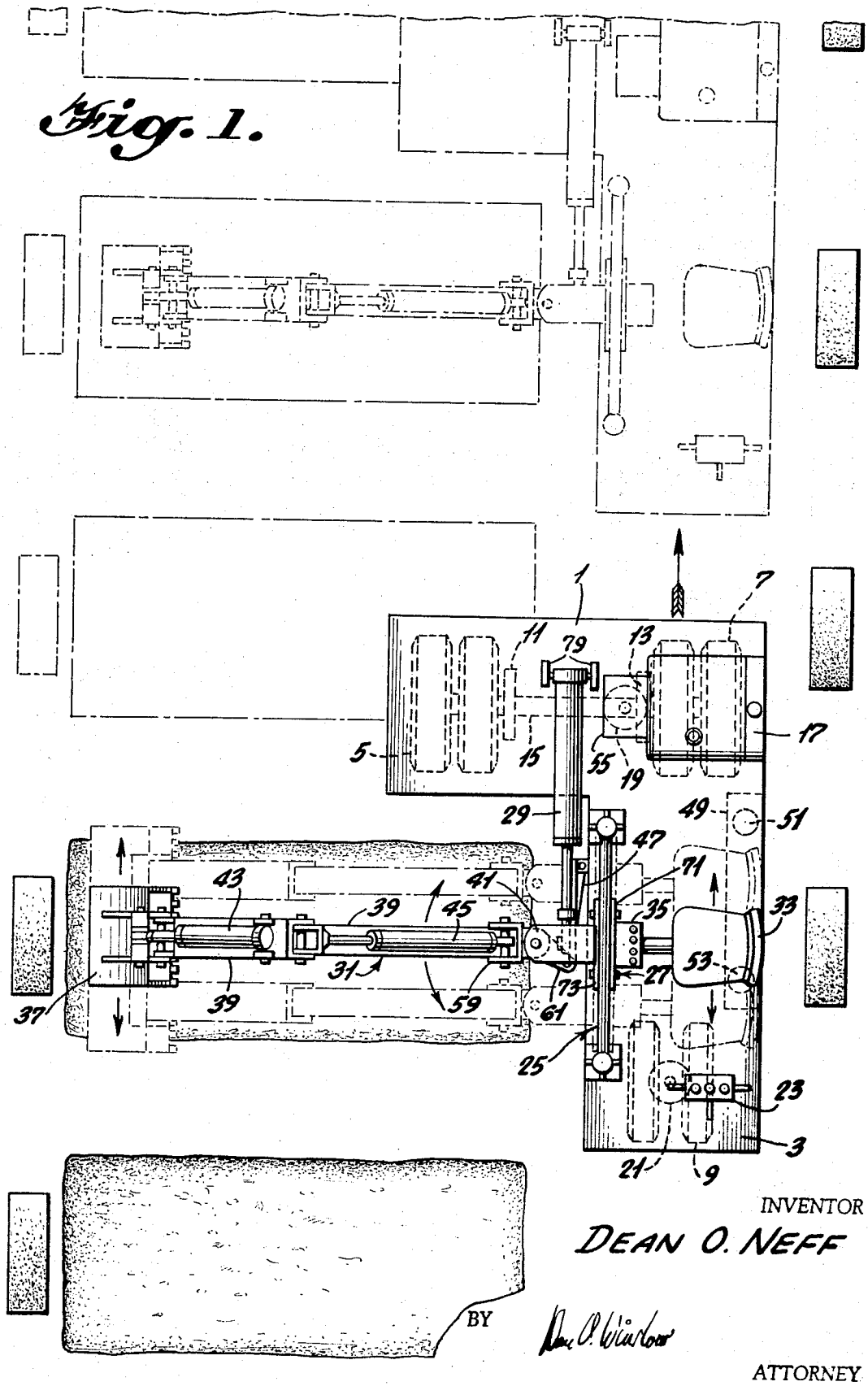
6 Sheets-Sheet 1

Fig. 1.



