Dec. 3, 1963 J. A. PODLESAK 3,112,830

POLE HANDLING DEVICE

Filed Oct. 17, 1961 5 Sheets-Sheet 1

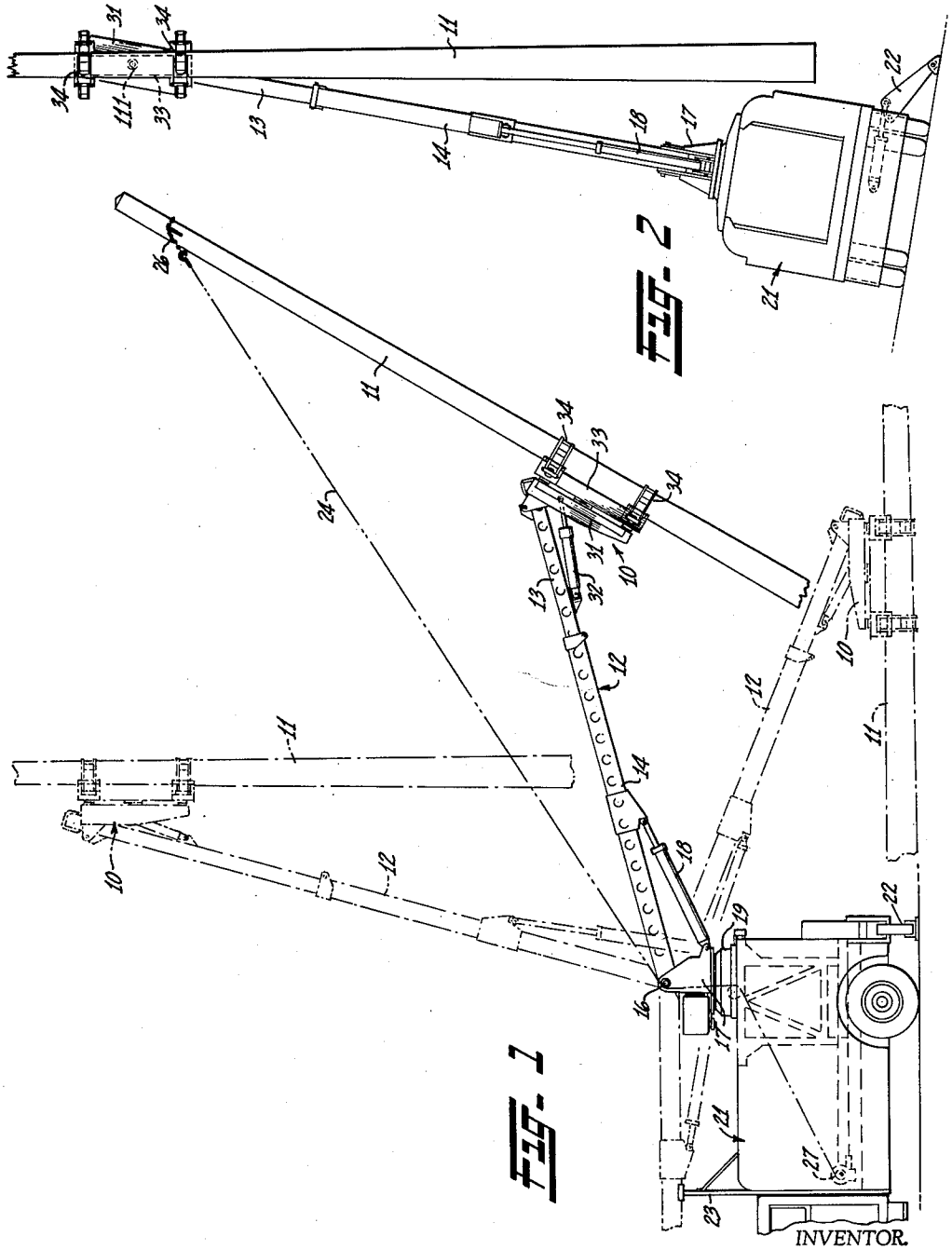

FIG. 2

FIG. 1

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Dec. 3, 1963 J. A. PODLESAK 3,112,830

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Filed Oct. 17, 1961 5 Sheets-Sheet 2

