

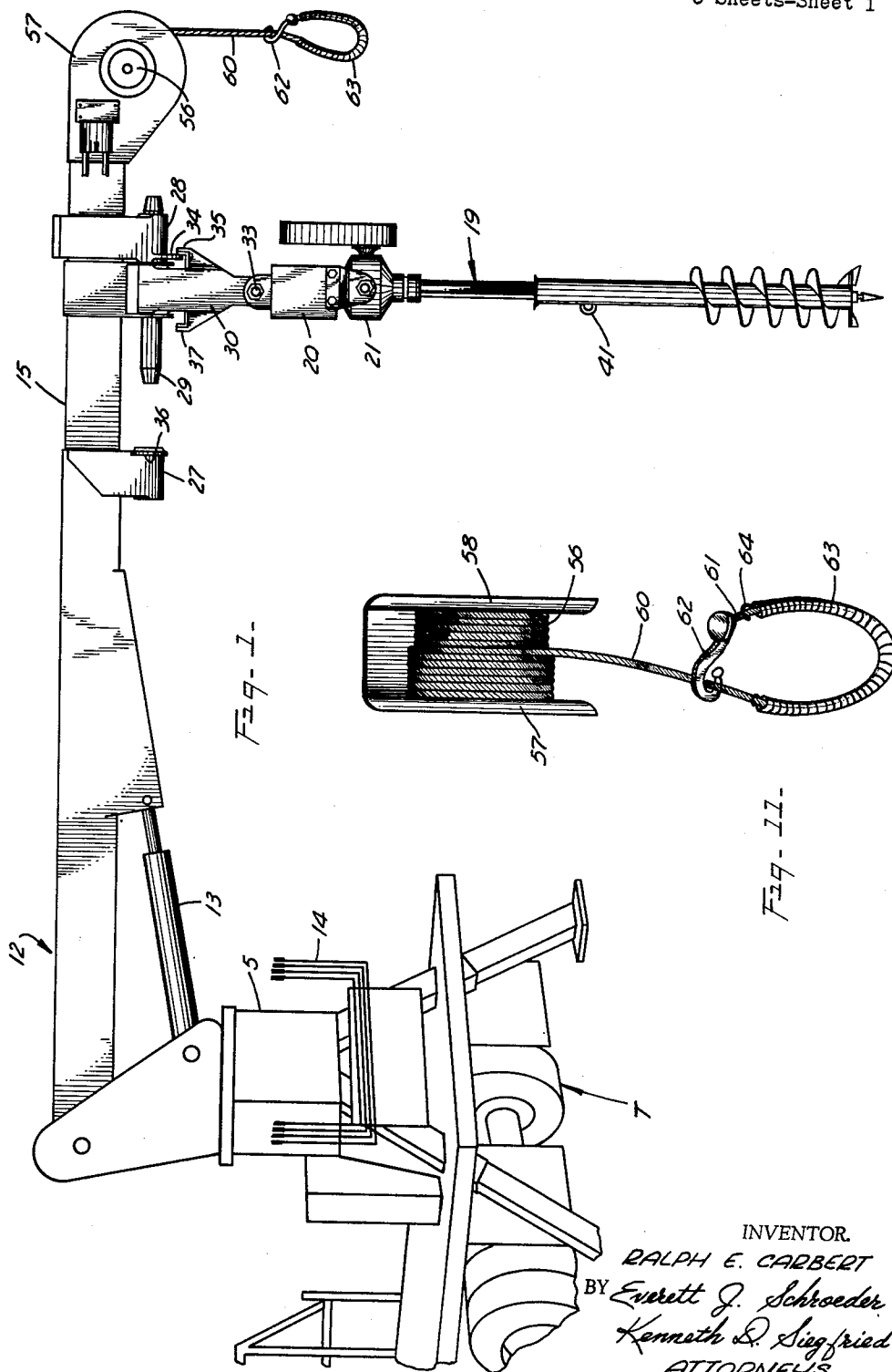
Jan. 12, 1965

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EARTH-BORING APPARATUS

3,165,157

Filed Nov. 1, 1961

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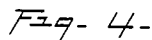
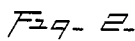


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EARTH-BORING APPARATUS

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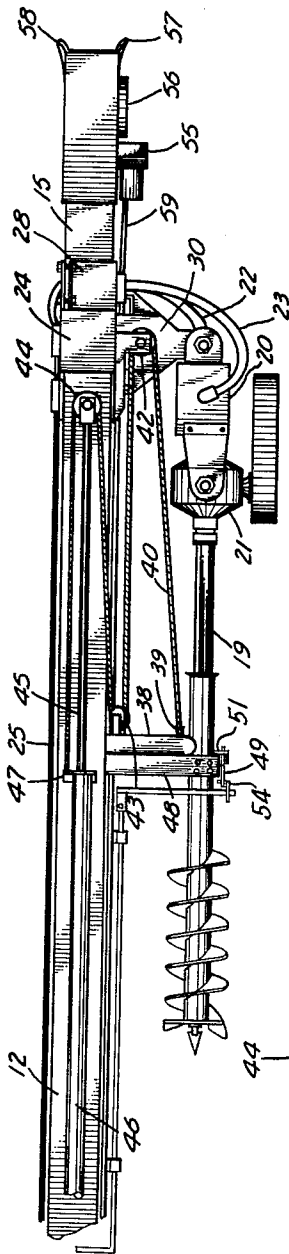