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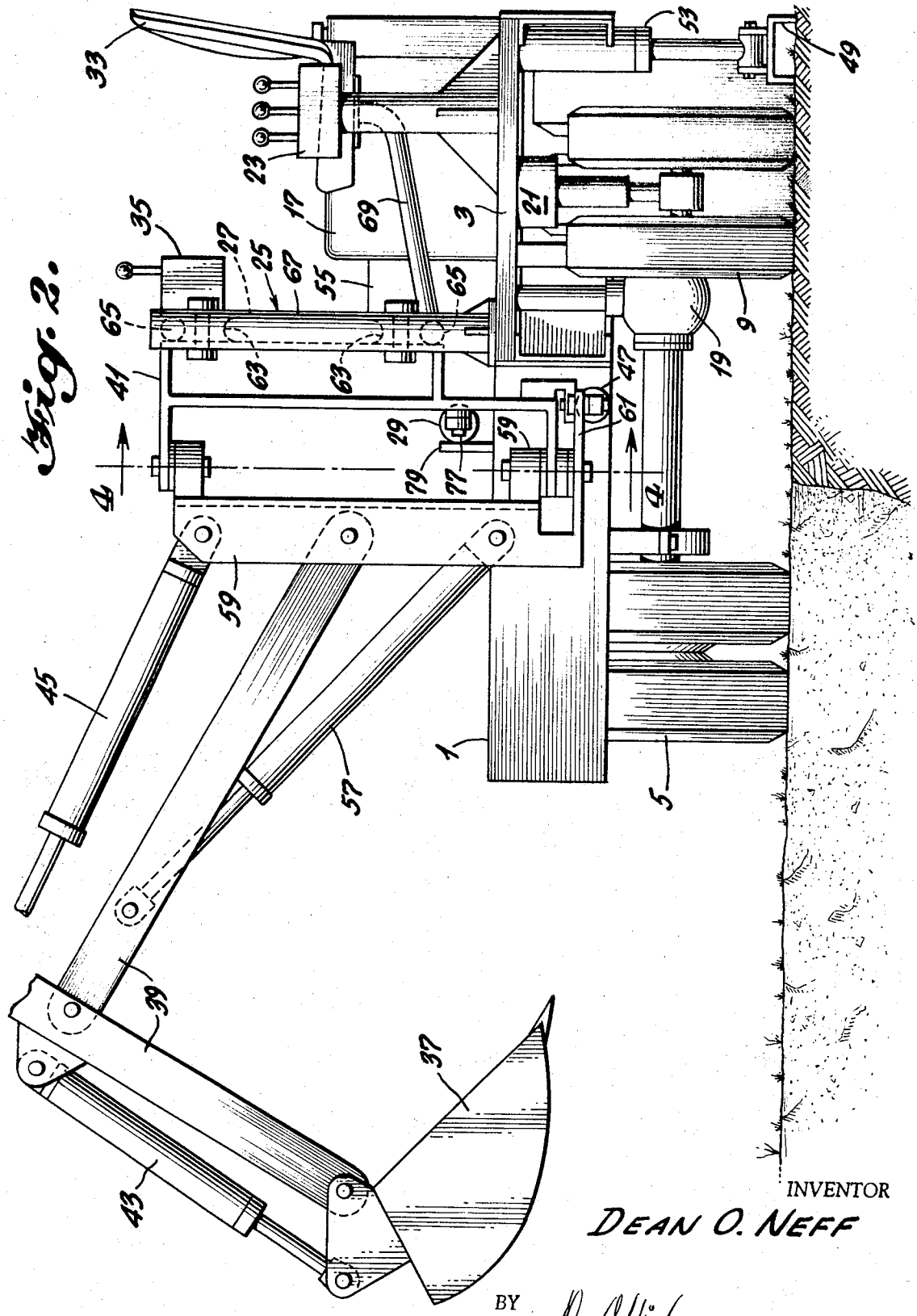

Fig. 2.

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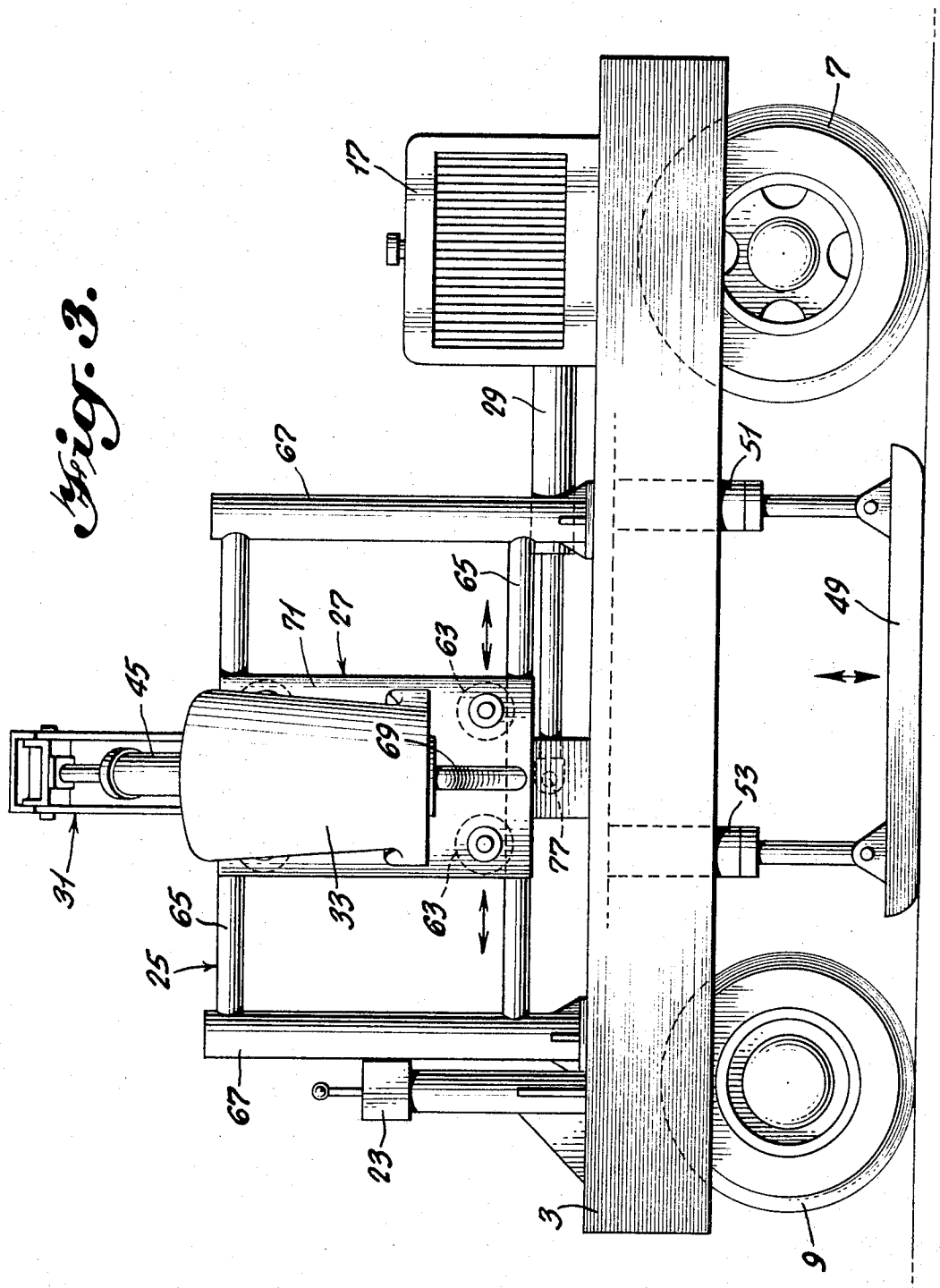
Fig. 3.