FIG. 3

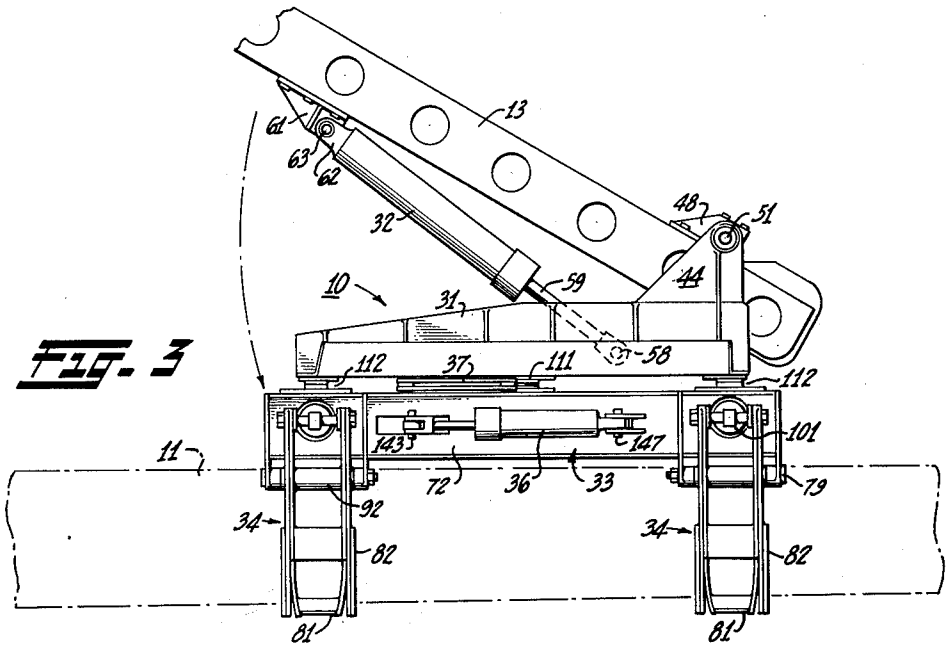
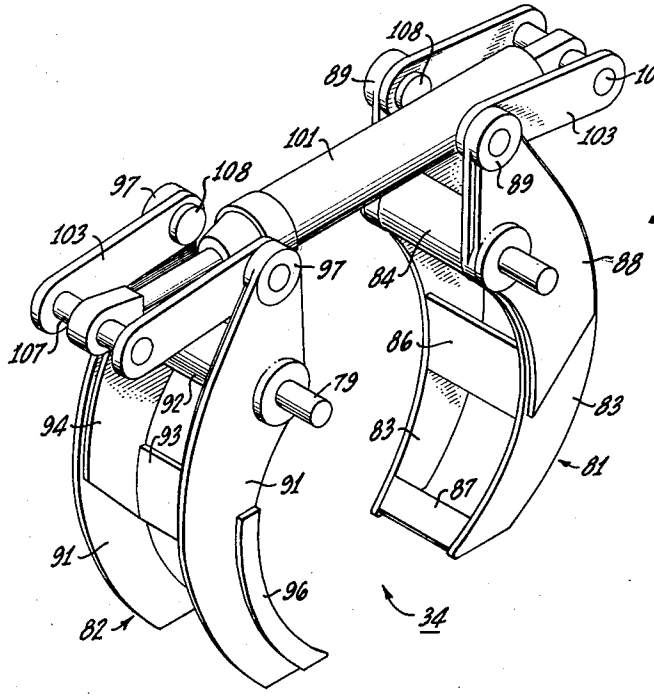


FIG. 7



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Filed Oct. 17, 1961 5 Sheets-Sheet 3