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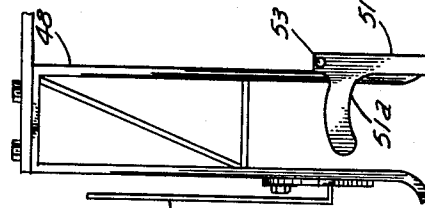
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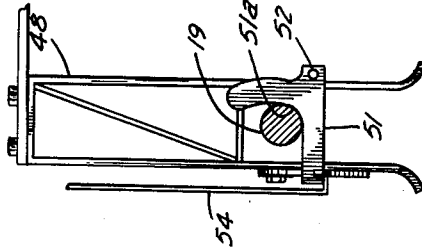
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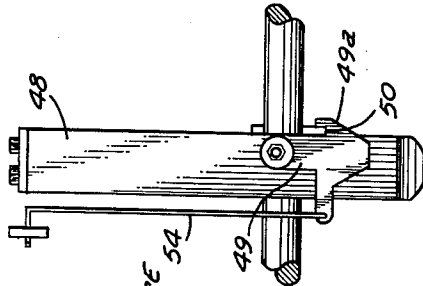
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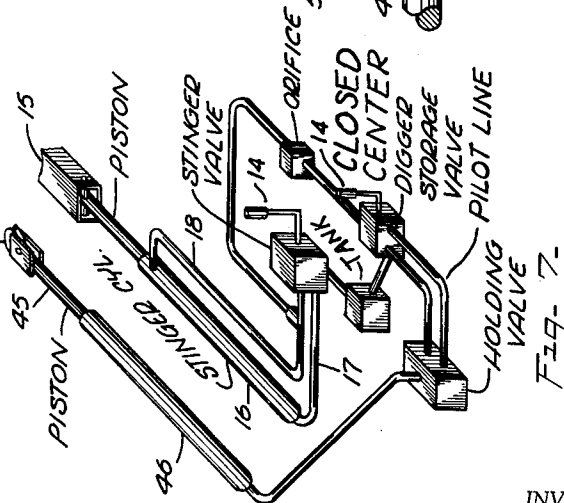


Fig. 7.

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EARTH-BORING APPARATUS

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12 Claims. (Cl. 173-28)

This invention relates to utility apparatus. More particularly, it relates to utility-type diggers mounted on booms which in turn are carried by a truck body and which generally have an extendible portion conventionally known as a stinger which is utilized in lifting and setting poles and the like.

Various means have been devised for mounting diggers in suspended relation upon truck mounted booms but none have proved completely satisfactory. This is true because it is necessary to store the boom and digger simultaneously over the body of the truck while the latter is enroute to and from different locations of operation. Since such diggers in the utility field are of substantial diameter, it is highly desirable to store the digger beside the boom rather than beneath it for under the latter arrangement, excessive vertical space is required. It has been the experience of the trade that lateral mountings of the digger upon the boom are unsatisfactory because it is not possible to apply sufficient pressure upon the digger via the boom because of the resulting twisting effect upon the boom. Since it frequently occurs that it is desirable to apply substantial pressure to the digger in order to cause it to progress downwardly in areas of difficult digging operations, there has heretofore been a conflict of desirable functions which has remained unsolved. This invention is directed toward overcoming this problem in such a manner as to provide both functions in the manner and to the extent desired without undue cost or delay.

Another problem which has vexed the utility trade with respect to its pole setting apparatus is the fact that whenever adjustment need be made of the stinger relative to the boom while supporting a pole during a pole setting operation, then simultaneous adjustment of the winch and cable which supports the pole is required. Thus, whenever it is necessary to extend or retract the stinger which is supporting a pole in upright position, such extension or retraction causes the effective length of the cable to be either decreased or increased with the result that if the pole has been supported at the desired elevation, it is necessary that an adjustment be made to the winch simultaneous with the adjustment to the stinger and to the exact amount to correspond with the change which such movement of the stinger creates in the effective length of the cable. One feature of the invention disclosed herein overcomes this requirement and consequently provides a much more desirable and satisfactory pole handling equipment.

It is a general object of the invention to provide a novel and improved utility-type apparatus of simple and inexpensive construction and operation.

A more specific object is to provide a novel and improved utility-type apparatus capable of applying heavy pressure upon the digger and of storing the same quickly and easily in small vertical compass.

A still more specific object is to provide a novel and improved utility-type apparatus which has a unique mounting for the digger which enables it to have great downward pressure applied thereto by the vehicle supported boom which carries the same and yet is capable of automatically swinging to a lateral out-of-way location when moved to storage position whereby the boom and digger may be stored over the body of the vehicle without requiring excessive vertical clearance and in small compass.

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Another object is to provide a novel and improved utility-type apparatus having a digger capable of being supported by the boom and stinger either simultaneously or in the alternative and capable of being moved longitudinally of the boom with the stinger.

Another object is to provide a novel and improved utility-type apparatus capable of extending and retracting its stinger irrespective whether the digger is supported on the stinger or not and capable of extending the digger with the stinger to permit its usage at remote locations relative to the vehicle supporting the boom.

Another object is to provide a novel and improved utility-type apparatus which automatically locks the digger to the stinger when the former is lowered to depending position from the boom while the stinger is retracted and which automatically locks said digger to said boom when raised to stored position.

Another object is to provide a novel and improved utility-type device the digger of which when lowered to operative position is disposed directly below the boom and stinger and which, when raised to inoperative or stored position, is projected laterally of said boom and in the same horizontal plane and has its mounting structure also extending laterally of said boom.

Another object is to provide a novel and improved utility-type apparatus constructed and arranged to make it impossible to raise the digger to stored position without having first retracted the stinger portion of the boom.

Another object is to provide a novel and improved utility-type apparatus constructed and arranged to utilize the by-passed hydraulic fluid from the cylinder which causes the stinger to retract for the purposes of raising the digger to inoperative or stored position.

Another object is to provide a novel and improved utility apparatus having automatic mechanical locking means for locking the digger in stored position upon the boom.

Another object is to provide a novel and improved pole handling apparatus constructed and arranged to obviate the necessity of adjusting the winch and cable holding a pole in supported relation upon a stinger when it becomes necessary to adjust the stinger relative to the boom.

Another object is to provide a novel and improved utility apparatus constructed and arranged to greatly facilitate and improve the handling of poles with the stinger of such apparatus.

Another object is to provide a novel and improved utility apparatus having novel and improved mechanical means for facilitating release of the hook member at the end of the cable supported by the stinger.

Another object is to provide novel and improved utility apparatus constructed and arranged to provide for the winch being mounted and driven at the outer end portion of the stinger to greatly facilitate handling of poles and the like thereby.

Another object is to provide novel and improved utility apparatus utilizing the outer end portions of the stinger in combination with the winch and cable in a novel and effective manner to more positively and accurately manipulate the pole being held thereby and facilitate setting or movement of the same to desired positions.

Another object is to provide novel and improved utility apparatus of novel construction which greatly facilitates the pulling of poles and also, the positioning and holding of poles in desired position while earth is being tamped around the base of the pole below ground level.