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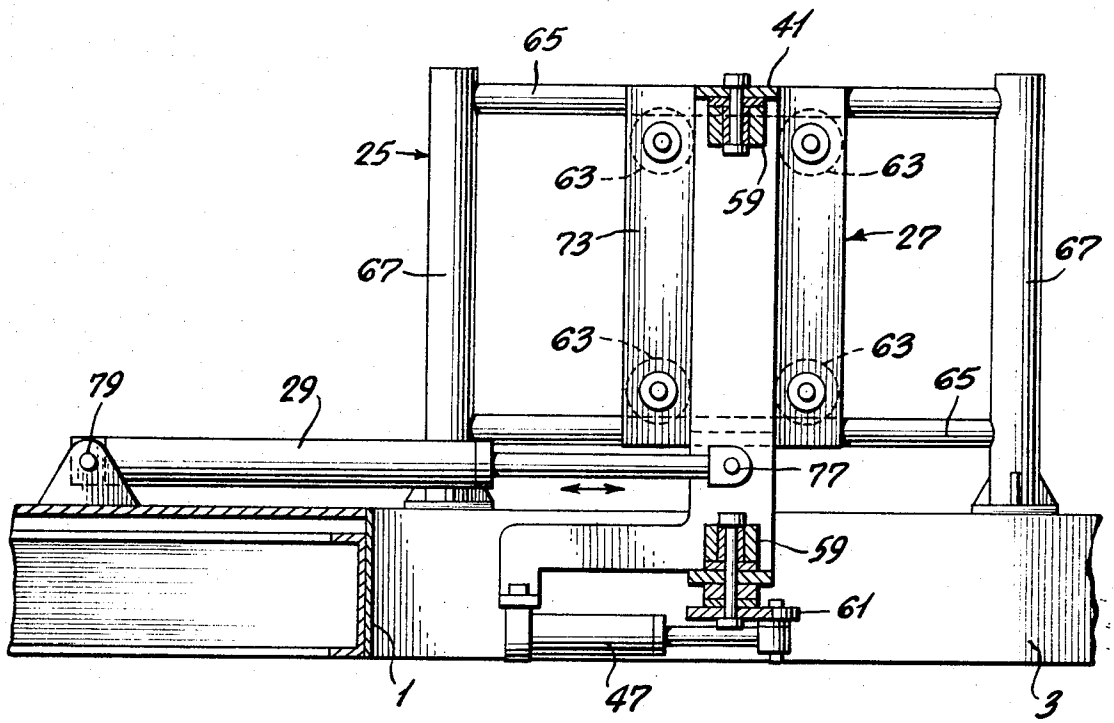

Fig. 4.