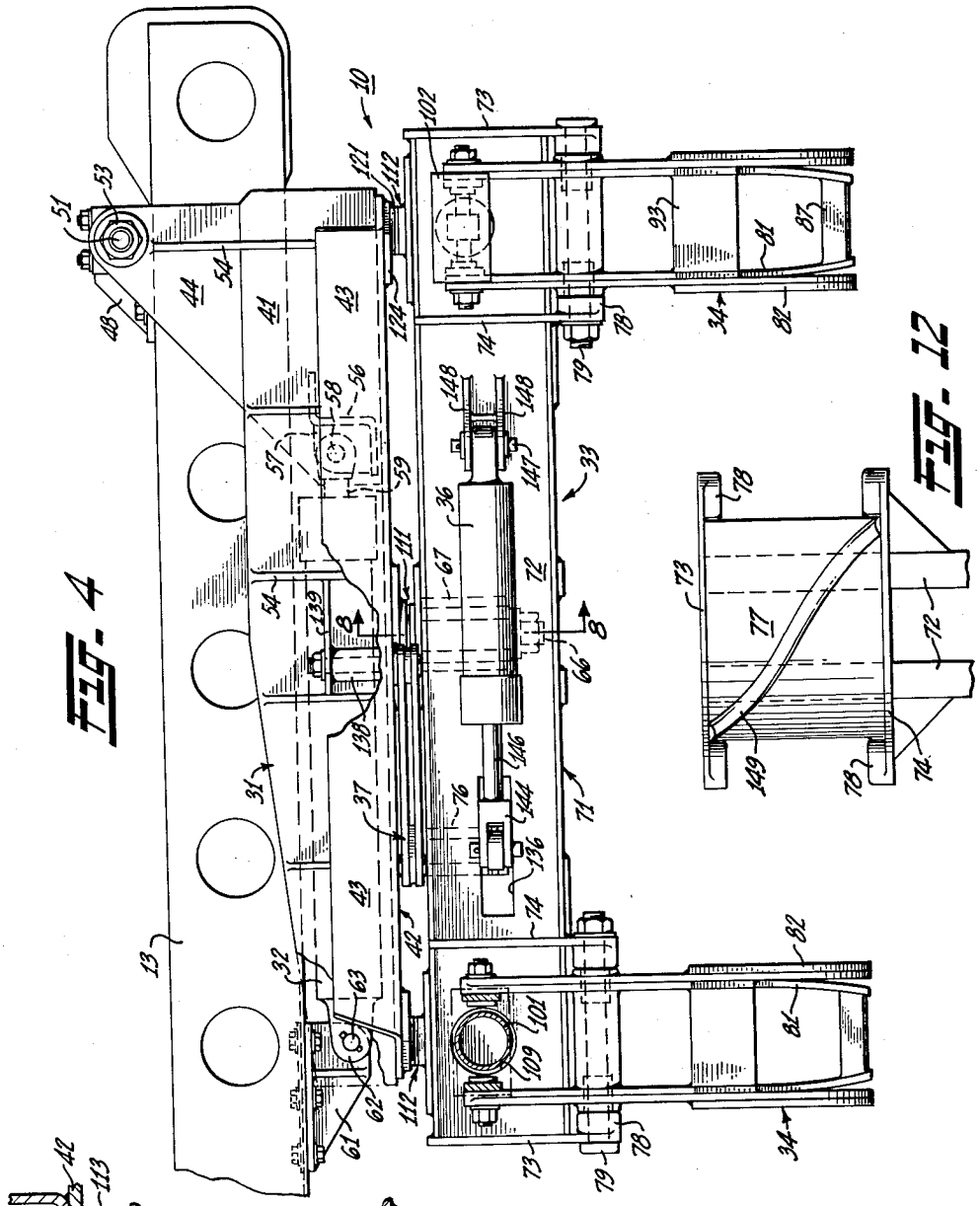

FIG. 4

FIG. 12

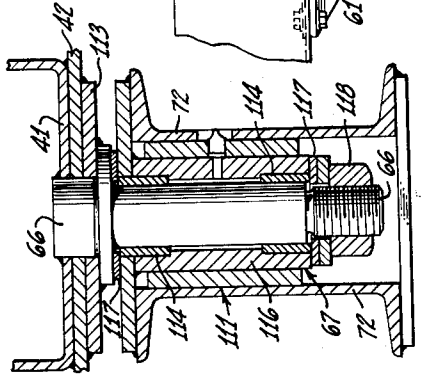

FIG. 8

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Dec. 3, 1963 J. A. PODLESAK 3,112,830