These and other objects and advantages of this invention will more fully appear from the following description, made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a side elevational view of utility apparatus embodying the invention disclosed herein and showing the digger carried by the stinger in extended position with the digger storing apparatus and hydraulic lines omitted.

FIG. 2 is a fragmentary side elevational view of the same showing the digger supported by the boom in operative position and by the stinger.

FIG. 3 is a fragmentary side elevational view taken from the opposite side of that shown in FIG. 2 and showing the details of the mounting of the digger upon the boom and the stinger with the digger shown in operative position and supported by both the stinger and the boom, all on an enlarged scale.

FIG. 4 is a vertical sectional view taken through the boom and stinger along approximately line 4—4 of FIG. 3 and showing the locking means between the stinger and digger in elevation.

FIG. 5 is a vertical sectional view taken through the boom and stinger along approximately line 5—5 of FIG. 3 and showing the locking means between the boom and digger in elevation.

FIG. 6 is a partial plan view of the boom and stinger with the digger shown in stored position.

FIG. 7 is a schematic view of the hydraulic system arrangement utilized to operate the stinger and move the digger to stored position.

FIG. 8 is a side elevational view on an enlarged scale of the storage bracket utilized to lock the digger in inoperative position.

FIG. 9 is a vertical sectional view through the digger when the latter is in stored position and showing the locking bracket in end elevational while supporting the digger.

FIG. 10 is an end elevational view of the digger holding bracket when the latter is in unlocked position and the digger is in operative position.

FIG. 11 is an end elevational view of the stinger and the winch mounted thereon with the cable and quick-hook and its associated means for disengaging the same.

In the embodiment shown in the drawings there is illustrated a vehicle such as a truck T which carries a boom support or turntable S and the boom indicated generally by the numeral 12. A hydraulic cylinder 13 is utilized to raise or lower the boom and a plurality of control levers indicated generally by the numeral 14 are utilized to control the flow of hydraulic fluid to the desired cylinders as will be more fully explained hereinafter. The boom 12 includes an extendible member 15, commonly referred to in the trade as a "stinger." Wherever hereinafter the term "stinger" is utilized it is intended to include any member which is extendible and retractable relative to the boom and carried thereby. The stinger 15 as shown, is extended and retracted by means of a double acting hydraulic cylinder shown schematically in FIG. 7 and identified by the numeral 16. This cylinder 16 is supplied by lines 17 and 18 and the by-pass from this system is connected to the cylinder which functions to move the digger from operative to inoperative or stored position.

Mounted upon the boom 12 and the stinger 15 is a hydraulically operated digger indicated generally by the numeral 19. This digger 19 is driven by a hydraulic motor 20 and a gear system carried by the transmission 21. Hydraulic lines 22 and 23 supply the necessary hydraulic fluid to the digger from the common source of hydraulic fluid (not shown). These lines 22 and 23 are mounted upon a sliding hollow rectangular mounting bracket 24 which slidably receives the stinger 15 and always moves with the digger and are supplied by telescoping hydraulic lines 25 carried alongside the boom as best shown in FIG. 6.

The digger 19 is supported by rigid mounting structure identified generally by the numeral 26. This mounting structure 26 includes a sleeve member 27 fixedly mounted upon the boom 12 by means of support brackets 27a and 27b welded thereto with the sleeve in depending relation

immediately therebelow and at the portion thereof adjacent where the stinger 15 commences. A similar sleeve member 28 is fixedly mounted on the stinger 15 on the opposite side of the bracket 24 which is connected to the digger and moves therewith. The two sleeves 27 and 28 are coaxial with their bores extending longitudinally of the stinger and boom. Each of the sleeves 27 and 28 are formed of hardened steel and are adapted to receive therein in a tight fit an elongated hollow pivot shaft or tube 29 which is received therewithin and extends longitudinally of the boom and stinger. This pivot shaft or tube 29 is also formed of hardened steel and is of sufficient strength to support the digger 19 by either of its end portions alone when the latter is received within one of the sleeves 27 or 28. The bracket 24 slidably surrounds the stinger 15 and, as mentioned previously, carries the hydraulic lines for the digger with that member.

Depending from the pivot shaft 29 is an elongated pivot arm 30. This pivot arm carries a pair of pivot ears 31 and 32 which support the digger 19. A bolt 33 extends through the lower end portion of these pivot ears with its axis extending normal to the pivot tube or shaft 29. The pivot arm 30 is fixedly connected with the pivot shaft or tube 29 so as to rotate therewith about the longitudinal axis of the tube 29.

Mounted on the sleeve 28 which is carried by the stinger 15 is a depending cam or connector element 34 which extends directly downwardly from the sleeve. This depending cam is a lock element which cooperates with a locking or connecting ear 35 that is carried at the forward side of the pivot arm 30, as best shown in FIG. 3. As shown, the locking ear 35 and the cam 34 are spaced slightly longitudinally of the stinger and they serve to releasably connect or lock and unlock the stinger to the digger 19 when the latter is in operative position as shown in FIG. 1.

Fixedly mounted on the sleeve 27 which is carried by the boom 12 and extending laterally thereof is a second cam or connector element 36 which cooperates with a locking or connecting ear 37 carried by the pivot arm 30 on the side opposite to that carrying the locking ear 35. As best shown in FIG. 3, each of the locking ears 35 and 37 extend upwardly in a position to cooperate with the cams 34 and 36 respectively, depending upon the position of the digger 19. It will be noted by reference to FIG. 3 that the locking ear 37 and the cam 36 are spaced slightly longitudinally of the boom and releasably connect the digger and the boom. It will also be noted that the ear 35 interlocks with the cam 34 when the digger is in operative position while the ear 37 does not interlock with the cam 36 until it is raised to a position beyond that at which the digger is normally operated. When the boom has been moved to stored position the ear 35 is unlocked relative to the cam 34 while the ear 37 is locked relative to the cam 36.