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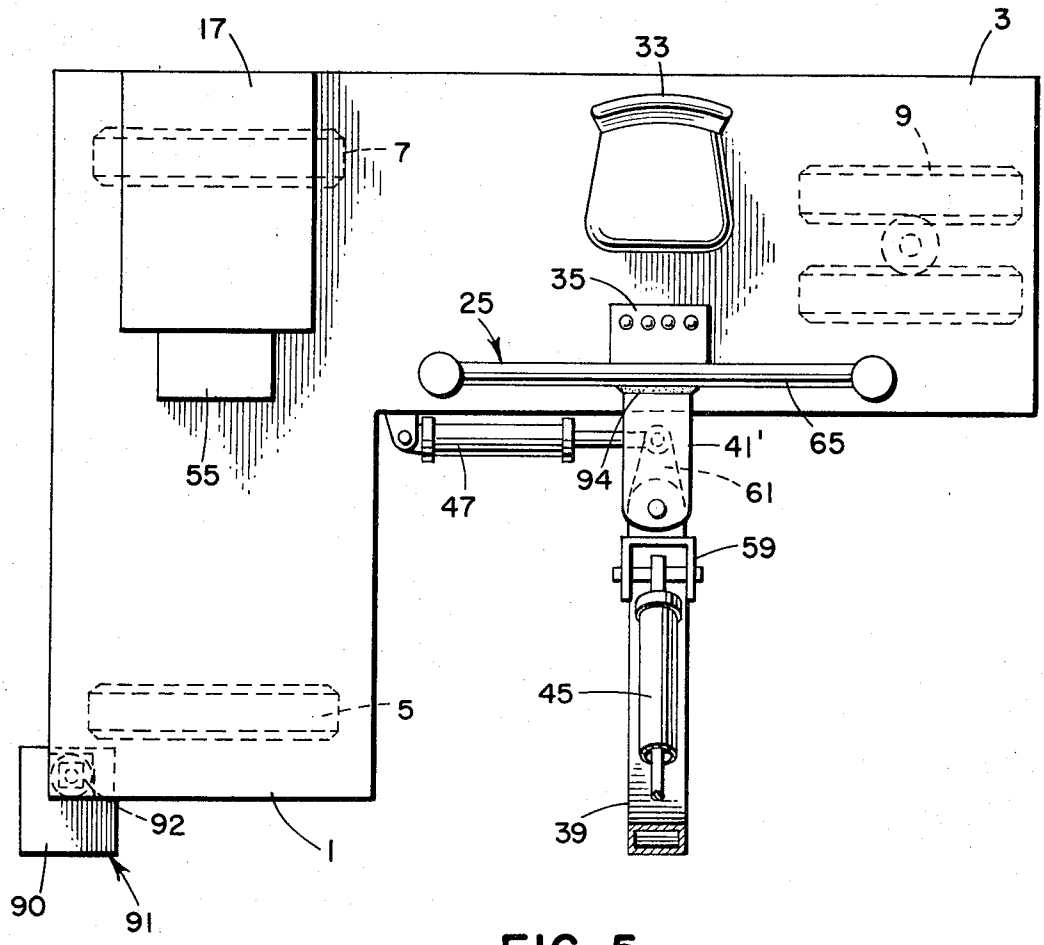

FIG. 5

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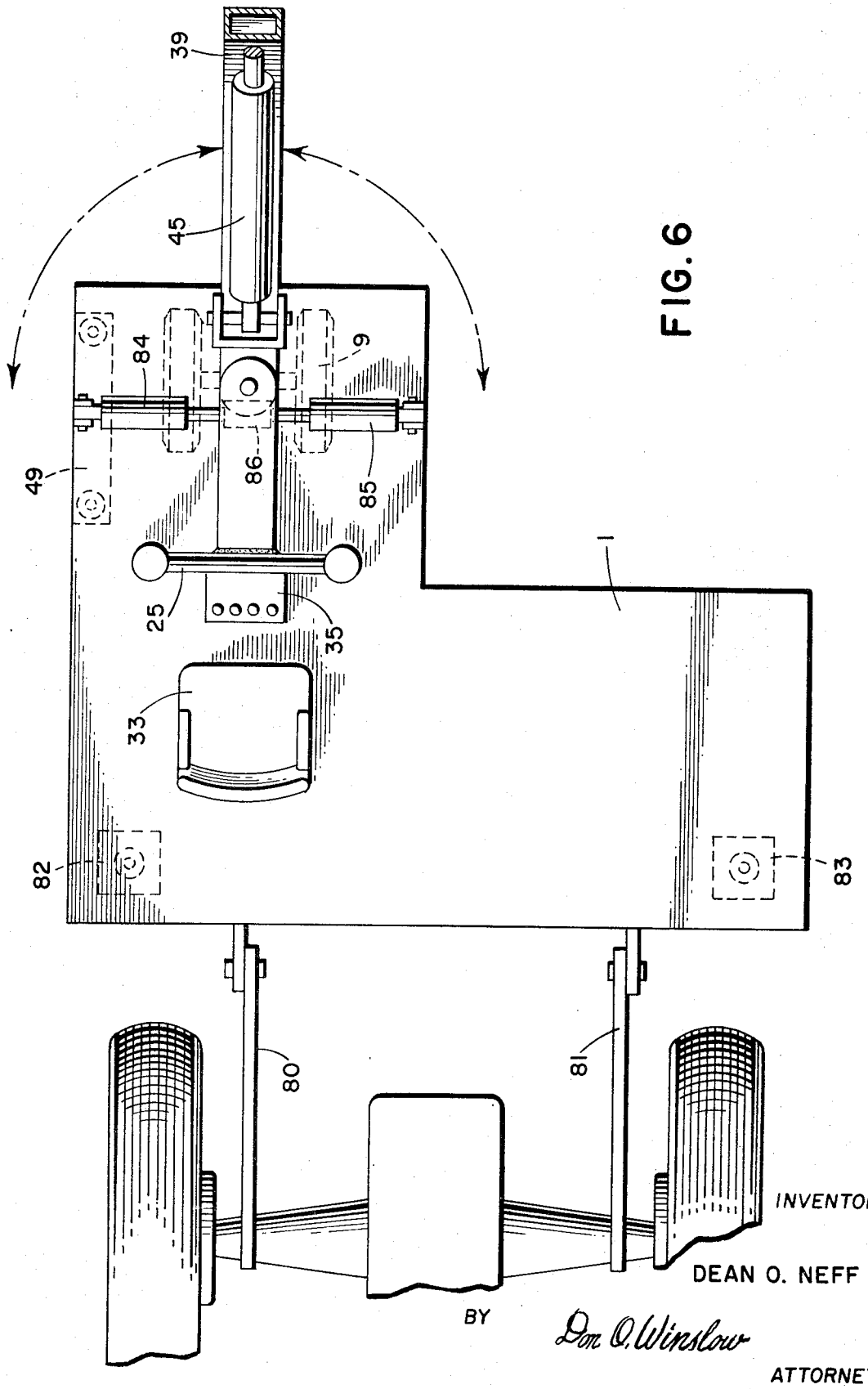