POLE HANDLING DEVICE

Filed Oct. 17, 1961 5 Sheets-Sheet 4

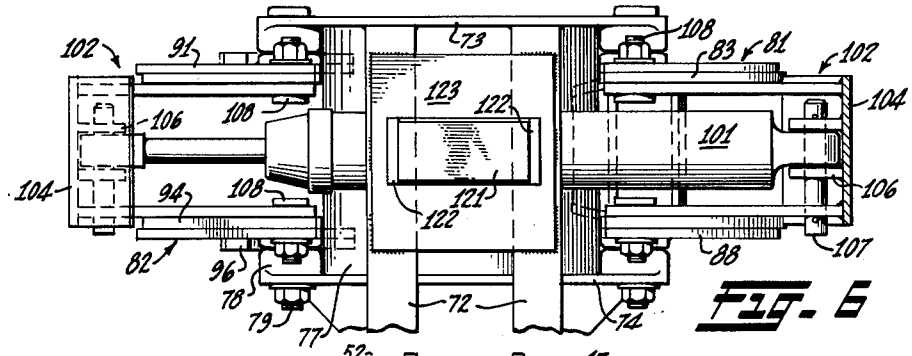


FIG. 6

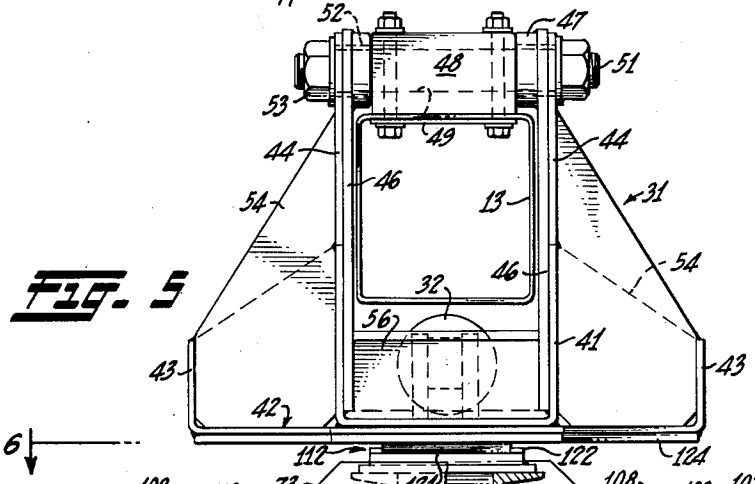
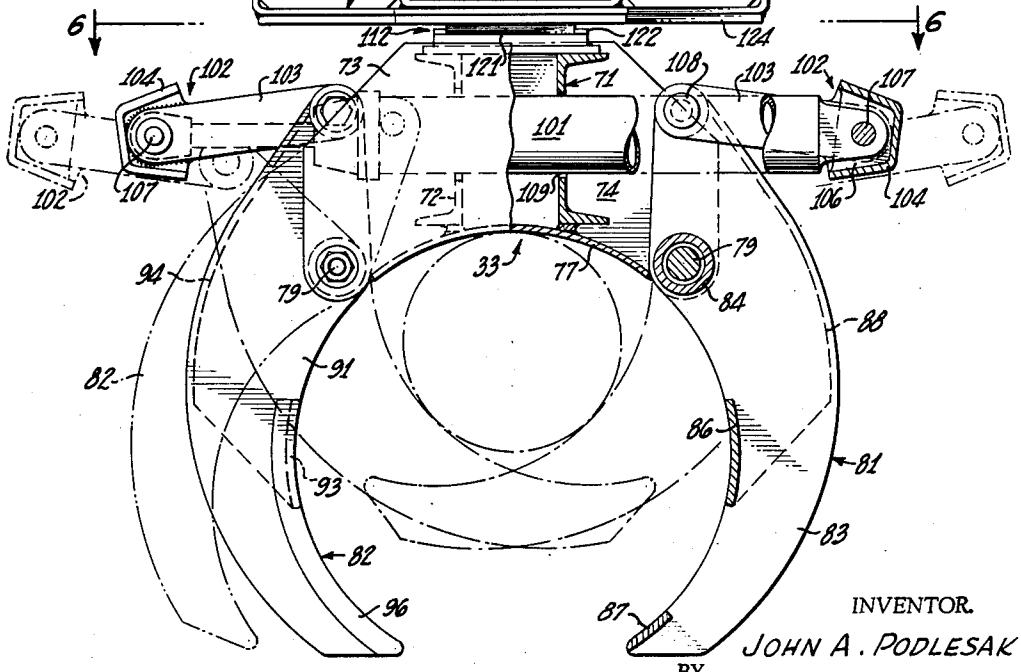