Mounted on the boom 12 and extending laterally therefrom is a storing arm 38. This storing arm 38 carries a sheave 39 through which a cable 40 passes. The outer end of the cable 40 is connected to the medial portions of the digger 19 when the digger is to be moved to stored position by means of a ring 41 (shown in FIG. 1) which is carried for that purpose. As best shown in FIG. 6 a cable 40 passes from the sheave 39 around a second sheave 42 which is mounted upon the boom 12 at one side thereof adjacent the area where the stinger commences. The cable 40 then extends rearwardly around a third sheave 43 which is also mounted upon the boom adjacent the storing arm 38 and thence forwardly again around the sheave 44 which is carried at the outer end of the piston rod 45 of the hydraulic cylinder 46. The end of the cable 40 is anchored at 47 to the hydraulic cylinder. It will be noted that the cylinder 46 is mounted upon the upper surface of the boom and the piston rod 45 thereof moves forwardly and rearwardly longitudinally of the boom to cause the end

of the cable 40 to be drawn upwardly toward the sheave 39 and its supporting mounting arm or released to permit the digger 19 to return to operative depending position.

Mounted on the boom 12 just rearwardly of the arm 38 is an auger storage bracket 48. This storage bracket 48 extends laterally of the boom in the same direction as the arm 38 and is generally U-shaped in cross-section as best shown in FIGS. 9 and 10. Pivotaly mounted upon the bracket 48 adjacent its lower end is a detent member 49 which when in locking position hangs vertically as shown in FIG. 8 so that the detent 50 thereof receives therein, and engages in locking relation, a generally L-shaped latch element 51. This latch element 51 is pivotally mounted adjacent its apex as at 52 upon the opposite side of the storage bracket 48 and is adapted to hang in depending position as shown in FIG. 10 when not engaged and held in locking position by the detent 50 as shown in FIG. 9. The axis of pivot of the latching member 51 is indicated by the numeral 53. A trip rod 54 is connected to the detent member to cause it to release the latch element 51 when the same is desired. It will be noted that the detent member has a camming surface 49a which is constructed and arranged to be engaged by the latch member 51 to cam the detent member 49 to an out-of-way position as the latch element 51 moves to a position where it may be engaged and locked by the detent member. It will also be noted that the latch element 51 has a cam surface 51a which is constructed and arranged to be engaged by the shaft of the digger 19 as it is raised upwardly by the cable 40. It will also be noted that the lower end portions of the bracket 48 are flared outwardly so as to direct the digger 19 as it is raised into the confines of the bracket.

Mounted on the outer end of the stinger 15 is a hydraulic motor 55 which drives a winch 56 rotatably mounted between a pair of outwardly flaring bracket members 57 and 58 that are carried by the outer end portions of the winch. As best seen in FIG. 6 these brackets, in addition to flaring outwardly laterally, also extend forwardly beyond the winch itself for a purpose to be hereinafter explained. The hydraulic motor is fed by a telescoping hydraulic line 59 which is also connected to the source of hydraulic fluid (not shown). The cable 60 is preferably of the steel wire type and has a loop member 61 at its outer end which surrounds and engages a hook member 62 commonly referred to in the trade as a "quick-hook." Encircling the outer end portion of the cable 60 is a stiff, elongated, coiled spring 63 having a hook member 64 engaging the loop 61 at the outer end of the cable 60. It will be noted that the diameter of the coiled spring 63 is somewhat larger than the diameter of the cable 60 and that it is prevented from rotating about the cable 60 by the engagement of the loops 61 by the hook 64 of the spring.

Operation

The utility apparatus described above is very flexible and adaptable for use in the utility field. One of the biggest advantages of this device is that the digger 19 may be quickly and easily stored in a completely out-of-way position as shown in FIG. 6. This is accomplished in the following manner commencing with the digger 19 in depending operative position as shown in FIG. 3 with the stinger retracted. When the stinger 15 is fully retracted the by-pass of hydraulic fluid from the stinger cylinder 16 is made available through the use of one of the levers 14 and its associated valves to introduce fluid into the cylinder 46 to cause the piston rod 45 and the pulley 44 to move forwardly or outwardly. Before so activating the cylinder 46 the free end of the cable 40 is secured to the ring 41 on the digger 19 so that extension of the piston rod 45 will cause the outer end portion of the cable 40 to be drawn upwardly toward and through the sheave 39. Since the sheave 39 is positioned laterally of the boom the digger will be drawn not only up-

wardly but also somewhat outwardly or laterally of the boom. As the digger 19 is drawn upwardly it pivots about the axis of the bolt 33 relative to the pivot arm 30. This relative pivotal movement causes the members which are pivoting relative to each other to lock insofar as lateral movement of the digger is concerned and consequently the pivot arm 30 also commences to pivot around the pivot tube 29 as the digger is drawn upwardly in closer proximity to the sheave 39 and the storing arm 38. By the time the digger 19 has been brought upwardly to a position where it is in the same horizontal plane as the boom 12, the pivot arm 30 will have pivoted about the pivot tube 29 to a laterally and horizontally extending position relative to the boom so that the digger and its mounting structure will extend in the same general horizontal plane as that occupied by the stinger and boom. Thus it will be seen that thereafter the boom 12 may be readily swung about its vertical pivot to an out-of-way storing position overhanging the cab of the vehicle T and the vertical storage compass of the combined boom, digger and stinger will be reduced to an absolute minimum in that the digger and its mounting structure is disposed completely laterally of the boom and stinger rather than therebeneath as has heretofore been the practice.

As the digger 19 is raised upwardly and swung outwardly as described above, it approaches the open storage bracket 48. The latch element 51 will be found in the position shown in FIG. 10. As the shaft of the digger 19 enters the bracket 48 it engages the cam surface 51a of the latch element 51, causing the latch element to pivot about the axis 53 to the position shown in FIG. 9. As the latch element pivots toward the position shown in FIG. 9, the outer end portion thereof engages the camming surface 49a of the detent 49, causing it to pivot about its pivotal mounting rearwardly to an out-of-way position until the latch element 51 can move to an elevation thereabove at which point the detent member 49 will return to the vertical position shown in FIG. 8. As soon as the detent assumes the position shown in FIGS. 8 and 9 the latch element 51 will drop into the detent 50 and lock the digger 19 within the bracket 48 as best shown in FIG. 9 at which point the digger may be again lowered to rest upon the latch element 51 and hold the digger in locked stored position as shown in FIG. 6.