FIG. 6

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APPARATUS FOR MOUNTING AND POSITIONING OF EXCAVATING DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of applicant's copending application, Ser. No. **786,343** entitled "DEVICE FOR MOUNTING AND POSITIONING OF EXCAVATING DEVICES," filed on Dec. 23, 1968, now abandoned, which is a continuation-in-part of applicant's application, Ser. No. 670,039, filed Sept. 25, 1967 and now abandoned.

This invention relates to an apparatus for operably mounting excavating devices, such as backhoe assemblies, especially adapted to facilitate excavating in limited spaces.

It is well known to mount auxiliary equipment to prime movers such as tractors in such manner that the equipment can be removed and replaced by other devices. For example, plows, seeders, spreaders, fork lifts, cranes, earth augers, scoops and blades are each removably mounted for use on tractors. In most instances, such appliances are operated (lifted, turned, lowered, rotated etc.) by secondary power means such as a hydraulic power source with which many tractors are equipped.

Backhoe excavators, in particular, are usually mounted directly to the rear of a prime mover, usually a tractor, along the longitudinal axis of the prime mover in such a manner that they have an effective working arc (swing arc) of about 180°. This method of mounting is generally adequate and does not require extensive modification of the tractor.

Though the above-described conventional backhoe assembly is quite satisfactory for most applications, it is distinctly unsatisfactory where room to back and turn is limited.

The length of even a small tractor is at least about 10 feet. Thus, to excavate an 8 feet long ditch, parallel to the long axis of the tractor, requires a space of over 18 feet. Moreover, there must be suitable access for the vehicle to attain proper excavating position. Even if the backhoe is turned 90° to dig at right angles to the tractor, the amount of space required is considerable. For example, to excavate an 8 feet long ditch using a small-to-medium sized tractor requires a total space of 13 or 14 feet, exclusive of clearances.

An important instance where space requirements of this magnitude are critical is the excavation of graves in cemeteries having conventional above-grade grave markers or headstones. Many such cemeteries, of which there are thousands in the United States alone, utilize tractor-mounted backhoes for the digging of graves, which replace much of the manual labor formerly needed to perform this function. In most instances, the space between parallel rows of markers is restricted to 10 -14 feet.

The use of tractor-mounted backhoes in cemeteries and graveyards to dig graves has severe disadvantages even though it reduces the amount of manual labor and the cost of preparing a grave for interrment. Firstly, as mentioned above, the space between rows of headstones is often limited, thus access to a grave site is either restricted or impossible with conventional tractor-mounted backhoes. The grave must therefore be dug with the backhoe in the 90° position. Because the backhoe has a fixed axis of rotation on the tractor it is apparent that an excavation having parallel sides is extremely difficult unless the tractor is moved periodically during the excavating operation. This is, of course, time consuming and therefore expensive.

Secondly, the size of conventional tractor-mounted backhoe assemblies is such that extensive damage to headstones and memorial markers occurs frequently in manipulating the assembly into position under conditions of restricted clearances. In fact, with conventional tractor-mounted backhoe units, it is frequently necessary to move large headstones and monuments in order to get suitable excavating position. This requires additional manpower as well as additional heavy equipment. Moreover, the risk of damage to monuments is much greater, especially to older stone monuments which have weathered.

Thirdly, the weight of conventional tractor-mounted backhoe devices is such that damage to graves over which it must pass is also frequent.

These disadvantages are overcome by the present invention which is a device having:

1. A rigid supporting frame having
   a. a front transverse leg and
   b. an off-center rearwardly extending leg, said frame being mounted on
2. Support means for the front transverse leg and for the rearwardly extending leg,
3. Excavator support means affixed on the rearwardly extending leg adapted to receive a secondary power-actuated excavator assembly to extend operably into the angle formed by the legs of the supporting frame,
4. Retractable secondary power-actuated stabilizer extendible from the rearwardly extending leg to the ground, and
5. Secondary power and control means adapted to operate the stabilizer means.