FIG. 5



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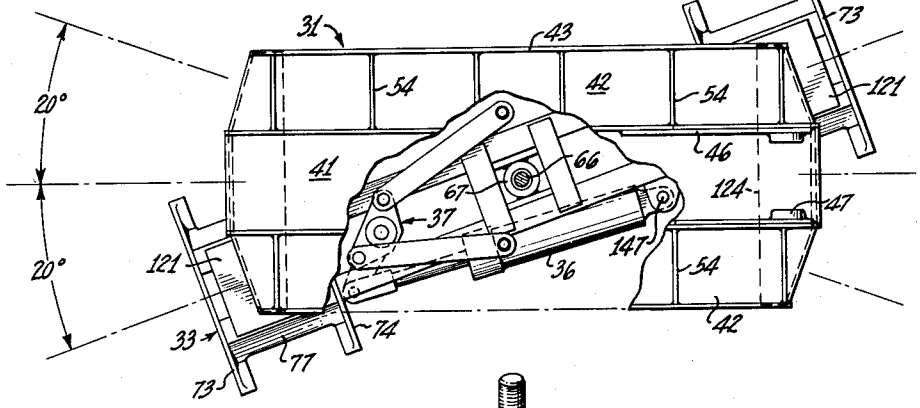
POLE HANDLING DEVICE

Filed Oct. 17, 1961 5 Sheets-Sheet 5

Fig. 9



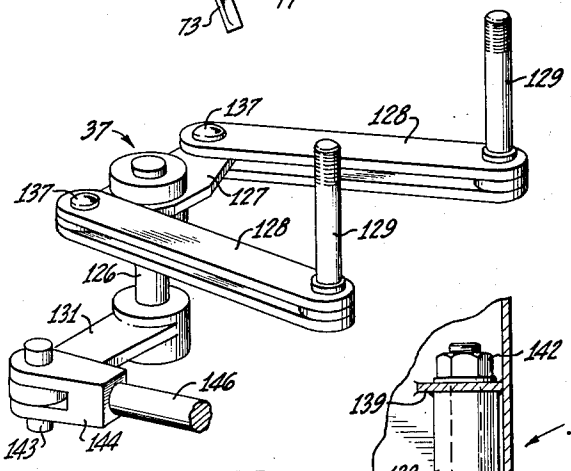


Fig. 11

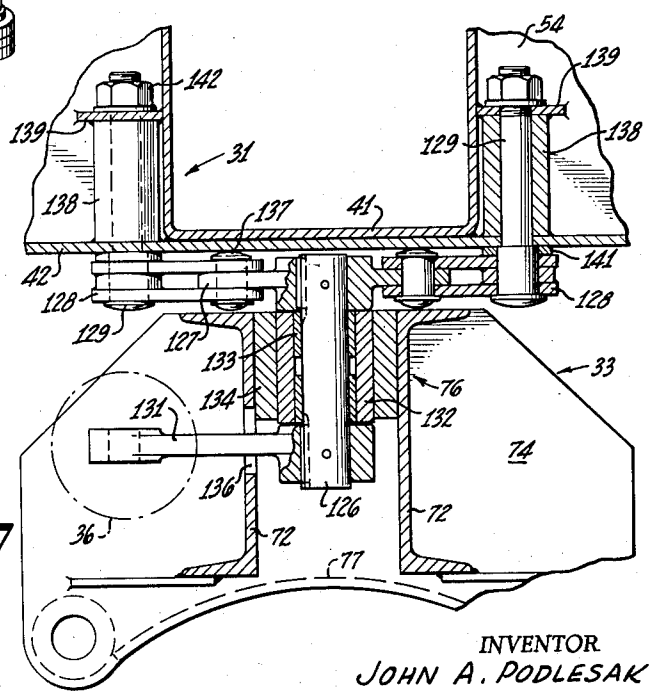


Fig. 10

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United States Patent Office

3,112,830

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3,112,830

POLE HANDLING DEVICE

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Filed Oct. 17, 1961, Ser. No. 145,664
2 Claims. (Cl. 214—3)

This invention relates generally to a grappling apparatus for handling utility poles and similar objects during installation.

A primary object of the invention is to provide an apparatus designed to pick up an object such as a utility pole located in a horizontal attitude either on the ground or on a conveyance, and elevate and tilt the object to a vertical attitude for placement in a prepared hole.