When it is desired to lower the digger to operative position the boom 12 is first swung to an outwardly extending position as shown in FIG. 1 and the fluid is caused to enter the cylinder 46 by by-passing cylinder 16 so as to take the weight of the digger off the latch elements 51. The trip member 54 is then activated to cause the detent member 49 to pivot to an out-of-way unlocking position, permitting the latch element to drop to the position shown in FIG. 10. The fluid is then permitted to escape from the digger storage cylinder by movement of the stinger valve and digger storage valve levers 14. This introduces fluid into the pilot line of the holding valve to open the ball check, allowing the fluid to return from the cylinder 46 through the holding valve to the tank and permit the weight of the digger to force the piston 45 inwardly and thereby lengthen the effective length of the cable 40 to permit the digger to be lowered. As the digger 19 is lowered, the pivot arm 30 will pivot about the pivot tube 29 and the digger itself will pivot about the axis of the bolt 33 until the digger hangs in suspended position as shown in FIG. 3. It will be noted that in this position the locking ear 35 is in locking relation to the depending cam 34.

It will be noted that when the digger 19 is in depending position as shown in FIGS. 1 and 3 the locking ear 37 is in unlocked position relative to the laterally extending cam 36 so that the stinger 15 can be moved outwardly from the boom 12, carrying the digger 19 with it to any desired position within the length of the stinger and, of course, it may be swung sidewise with the boom and

stinger. This provides a definite advantage in that the positioning of the stinger is made highly flexible so that the entire device is more maneuverable. One the stinger has been moved to the desired position, a great deal of pressure may be applied to the upper end of the digger 19 by allowing the full weight of the stinger and boom to rest thereupon. It will be noted that when this is done there is no lateral twisting upon the digger for the full pressure of the stinger and boom is applied from directly overhead. If necessary the cable 60 may be applied to a tree or other fixed object or to a heavy weight and additional pressure may thereupon be applied to the digger 19 by operating the winch 56 so that tension is applied to the cable 60. In this manner almost any desired pressure may be applied to the digger 19 during the digger operation without applying any twisting effect to the structure mounting the same.

It will be noted that when the digger 19 is moved to an outward position with the stinger 15, it is supported solely by means of the sleeve 28 and the inner end of the pivot tube 29 is withdrawn from the sleeve 27 of the boom. Of course, if it is desired to dig or drill a hole immediately below the position of the digger when the stinger 15 is fully retracted to the position shown in FIG. 3, this can be accomplished in the same manner and with the same advantages. It will be noted, however, that in this position the pivot tube 29 is supported by each of the sleeves 27 and 28 so that the weight thereof and its mounting is supported by the combined actions of the sleeves 27 and 28.

The mounting of the winch 56 upon the outer end portion of the stinger 15 also provides distinct advantages in the operation of this apparatus. When it is desired to erect or pull a pole or position it in some other manner, the winch is operated through control of the hydraulic motor 55 to cause the cable 60 to play out and the outer end portion of the cable is passed around the pole and the quick-hook 62 is hooked onto the cable in the manner best shown in FIG. 11. When the winch 56 is operated in the opposite direction the cable will be drawn taut around the pole in the conventional manner. Under such conditions the quick-hook 62 tends to bite into the wood or the pole. Cables of the conventional type also tend to cut into the pole with the result that it is often times extremely difficult to disengage the quick-hook even though the cable is relaxed by operation of the winch. In the apparatus shown herein, however, the elongated stiff coil spring 63 tends to straighten out as soon as the tension is released on the cable 60 with the result that the loop around the pole will be loosened because the coil 63 will draw additional cable length through the quick-hook 62. This loosens the loop of cable around the pole, permitting the loop to be lowered for disengagement from the pole or for rotation of the pole within the loop. The movement of the cable and the quick-hook by the spring 63 eliminates the disadvantages previously experienced as a result of the hook and cable biting into the wood. It will be noted that the hook element 64 of the coiled spring 63 extends through the loop 61 of the cable 60 so that the spring 63 cannot roll around the cable. This prevents the pole from slipping out of the cable when an attempt is made to lift the same as a result of relative rolling between the spring 63 and the cable 60. Thus the pole is held in positively gripped relation by the spring 63, the cable 60 and the hook 62.

Handling of the pole is further facilitated by the winch 56 being disposed at the outer end of the stinger 15 in that the pole can be brought up into erect position and drawn tightly against the end of the winch with the pole itself being positioned between the outwardly flared flanges 57 and 58. When the pole is brought to an erect position and into the area between the two flanges 57 and 58 with the cable 60 drawn taut, the pole can be manipulated as desired without any further ad-

justment of the cable. Thus, the stinger 15 can be moved forwardly or rearwardly to change the attitude of the pole in a vertical plane extending parallel to the boom and stinger and the stinger and boom can be swung laterally to change the attitude of the pole in a vertical plane extending at substantially right angles to the boom and stinger. From this it will be readily appreciated that the attitude of the pole can be altered and adjusted as desired until at optimum or truly vertical disposition within the hole and can be held in this position while the earth is being tamped around the pole. It will be noted that this change in position and attitude of the pole can be accomplished without any associated adjustment of the winch 56 and cable 60 as would be required by apparatus heretofore known. Thus it is now possible to set a pole in a truly vertical position and without the need of a plurality of pike poles at each side of the pole to maintain the pole in such vertical position during tamping of earth around the pole, below ground level.

It will also be noted that through the use of the winch 56 and cable 60 at the outer end of the stinger 15, the pulling of a pole is greatly facilitated for the cable 60 can be attached by means of the quick-hook 62 at the desired elevations opposite the end of the stinger 15 and the cable 60 is drawn taut so that the pole will extend between the flanges 57 and 58. Once this has been accomplished the pole can readily be rocked back and forth by extending and retracting the stinger 15 and can be rocked sideways by swinging the boom 12 laterally back and forth until the pole has been effectively loosened at which time it can be quickly and easily pulled by elevating the boom 12 and the stinger 15.

In the handling of utility poles it is sometimes necessary to turn the pole about its longitudinal axis as much as 180 degrees. This presents a problem with devices heretofore known for the cable and hook will refuse to loosen when the cable is played out. This requires a delay in that it is necessary to utilize a separate device to cause the cable to loosen and expends time and effort. With the apparatus shown herein this is readily overcome for the spring 63 causes the quick-hook 62 to loosen almost immediately and the pole can then be turned about its longitudinal axis to the desired position whereupon the cable may again be tightened by operation of the winch 56. Thus it can be seen that in this manner the handling of utility poles is greatly facilitated with the apparatus shown herein.