In one preferred aspect, the device is self-propelled, having primary power means mounted on the frame and adapted to transmit motive power to the front wheel assemblies. In a further preferred embodiment of this aspect of the invention, the primary power means is also a source of secondary power to actuate and position the stabilizer means and movable carriage as well as the attached excavating assembly. In a still further preferred embodiment, there is movably attached to the support affixed along the rearwardly extending leg a carriage which is capable of horizontal shuttling motion along the carriage support.

In a second preferred aspect, the device is not self-propelled but the front leg is supported by attachment to the rear of a prime mover, such as a tractor, in a manner such that the apparatus is restricted from any substantial independent motion, apart from that of the prime mover, in those planes of rotation perpendicular to the longitudinal and vertical axes of the prime mover. However, the attachment may be such that rotation of the apparatus is free to rotate in a plane of rotation perpendicular to the transverse axis (rear axle of the prime mover. Though rigid attachment as to rotation about this last-named axis is fully operable, flexible attachment permitting such rotation is to be preferred, especially when the apparatus is used on rolling, hilly or otherwise irregular surfaces. The precise mode of attachment, within the above-noted limits, is not critical and various configurations therefor will be readily apparent to anyone skilled in the mechanical arts. However, among those systems which may be used are a conventional three-point tractor hitch and dual hinged clamps affixed to the rear axle housing of the prime mover.

In its complete operation-ready form, i.e. with the excavating assembly attached, the invention is an excavating device having:

1. An L-shaped rigid supporting frame having
   a. a front transverse leg and
   b. a rearwardly extending leg, said frame being mounted on;
2. Support means for the front transverse leg and for the rearwardly extending leg,
3. Excavator support means affixed on the rearwardly-extending leg adapted to receive a secondary power-actuated excavator assembly to extend operably into the angle formed by the legs of the supporting frame.
4. A secondary power-actuated excavating assembly affixed to the excavator support and operably extendible into the angle formed by the legs of the L-shaped frame;
5. Retractable secondary power-actuated stabilizer and extendible from the rearwardly extending leg to the ground; and
6. Secondary power and control means adapted to operate the stabilizer means and excavating assembly independently.

Though, when the apparatus is self-propelled, separate motive and secondary power means may be used, it will ordinarily be preferred to use a single unit, such as a gasoline engine, as a

source for both motive power and power to operate the stabilizer and backhoe excavating assembly. This is, of course, well known and can be accomplished by using a gasoline-fuelled internal combustion engine having a secondary power takeoff. When the transverse leg of the apparatus is supported by attachment to a prime mover, provision for motive power is unnecessary. Likewise, the prime mover is normally the source of secondary power as well by means of a secondary power takeoff. Conventional agricultural tractors are, of course, normally equipped with such power takeoffs and are useful as the prime mover for the invention, as are small trucks and the like.

The most reliable and economical power for operation of the device (secondary power means) is hydraulic power. Thus, the source of power for the stabilizer and excavator will usually be a hydraulic pump activated by the primary power means. Each of the three above-named components is operably connected by means of a system of hydraulic cylinders each connected to two hoses via independently operating valve controls connected in fluid flow relationship to the intake and output side of an hydraulic pump. This means of actuating and controlling devices of this type is, of course, well known and widely used.

The invention can be better understood by reference to the drawings comprised of six figures, as follows:

FIG. 1: Overhead view of the invention positioned for making a series of parallel excavations;

FIG. 2: Rear elevation of the invention;

FIG. 3: Side elevation of the invention from behind the rearwardly extending leg;

FIG. 4: Side elevation of the excavator carriage and carriage support (Section 4—4, from FIG. 2); and

FIG. 5: An overhead view of a preferred embodiment of the invention.

FIG. 6: An overhead view of the invention in which the front transverse leg is supported by attachment to the prime mover.

Referring now to FIG. 1, the invention is shown as having a rigid frame or chassis comprising a front transverse leg **1** and a rearwardly extending leg **3**, the frame being mounted on three wheel assemblies **5, 7, 9**. The front wheel assemblies **5, 7** both of which are dual wheel assemblies are mounted by means of axle supports **11, 13** on an axle **15** along the transverse leg **1** and are powered by primary power means, here a gasoline engine **17**, through transmission **19** the rear dual wheel assembly **9** is steered by means of steering assembly **21**, which is operated by control assembly **23** which is also used to regulate the direction and amount of power transmitted to the front wheels.

Located along and atop the rearwardly extending leg of the frame **3** is carriage support **25** on which is mounted a movable carriage **27**. The carriage **27** is movably positioned along the support **25** by means of hydraulic power means **29** including a cylinder with piston and rod to actuate the carriage support. On the movable carriage are mounted an excavator assembly **31** extending for operation within the angle of the carriage formed by the legs of the frame and on the opposite side an operator's seat **33** from which the excavator assembly is operated by means of hydraulic value control **35** also affixed to the carriage.