Another object of the invention is to provide a power-operated pole grappling apparatus whereby the attitude of the pole may be controlled in two planes at right angles to each other, allowing manipulation in all directions.

An additional object of this invention is to provide a power-operated pole handling apparatus affixed to an adjustable boom, wherein a stationary operator may control the manipulation of the boom as well as the positioning of the pole relative to the boom in two separate planes for universal position control.

An additional object of the invention is to incorporate into a grappling apparatus a mechanism which permits the guided rotation of a vertically aligned pole about its longitudinal (axial) centerline utilizing normal gravitational force.

Generally, the invention comprises a pair of spaced, aligned, individually operated sets of overlapping jaw elements mounted adjacent an arcuate guide plate to permit dual three-point grasping contact of a tapered pole, the jaws being mounted at the opposing ends of a cross beam member rotatably mounted on a tiltable frame attached to an extensible derrick boom.

In the accompanying drawings:

FIGURE 1 is a side elevation of the pole handling apparatus mounted on a vehicle and showing alternative positions in broken lines.

FIGURE 2 is a rear view of the vehicle and apparatus showing the method of vertical alignment.

FIGURE 3 is a side elevation of the handling apparatus in a pick-up position.

FIGURE 4 is an enlarged detail view of the handling apparatus with portions cut away.

FIGURE 5 is an end view of the pick up apparatus on a larger scale, part cut away and sectional, illustrating several operational positions of the jaws in broken lines.

FIGURE 6 is a plan view taken on line 6—6 of FIGURE 5, rotated 180° for convenience of illustration.

FIGURE 7 is an enlarged, perspective view of the pole grasping jaws and actuating linkage.

FIGURE 8 is a section on line 8—8 of FIGURE 4 showing the pivotal mounting of the cross beam assembly.

FIGURE 9 is a simplified plan view of the assembly in a maximum pivoted position with the support frame partially cut away to show the operating linkage.

FIGURE 10 is a transverse sectional view of the operating linkage and method of mounting.

FIGURE 11 is a perspective view of the linkage.

FIGURE 12 shows the underside of one of the arcuate bearing plates with its spiral guide element.

A pole grappling apparatus designated generally as 10, is designed to pick up and position a utility pole 11 or similar object. In the configuration shown herein, hydraulic powered cylinders have been illustrated as the power mechanisms for actuating the various moving parts under the remote control of an operator adjacent the support vehicle. Fluid lines have not been shown, these being conventional. Other power mechanisms may be substituted to provide equivalent mechanical movement of the parts.

In normal use the apparatus is mounted on a telescopic boom generally 12 having an outer extensible section 13 and a main, non-extensible section 14 pivoted at 16 to a support structure 17. A hydraulic cylinder 18 is provided for elevating and lowering the boom 12 and structure 17 is rotatably mounted on a platform 19 rigidly supported on vehicle 21. Retractable outrigger members 22 are built into the chassis of vehicle 21 and are utilized to stabilize the vehicle. A bracket assembly 23 provides for stowage of the boom and attached grappling assembly when not in use. In the event that the pole being handled is of greater than normal length, an assist cable 24 may be attached around the upper end of pole 11 as at 26 and through operation of winch 27 the pole may be elevated to a vertical position where it may be handled more readily by the grappling apparatus alone.

The grappling assembly 10 comprises a first support frame 31 pivotally attached to the distal end of extensible boom 13 and has a hydraulic cylinder unit 32 for position control. A cross beam assembly or second frame 33 supporting two sets of grasping jaws is rotatably mounted at the midpoint of frame 31 and a hydraulic cylinder 36 controls the rotation of beam assembly 33 relative to frame 31 through linkage generally 37. The design illustrated permits approximately 20° of travel in either direction away from the boom axis. This controlled movement permits accurate vertical positioning of the pole regardless of the position of the supporting vehicle, as illustrated in FIGURE 2.