These flanges 57 and 58 are spaced from each other by a distance of approximately eight inches. These flanges extend forward between the winch a distance of about one foot. These dimensions are such to cause these brackets to cooperate with the cable and with the winch in holding a pole of average size fixedly secured.

From the above it can be seen that the apparatus disclosed herein has very distinct advantages over devices heretofore known in the utility field. The high degree of flexibility and adaptability of the structure shown herein makes it a highly desirable piece of equipment for use in the field. It will be noted that although very definite advantages are provided, this structure can be manufactured and operated relatively inexpensively. It is possible with this apparatus to apply great pressure to the digger without any associated twisting or undue strain upon the mounting for the digger or upon the boom and stinger. The unique mounting for the digger provides this advantage for the operator in addition to making it possible to store the digger in a minimum of vertical compass and in an out-of-way position.

It will also be noted that through the use of this apparatus the holding, setting, and pulling of utility poles is greatly facilitated with the result that less equipment is required and a substantial saving in time is effected.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts without departing from the scope

of this invention which consists of the matter shown and described herein and set forth in the appended claims.

I claim:

1. A utility-type digger mounted on a vehicle and constructed and arranged thereon for selective connection either with the boom or stinger carried by the vehicle or with both, said digger comprising

- (a) an elongated boom pivotally mounted on said vehicle,
- (b) a power driven digger,
- (c) means carried by said vehicle and connected to said digger for driving the latter,
- (d) a stinger telescopically carried by said boom and being extendable and retractable relative thereto,
- (e) means carried by said vehicle and operatively connected to said stinger for extending and retracting said stinger relative to said boom,
- (f) pivot shaft mounting means on said boom,
- (g) pivot shaft mounting means on said stinger and substantially in alignment with the said means on the boom,

(h) a digger-supporting arm supporting said digger and carrying pivot shaft means for disposition either in the shaft mounting means on, and supported by, said boom with the stinger in extended position, or for disposition in the shaft mounting means on, and supported by, said stinger with the stinger also in extended position, or for disposition in the mounting means on the boom and stinger when the stinger is in retracted position,

(i) and releasable interengaging means carried by said boom and said digger-supporting arm for selectively maintaining said digger in boom and stinger supported positions.

2. A utility-type digger mounted on a vehicle and constructed and arranged thereon for selective connection either with the boom or stinger carried by the vehicle or with both, said digger comprising

- (a) an elongated boom pivotally mounted on said vehicle,
- (b) a power driven digger,
- (c) means carried by said vehicle and connected to said digger for driving the latter,
- (d) a stinger telescopically carried by said boom and being extendable and retractable relative thereto,
- (e) means carried by said vehicle and operatively connected to said stinger for extending and retracting said stinger relative to said boom,
- (f) pivot shaft mounting means on said boom,
- (g) pivot shaft mounting means on said stinger and substantially in alignment with the said means on the boom,

(h) a digger-supporting arm supporting said digger and carrying pivot shaft means for disposition either in the shaft mounting means on, and supported by, said boom with the stinger in extended position, or for disposition in the shaft mounting means on, and supported by, said stinger with the stinger also in extended position, or for disposition in the mounting means on the boom and stinger when the stinger is in retracted position,

(i) releasable interengaging means carried by said boom and said digger supporting arm for selectively maintaining said digger in boom and stinger supported positions,

(j) and said pivot shaft mounting means on said boom and said stinger being comprised of a pair of aligned adjacent sleeve members extending parallel to said boom and said stinger and being spaced longitudinally thereof.

3. A utility-type digger mounted on a vehicle and constructed and arranged thereon for selective connection either with the boom or stinger carried by the vehicle or with both, said digger comprising

(a) an elongated boom pivotally mounted on said vehicle,

(b) a power driven digger,

(c) means carried by said vehicle and connected to said digger for driving the latter,

(d) a stinger telescopically carried by said boom and being extendable and retractable relative thereto,

(e) means carried by said vehicle and operatively connected to said stinger for extending and retracting said stinger relative to said boom,

(f) pivot shaft mounting means on said boom,

(g) pivot shaft mounting means on said stinger and substantially in alignment with the said means on the boom,

(h) a digger-supporting arm supporting said digger and carrying pivot shaft means for disposition either in the shaft mounting means on, and supported by, said boom with the stinger in extended position, or for disposition in the shaft mounting means on, and supported by, said stinger with the stinger also in extended position, or for disposition in the mounting means on the boom and stinger when the stinger is in retracted position,

(i) releasable interengaging means carried by said boom and said digger-supporting arm for selectively maintaining said digger in boom and stinger supported positions,

(j) said releasable interengaging means being comprised of two pairs of cooperative connector elements for selectively coupling and uncoupling said digger with said stinger for movement therewith,

(k) one of said pairs of connector elements being constructed and arranged so as to engage each other and thereby connect said digger with said stinger for movement therewith,

(l) the other pair of said connector elements being constructed and arranged so as to engage each other and thereby hold said digger with said boom as said stinger is extended,

(m) and said pairs of connector elements being constructed and arranged so that one pair engages as the other pair disengages and vice versa.

4. A utility-type digger mounted on a vehicle and constructed and arranged thereon for selective connection either with the boom or stinger carried by the vehicle or with both, said digger comprising

(a) an elongated boom pivotally mounted on said vehicle,

(b) a power driven digger,

(c) means carried by said vehicle and connected to said digger for driving the latter,

(d) a stinger telescopically carried by said boom and being extendable and retractable relative thereto,

(e) means carried by said vehicle and operatively connected to said stinger for extending and retracting said stinger relative to said boom,

(f) pivot shaft mounting means on said boom,

(g) pivot shaft mounting means on said stinger and substantially in alignment with the said means on the boom,

(h) a digger-supporting arm supporting said digger and carrying pivot shaft means for disposition either in the shaft mounting means on, and supported by, said boom with the stinger in extended position, or for disposition in the shaft mounting means on, and supported by, said stinger with the stinger also in extended position, or for disposition in the mounting means on the boom and stinger when the stinger is in retracted position,

(i) releasable interengaging means carried by said boom and said digger supporting arm for selectively maintaining said digger in boom and stinger supported positions,

(j) and said releasable interengaging means being constructed and arranged so that said digger is main-

tained in stinger supported position when said digger is disposed in depending relation to said stinger.