The excavator **31** is here a conventional hydraulically powered backhoe of the type used for trenching and other excavating, comprising a bucket **37**, segmented boom **39** pivotably connected in both the horizontal and vertical planes to a support **41** affixed to the movable carriage **27**. The bucket is actuated by hydraulic power means **43**. Lift, swing and crowd of the boom are also controlled respectively by hydraulic power means **45** and **47** and by another located beneath the boom and therefore not visible in this view. Each of the four movements of the backhoe —bucket, lift, crowd and swing—is controlled by means of a set of hydraulic valve controls **35** located on the opposite side of the movable carriage **27**.

Along and below the rearward leg **3** is located an extendible and retractable stabilizer pad **49**, here shown in phantom drawing, actuated by hydraulic power means **51** and **53** by which the bending and twisting movement of the excavator is countered during operation of the backhoe. All hydraulic power means are operably connected to secondary power means **55**, i.e. a hydraulic power takeoff, powered by the primary power means **17**.

In the view of FIG. 1, the invention is shown to be positioned at the second of four excavation sites, wherein the space is extremely limited by the presence of obstructions on both sides of the invention such as would occur in a typical application in a cementery.

Turning now to FIG. 2 which is a rear elevation drawing of the invention looking forwardly to the transverse leg **1** and along the rearwardly extending leg **3**. In this figure, the carriage support **25**, the backhoe assembly and ancillary equipment are seen more clearly. In particular, the backhoe assembly is shown to be comprised of a bucket **37** rotatable in a vertical plane by the action of hydraulic power means **43**, the bucket being mounted on segmented boom **39**. Elevation of the boom **39** is controlled by actuating hydraulic pressure means **57** while the angle between the segments (crowd) is adjusted by hydraulic power means **45**. The boom, along with hydraulic power means **45** and **57**, is linked to a vertical swing post **59**. Thus, the swing of the excavator assembly is adjusted by actuating hydraulic power means **47**, mounted on the vertical swing post support **41**, which swings the backhoe assembly by action upon linkage **61** between the swing post support **41** and the swing post **59**. The carriage **27**, is comprised of a rigid supporting frame movably mounted onto the carriage support **25** by means of two sets of two flanged wheels **63**, each of which tracks respectively an upper and lower round tubular horizontal carriage frame member **65** extending between two vertical frame members **67**.

The backhoe assembly is positioned along the track or tubular frame members **65** by operation of hydraulic power means **29**. An operator's seat **33** is also affixed to the carriage **25** by means of a rigid support **69**, thus maintaining the operator in comfortable operating position with respect to the hydraulic control valves **35** on the carriage.

FIG. 3 is an elevation view of the invention from behind frame member **3** looking in a direction parallel to the transverse frame member **1**, now shown in this view. In particular, structural details of the stabilizer assembly are shown. The stabilizer assembly is comprised of hydraulic power means **51** and **53** affixed to the underside of frame **1**. On the lower end of the hydraulic power means, is affixed stabilizer pad means **49**. By actuating the hydraulic power means, the stabilizer pad means **49** is retracted to above ground level or extended to ground level to effect stabilization of the invention during excavating operations, as described hereinabove with respect to FIG. 1.

Also detailed in this figure are the excavator carriage **27** and carriage support **25**, which as shown here contains two rigid upright frame members **67** and two tubular cross members **65**, the whole assembly being affixed in a vertical position atop and along the rearward leg **3**. The carriage support, comprising two sets of flanged wheels **63** mounted on a rigid frame **71** in such manner that they track the tubular frame members **65** of the carriage support **25**. The entire carriage is shuttled and positioned along the support by the action of hydraulic power means **29**.

FIG. 4 is a more detailed elevation view of the carriage and carriage support looking along the section **4—4** toward the rearwardly extending leg **3**. The carriage support comprising two vertical frame members **67** and two horizontal frame members **65** is rigidly affixed along rearwardly extending leg **3**. To the back side and to the front side of the carriage support are juxtaposed the carriage frame members **75** and **73** respectively. Extending between the carriage frame members are two sets of two flanged wheels **63** placed so as to track the upper and lower tubular frame members **65** of the carriage support. The carriage, to which the excavator assembly is mounted, is therefore rollably moved and positioned along the

carriage support **25** by operation of the hydraulic power means **29** which is connected to the carriage by means of linkage **77** and affixed to the frame by means of pivot linkage **79**.

FIG. **5** is an overhead view of the invention which differs from the device of FIG. **1** in two important respects:
(a) the support means **25** affixed along the rearwardly extending leg is adapted to receive directly a secondary power actuated excavator assembly to extend operably into the angle formed by the legs of the frame; (b) a secondary power actuated stabilizer means **91** is mounted below and toward the free end of the front transverse leg and extendible to the ground.

FIG. **6** is an overhead view of the invention in which the front transverse leg **1** is attached directly by means of support means **80** and **81** to the rear of a tractor prime mover, without the use of supporting wheels under the front transverse leg as in the previous drawings. In this drawing, it is observed that the excavator support **25** is mounted on the rearwardly extending leg **3** to permit operation of the excavator assembly **31** not only in the angle formed by the legs, but also toward the rear and to the opposite side of the rearwardly extending leg **3**, thereby giving even greater flexibility and versatility of operations. As shown, the turning action of the excavator assembly is powered twin hydraulic cylinders **84** and **85** which activate a rack and pinion assembly **86** to rotate the excavator boom **39**.