The support frame assembly 31 includes a central channel member 41 having affixed to its base, as by welding, a rectangular plate 42 with an upturned flange 43 on each long side (see FIGURES 4 and 5). Vertical triangular-shaped extension plates 44, together with reinforcing back-up plate 46, are welded to the outer end of channel 41 on each flange to provide support for hubs 47, providing for pivotal mounting of frame 41 around boom 13. A flanged bracket 48 (see FIGURES 3 and 5), bolted to the upper surface of boom 13 has a bore 49 therethrough for receiving a pivot shaft 51. Bushings 52 are installed in hubs 47 and nuts 53 and washers secure the shaft. A plurality of spaced gusset plates 54 are welded in position between the outer flanges 43 and sides of channel 41 and serve as reinforcements to rigidize the entire frame assembly 31. A generally Z-shaped cross member 56 (see FIGURES 4 and 5) is welded between the sides of channel 41 to support a pair of lugs 57. A pivot pin 58 passes through lugs 57 to attach piston rod end 59 of hydraulic cylinder 32. A second bracket member 61 is bolted to the lower surface of boom 13 and provides for the attachment of clevis end 62 of cylinder 32 through pivot pin 63. A shaft member 66 (see FIGURES 4 and 8) is affixed to the bottom of support frame assembly 31 at its center. Shaft 66 is journalled in bearing assembly 67 in cross beam assembly 33 to permit rotation relative

to the support frame 31 as will be described in greater detail later.

The cross beam assembly 33 includes an elongated structural member 71 supporting the sets of jaws 34 at its two ends. Member 71 comprises a pair of spaced channel elements 72 with flanges facing outwardly, to which are welded transverse end plates 73 and secondary plates 73 which cooperate to support the jaws 34. The bearing assembly 67 for receiving shaft 66 in frame 31 and a second bearing assembly 76 for supporting the rotating linkage 37, as well as a plurality of reinforcing tie plates, are made an integral part of structure 71. An arcuate guide plate 77 is welded into position between the bottom extremities of end plates 73 and secondary plates 74 to provide a concave bearing surface which cooperates with jaws 34 to provide three-point pole support at each end of cross beam 33. Hub elements 78 affixed to the lower corners of plates 73 and 74 provide pivotal support for jaws 34 mounted on bolts 79.

Each jaw assembly 34 includes a tapered jaw 81 and an open-ended jaw 82 designed to permit over-lapping or nesting of the two jaws for complete encirclement of a pole during handling. The drawing of FIGURE 5 in dash-dot lines illustrates the position of the jaws about a pole of small diameter. Jaw 81 comprises a pair of generally crescent-shaped spaced plates 83 rigidly affixed to a hub element 84 bridged by an intermediate plate 86 and a lower tip plate 87. It will be noted in FIGURE 7 that side plates 83 converge at their lower ends. A reinforcing plate 88 is welded to the outer face of each plate 83 for increased strength and an eye 89 is provided at the top for attachment of an operating linkage. Jaw 82 is similar in basic construction to jaw 81 except that the pair of plates 91 are located in a parallel spaced relationship on a hub 92 and a single transverse plate 93 is utilized. A pair of reinforcing plates 94 is added to the inner face of plates 91 and arcuate strips 96 are welded to the outer faces in the lower half for stiffening and to increase the area of contact of the jaw edges with the pole. Eyes 97 at the top of plates 91 provide for attachment of the operating linkage. A hydraulic cylinder 101 is provided for power operation of each set of jaws through connecting linkages 102. Each linkage 102 comprises a pair of shaped parallel links 103 welded at one end to a transverse channel element 104 incorporating a pair of holed lugs 106 for attachment of the ends of operating cylinder 101 with pivot pins 107. The opposite ends of each link 103 are connected to the eyes 89 and 97 of the jaw members 81 and 82, respectively, with bolts 108. Thus, extension of the piston rod of cylinder 101 forces the jaws 34 to rotate to a closed or grasping position and, conversely, retraction of cylinder 101 opens the jaws. An opening 109 in the web of each channel 72 allows installation and limited movement of cylinder 101.

The rotative connection between support frame 31 and cross beam assembly 33 is designed to provide a high degree of stability and comprises a central pivot 111 and a thrust-carrying slide-bearing assembly 112 at both ends of support frame 31. The pivot assembly 111 is best seen in FIGURE 8 and comprises a flanged shaft 66 with its upper end inserted into and welded to a tie plate 113, plate 42, and channel member 41. Shaft 66 is journalled in bearing assembly 67 having sleeve bushings 114 located in a hub member 116 affixed to the structural member 71. Upper and lower thrust washers 117 and lock nut 118 complete the assembly.