5. A utility-type digger mounted on a vehicle and constructed and arranged thereon for selective connection either with the boom or stinger carried by the vehicle or with both, said digger comprising

- (a) an elongated boom pivotally mounted on said vehicle,
 - (b) a power driven digger,
 - (c) means carried by said vehicle and connected to said digger for driving the latter,
 - (d) a stinger telescopically carried by said boom and being extendable and retractable relative thereto,
 - (e) means carried by said vehicle and operatively connected to said stinger for extending and retracting said stinger relative to said boom,
 - (f) pivot shaft mounting means on said boom,
 - (g) pivot shaft mounting means on said stinger and substantially in alignment with the said means on the boom,
 - (h) a digger-supporting arm supporting said digger and carrying pivot shaft means for disposition either in the shaft mounting means on, and supported by, said boom with the stinger in extended position, or for disposition in the shaft mounting means on, and supported by, said stinger with the stinger also in extended position, or for disposition in the mounting means on the boom and stinger when the stinger is in retracted position,
 - (i) releasable interengaging means carried by said boom and said digger-supporting arm for selectively maintaining said digger in boom and stinger supported positions,
 - (j) said digger being movable between stored and depending operative positions,
 - (k) and said releasable interengaging means being constructed and arranged so that said digger is maintained in boom supported position as said stinger is extended while said digger is in stored position.
6. A utility-type digger mounted on a vehicle and constructed and arranged thereon for selective connection either with the boom or stinger carried by the vehicle or with both, said digger comprising
- (a) an elongated boom pivotally mounted on said vehicle,
 - (b) a power driven digger,
 - (c) means carried by said vehicle and connected to said digger for driving the latter,
 - (d) a stinger telescopically carried by said boom and being extendable and retractable relative thereto,
 - (e) means carried by said vehicle and operatively connected to said stinger for extending and retracting said stinger relative to said boom,
 - (f) pivot shaft mounting means on said boom,
 - (g) pivot shaft mounting means on said stinger and substantially in alignment with the said means on the boom,
 - (h) a digger-supporting arm supporting said digger and carrying pivot shaft means for disposition either in the shaft mounting means on, and supported by, said boom with the stinger in extended position, or for disposition in the shaft mounting means on, and supported by, said stinger with the stinger also in extended position, or for disposition in the mounting means on the boom and stinger when the stinger is in retracted position,
 - (i) releasable interengaging means carried by said boom and said digger-supporting arm for selectively maintaining said digger in boom and stinger supported positions,
 - (j) said pivot shaft mounting means on said boom and said stinger being comprised of a pair of aligned adjacent sleeve members extending parallel to said boom and said stinger and mounted thereon di-

rectly therebelow and being spaced longitudinally thereof,

- (k) pivot structure carried by said digger-supporting arm and pivotally supporting said digger thereon and being disposed below said sleeve members and said pivot shaft means and having its axis of pivot extending transversely of said boom and permitting free pivotal movement of said digger about said transverse axis,
- (l) said digger being movable between a depending operative position relative to said boom and said stinger and a stored inoperative position extending alongside and parallel to said boom, and
- (m) means connected to said digger below said pivot structure for raising the lower end portion of said digger laterally and longitudinally of said boom from a depending position and thereby causing said digger to pivot about said transverse axis and, with the digger partially raised, effecting pivotal movement between said pivot shaft means and said pivot shaft mounting means and thus moving the digger to a position substantially parallel with and substantially in the plane of said boom.

7. The structure defined in claim 6 wherein said digger raising means includes a support carried by said boom and extending laterally therefrom, a sheave carried by said support laterally of said boom, and cable means extending around said sheave and connectable to said digger below said pivot structure to effect the raising of said digger.

8. A utility-type digger mounted on a vehicle and so constructed and arranged thereon to provide minimum headroom requirements when the digger is in stored position, said digger comprising

- (a) an elongated boom pivotally mounted on said vehicle for movement between stored and operative position and extending outwardly therefrom,
- (b) a power driven digger,
- (c) means carried by said vehicle and connected to said digger for driving the latter,
- (d) rigid mounting structure carried by said boom directly therebelow and pivotally supporting said digger in depending relation upon said boom for pivotal movement of said digger relative thereto,
- (e) said mounting structure including pivot structure directly below said boom and having its axis of pivot extending longitudinally of said boom and permitting free pivotal movement of said digger about said axis,
- (f) said mounting structure also including pivot structure disposed below said first mentioned pivot structure and having its axis of pivot extending transversely of said boom and permitting free pivotal movement of said digger about said transverse axis, and
- (g) means connected to said digger below said pivot structure for raising the lower end portion of said digger laterally and longitudinally of the boom from a depending position and thereby causing the digger to pivot about the said transverse axis and, with the digger partially raised, effecting pivotal movement on the said longitudinal axis and thus move the digger to a position substantially parallel with and substantially in the horizontal plane of a side of the boom.

9. A utility-type digger mounted on a vehicle and so constructed and arranged thereon to provide minimum headroom requirements when the digger is in stored position, said digger comprising

- (a) an elongated boom pivotally mounted on said vehicle for movement between stored and operative position and extending outwardly therefrom,
- (b) a power driven digger,
- (c) means carried by said vehicle and connected to said digger for driving the latter,
- (d) rigid mounting structure carried by said boom directly therebelow and pivotally supporting said