Also mounted on the transverse leg are retractable auxiliary stabilizers **82** and **83** which are likewise extendible to the ground to effect still further stabilization of the device while in operation. These auxiliary stabilizers may be powered in the manner of stabilizer **49** or they may be manually operated, e.g. as with a screw jack mechanism.

From the foregoing it is apparent that operation of the excavating apparatus within the angle of the L-shaped frame, especially when combined with the shuttling action of the carriage, provides a maximum of excavating flexibility within a minimum amount of space. Moreover, a parallel-sided excavation, such as a grave, can be dug with a simple uniplanar scooping action, which does not require any correlation with the swinging action of the backhoe. Thus less operators' skill and less time are needed to dig a neat, straight-sided excavation. Within the limits of the length of the shuttle path plus the bucket width, a parallel-sided hole or ditch may be dug without repositioning the invention, whereas conventional tractor-mounted backhoes would require several repositionings to accomplish the same thing.

A further advantage of the invention is that, in digging a series of parallel excavations, the device may be moved from the first site to the second and to the third etc. without danger of caving in the sides of the just completed excavation. By virtue of the L-shaped configuration of the frame, the wheels are, of course, also located well back from the rim of the excavation, yet a firm base for resisting the movements and stresses of excavation is provided.

It has been found that the employment of at least one additional stabilizer means mounted below the front transverse leg greatly reduces the turning moments created by heavy excavation operations. Such stabilizer may be located either toward the free end or toward the angle end of the front transverse leg, the former being preferred when only one such auxiliary stabilizer is used. It is still further preferred to employ such stabilizers in both these positions. When either or both of these are used in conjunction with the rearward leg stabilizer, undesirable tilting of the device is virtually eliminated, thus increasing the effective power transmittable to the bucket.

Backhoe assemblies suitable for use in conjunction with the invention are available in the U.S. from a number of equipment manufacturers in a wide range of sizes as to capacity, lift, reach, digging depth, loading height and the like. They are normally designed for quick hookup and detachment, though, of course, permanent or semipermanent mounting may be used.

The backhoe assembly itself may also have a set of two hydraulically operated stabilizer feet or pads which are raised or lowered to straddle the excavation and, in conjunction with the stabilizer pad on the invention, provide stabilization of the unit both behind and alongside the excavation.

It will be appreciated that while the use of an L-shaped frame is preferred to obtain maximum stability with minimum dimensions, it will be apparent that other substantially L-shaped and other configurations may be used, e.g. a 90° arc, of a circle or ellipse, T-shaped configurations in which the rearwardly extending leg is offset from the center of the cross and similar configurations in which the rearwardly extending leg is substantially off-center with respect to the transverse leg.

Though only a limited number of embodiments of the present invention have been specifically disclosed, it will be apparent that many variations may be made therein, all within the spirit of the invention as defined herein

What is claimed is:

1. An apparatus for mounting and operating excavating devices comprising:
1. A rigid supporting frame having
   a. a front transverse leg and
   b. an off-center rearwardly extending leg, said frame being mounted on
2. Support means for the front transverse leg and for the rearwardly extending leg,
3. Excavator support means affixed on the rearwardly extending leg adapted to receive a secondary power-actuated excavator assembly to extend operably into the angle formed by the legs of the supporting frame,
4. Retractable secondary power-actuated stabilizer means extendable from the rearwardly extending leg to the ground, and
5. Secondary power and control means adapted to operate the stabilizer means.

2. The apparatus of claim **1** in which a secondary power-actuated excavator assembly is affixed to the excavator support means and is operably extendible into the angle formed by the legs of the frame and the control means is adapted to operate both the stabilizer means and the excavator assembly independently.

3. The apparatus of claim **1** in which the support means for the rearwardly extending leg comprises a wheel assembly mounted toward and supporting the free end of the rearwardly extending leg.

4. The apparatus of claim **2** in which the support means for the front transverse leg comprises hitching means adapted to hitch the front transverse leg parallel to the transverse axis and to the rear of a prime mover in such manner that the apparatus is substantially restricted from independent motion in those planes of rotation perpendicular to the longitudinal and vertical axes of the prime mover.

5. The apparatus of claim **4** in which an auxiliary retractable stabilizer means extendible to the ground is located on the front transverse leg toward the angle formed by the legs of the frame.

6. The apparatus of claim **4** in which the secondary power is provided from the prime mover.

7. The apparatus of claim **2** in which the support means for the front transverse leg comprises two wheel assemblies mounted at opposite ends of an axle along the transverse leg and the wheel assembly on the rearwardly extending leg is operably connected to steering means.

8. The apparatus of claim **7** in which primary power means is mounted on the frame and adapted to transmit motive power to the front wheel assemblies.

9. The apparatus of claim **8** in which the primary power means is also adapted to operate secondary power means.

10. The apparatus of claim **7** in which the excavator assembly is affixed to the excavator support by means of a secondary power-actuated carriage mounted on the support in such a manner that it is capable of horizontal shuttling motion along the excavator support and the secondary power and control means is adapted to operate the stabilizer means, carriage and excavator assembly independently.

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