The slide bearing assemblies 112 include a rectangular plastic plate 121 held between guide strips 122 mounted on top of a reinforcing tie plate 123 welded across the channels 72. A pair of elongated polygonal plates 124 (see FIGURE 4) welded to the bottom surface of plate 42 at each end provide a smooth bearing surface for plastic plates 121, thus permitting rotative movement of cross beam 33 relative to frame 31, as previously set forth.

The interconnecting drive linkage 37 comprises essentially a main pivot shaft 126, a double-ended lever arm 127, links 128 with integral studs 129 and a drive lever 131. Shaft 126 is journalled in bearing assembly 76, in line with but spaced from central pivot 111 in cross beam assembly 33. Bearing 76 includes a hub member 132 incorporating a pair of sleeve bushings 133. Hubs 132 are structurally affixed to channels 72 through intermediate reinforcing plates 134 and an aperture 136 is provided in one channel 72 to permit movement of drive lever 131. Lever arm 127 is keyed or otherwise affixed to the upper end of shaft 126 and doubled link members 128 are pivotally attached to the opposing ends of arm 127 by pins 137. Upstanding studs 129 on links 128 are journalled in sleeve bearings 138 welded in position on support frame 31 between an auxiliary cross plate 139 and bottom plate 42. Thrust washers 141 and lock nuts 142 secure the studs. Operating lever 131 is pivotally connected by pin 143 to the clevis end 144 on piston rod 146 of control cylinder 36. The opposite end of cylinder 36 is supported on pivot pin 147 which passes through a pair of spaced lugs 148 welded to the vertical web of channel 72. The geometry of linkage 37 is designed to augment the force of cylinder 36 and to provide positive control of the movement of cross beam assembly 33.

Provision is made for supplementary rotational movement of the pole about its own longitudinal axis when located in a vertical attitude to permit positioning especially when the pole is preassembled with one or more cross bars attached prior to erection. To accomplish this movement, a spiral element 149 of half-round section is welded to the underside of arcuate guide plate 77. The spiral element 149 provides for more positive gripping contact with the pole during handling and also permits the operator to rotate a vertically aligned pole by slowly releasing the jaws sufficiently to allow slippage while still retaining guidance. The configuration of the element 149 causes the pole to rotate in a clockwise direction as it is lowered into the prepared hole. Thus, it is obvious that an operator situated remotely from the pole handling apparatus can effectively control the movement and positioning of the pole in all directions.

I claim:

1. Grappling apparatus for handling utility poles and the like comprising:

(*a*) a boom having power means in association therewith for raising and lowering the distal end thereof;

(*b*) a support frame assembly for a pair of jaws secured to the said distal end of the said boom;

(*c*) a pair of jaws pivotally secured to the said support frame;

(*d*) power means in association with said jaws for pivoting said pair of jaws through two perpendicular planes;

(*e*) power means for opening and closing said jaws;

(*f*) and a spiral flange mounted to said frame within the area circumscribed by said jaws for cooperation with said jaws whereby to provide means for rotating a utility pole or the like gripped by the said jaws when the said pole or the like is permitted to slip downwardly through the said jaws under the influence of gravity.

2. Grappling apparatus for handling utility poles and the like comprising:

(*a*) a straight boom having power means in association therewith for raising and lowering the distal end thereof;

(*b*) a support frame assembly for a pair of jaws, said frame assembly being pivotally secured about a first horizontal pivot axis to the said distal end of the said boom at the end of said frame assembly which is uppermost when said boom is raised, whereby said

frame may pivot outwardly from the bottom thereof to form an acute angle with the said boom;

(*c*) power means for pivoting said bottom of said frame outwardly from said boom;

(*d*) a second frame pivoted to said first frame about a second pivot axis to said first frame, said second pivot axis being substantially perpendicular to said first pivot axis;

(*e*) power means for pivoting the said second frame about the second pivot axis;

(*f*) cooperating jaws mounted on said second frame for pivotal movement;

(*g*) power means for opening and closing said jaws;

(*h*) and a spiral flange mounted to said second frame within the area circumscribed by said jaws for cooperation with said jaws, whereby to provide means for rotating a utility pole or the like gripped by the said jaws when the said pole or the like is permitted to slip downwardly through said jaws under the influence of gravity.

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