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- digger in depending relation upon said boom for pivotal movement of said digger relative thereto,
- (e) said mounting structure including pivot structure directly below said boom and having its axis of pivot extending longitudinally of said boom and permitting free pivotal movement of said digger about said axis,
- (f) said mounting structure also including pivot structure disposed below said first mentioned pivot structure and having its axis of pivot extending transversely of said boom and permitting free pivotal movement of said digger about said transverse axis,
- (g) means connected to said digger below said pivot structure for raising the lower end portion of said digger laterally and longitudinally of the boom from a depending position and thereby causing the digger to pivot about the said transverse axis and, with the digger partially raised, effecting pivotal movement on the said longitudinal axis and thus move the digger to a position substantially parallel with and substantially in the horizontal plane of a side of the boom,
- (h) and said digger raising means including a support carried by said boom and extending laterally therefrom, a sheave carried by said support laterally of said boom, and cable means extending around said sheave and connectable to said digger below said pivot structure to effect the raising of said digger.
10. A utility-type digger mounted on a vehicle and so constructed and arranged thereon to provide minimum headroom requirements when the digger is in stored position, said digger comprising
- (a) an elongated boom pivotally mounted on said vehicle for movement between stored and operative position and extending outwardly therefrom,
- (b) a power driven digger,
- (c) means carried by said vehicle and connected to said digger for driving the latter,
- (d) rigid mounting structure carried by said boom directly therebelow and pivotally supporting said digger in depending relation upon said boom for pivotal movement of said digger relative thereto,
- (e) said mounting structure including pivot structure directly below said boom and having its axis of pivot extending longitudinally of said boom and permitting free pivotal movement of said digger about said axis,
- (f) said mounting structure also including pivot structure disposed below said first mentioned pivot structure and having its axis of pivot extending transversely of said boom and permitting free pivotal movement of said digger about said transverse axis,
- (g) means connected to said digger below said pivot structure for raising the lower end portion of said digger laterally and longitudinally of the boom from a depending position and thereby causing the digger to pivot about the said transverse axis and, with the digger partially raised, effecting pivotal movement on the said longitudinal axis and thus move the digger to a position substantially parallel with and substantially in the horizontal plane of a side of the boom,
- (h) said first mentioned pivot structure being comprised of a pair of aligned adjacent but spaced sleeves carried by said boom and extending longitudinally thereof, and a pivot shaft pivotally received within said sleeves and extending therebetween, and
- (i) said pivot shaft being connected to said second mentioned pivot structure and supporting the same and said digger.
11. A utility-type digger mounted on a vehicle and so constructed and arranged thereon to provide minimum head-room requirements when the digger is in stored position, said digger comprising
- (a) an elongated boom pivotally mounted on said vehicle for movement between stored and operative position and extending outwardly therefrom,
- (b) a power driven digger,

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- (c) means carried by said vehicle and connected to said digger for driving the latter,
- (d) rigid mounting structure carried by said boom directly therebelow and pivotally supporting said digger in depending relation upon said boom for pivotal movement of said digger relative thereto,
- (e) said mounting structure including pivot structure directly below said boom and having its axis of pivot extending longitudinally of said boom and permitting free pivotal movement of said digger about said axis,
- (f) said mounting structure also including pivot structure disposed below said first mentioned pivot structure and having its axis of pivot extending transversely of said boom and permitting free pivotal movement of said digger about said transverse axis,
- (g) means connected to said digger below said pivot structure for raising the lower end portion of said digger laterally and longitudinally of the boom from a depending position and thereby causing the digger to pivot about the said transverse axis and, with the digger partially raised, effecting pivotal movement on the said longitudinal axis and thus move the digger to a position substantially parallel with and substantially in the horizontal plane of a side of the boom,
- (h) a stinger telescopically carried by said boom and being extendable and retractable relative thereto,
- (i) means carried by said vehicle and operatively connected to said stinger for extending and retracting said stinger relative to said boom,
- (j) said first mentioned pivot structure being comprised of a sleeve member mounted on said boom and extending longitudinally thereof, a second sleeve member mounted on said stinger in adjacent but spaced relation to said first mentioned sleeve member and in alignment therewith, and a digger-supporting arm carrying pivot shaft means extending longitudinally of said boom and stinger in alignment with said sleeves, said pivot shaft means being receivable either in said stinger supported sleeve member when said stinger is in extended position or in said boom supported sleeve member when said stinger is in extended position or in both of said sleeve members when said stinger is in retracted position, and
- (k) releasable interengaging means carried by said boom and said digger-supporting arm for selectively maintaining said digger in boom and stinger supported positions.
12. In a utility-type digger,
- (a) a vehicle,
- (b) an elongated boom mounted on said vehicle and extending outwardly therefrom,
- (c) a power-driven digger,
- (d) means carried by said vehicle and connected to said digger for driving the latter,
- (e) a stinger telescopically carried by the outer end portion of said boom and being extendible and retractable relative thereto,
- (f) means carried by said vehicle and operatively connected to said stinger for extending and retracting said stinger relative to said boom,
- (g) a rigid sleeve member fixedly mounted on said boom in depending relation directly therebelow,
- (h) a second rigid sleeve member fixedly mounted on said stinger in depending relation directly therebelow and in axially aligned relation to said first mentioned sleeve,
- (i) said sleeves being spaced longitudinally of said boom and said stinger but being disposed adjacent each other when said stinger is in retracted position,
- (j) a rigid pivot shaft extending axially of said sleeve members and disposed between said sleeve members and slidably but removably received therewithin when said stinger is in retracted position, said pivot

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- shaft extending longitudinally of said boom and said stinger and directly therebelow,
- (k) said sleeve members cooperatively supporting said pivot shaft when said stinger is in retracted position,
- (l) said sleeve members alternatively individually supporting said pivot shaft when said stinger is in extended position, 5
- (m) a pivot arm fixedly connected to said pivot shaft intermediate its ends and between said sleeve members and depending from said pivot shaft in supported relation, 10
- (n) pivot means carried by said pivot arm and connected to and pivotally supporting said digger in depending relation thereupon,
- (o) said pivot means extending transversely of said boom and having an axis of pivot extending transversely of said boom, 15
- (p) means for drawing the lower end portion of said digger upwardly and laterally and towards said vehicle to inoperative storing position, 20
- (q) a bracket of generally inverted U-shape mounted on said boom and positioned and arranged so that said digger will be received therewithin when drawn to said inoperative position,
- (r) a detent member pivotally mounted on said bracket at one side thereof and having a camming surface adapted to cause the same to pivot upwardly to a non-latching out-of-way position when pressure is applied thereagainst, 25
- (s) and a latch member pivotally mounted on said bracket opposite said detent member and being pivotable relative to such bracket into cooperative latching and unlatching positions, 30

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- (t) said latch member having a digger-engaging lever portion disposed in position to be engaged and cammed by said digger as said digger moves to said inoperative position within said bracket to cause said latch member to pivot into cooperative latching position with said detent member and relative to said digger,
- (u) said latch member having a cam surface positioned to engage said camming surface of said detent member as said latch member is cammed into latching position and cause said detent member to pivot to said out-of-way position until said latch member has moved therepast,
- (v) and means for causing said detent member to pivot back into latch-engaging position when said latch member has moved therepast to cooperatively lock said digger within said bracket.

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