May 16, 1944. R. FERWERDA ET AL 2,348,796

MATERIAL MOVING DEVICE

Filed Aug. 19, 1940 3 Sheets-Sheet 1

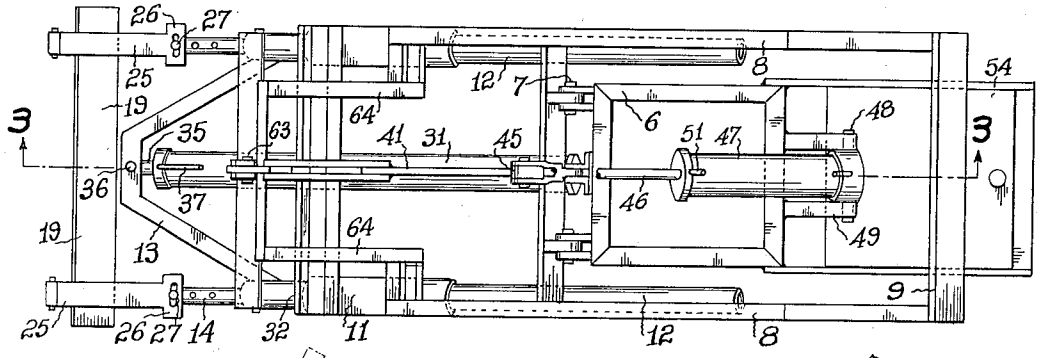


FIG. 1

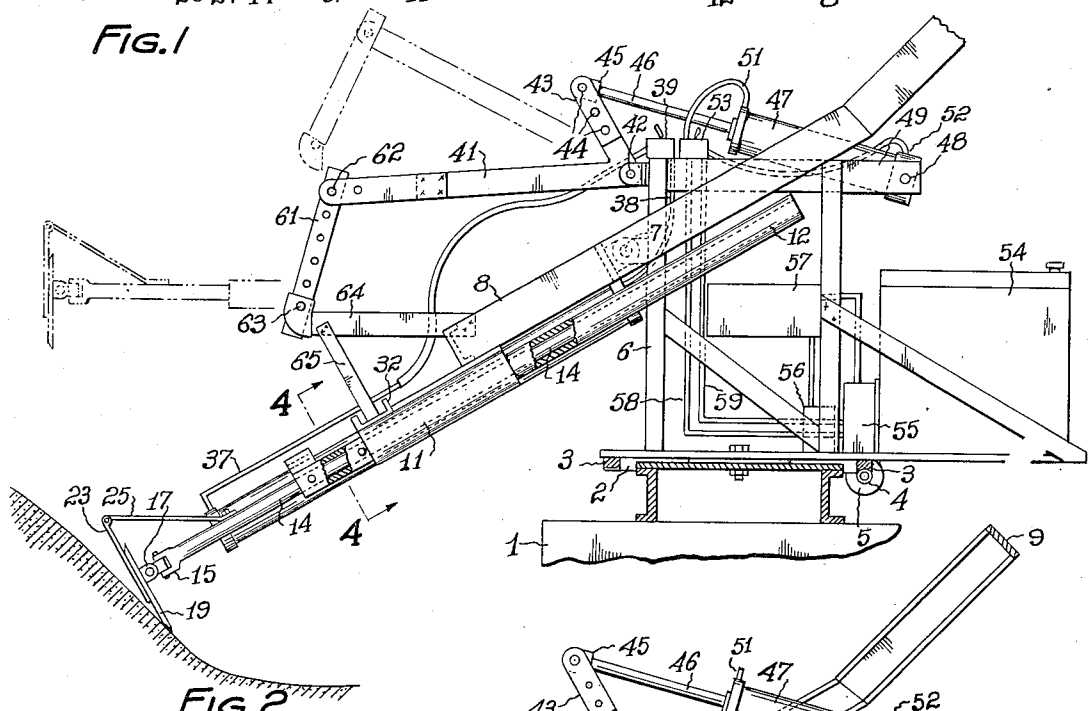


FIG. 2

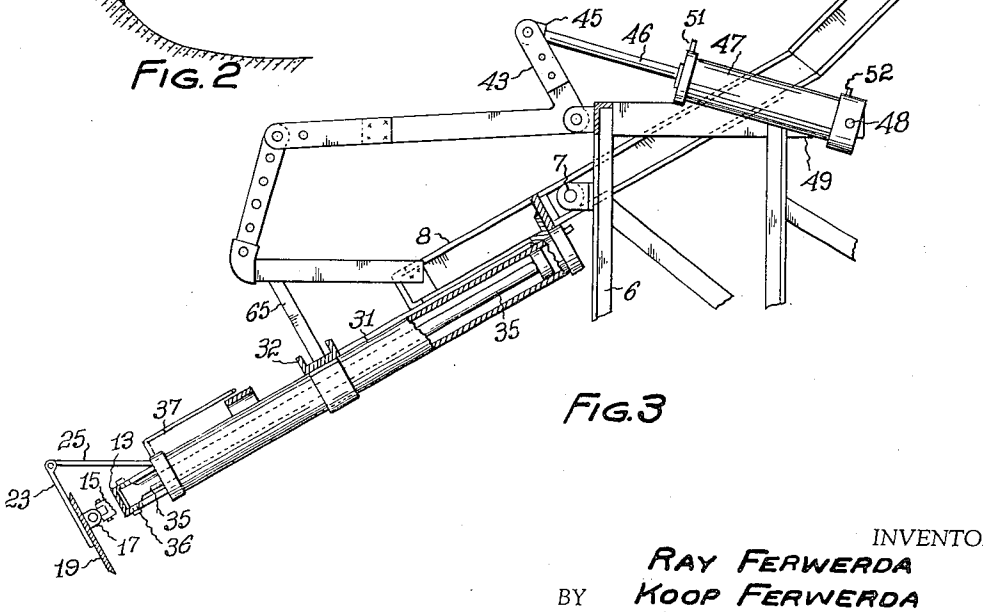


FIG. 3

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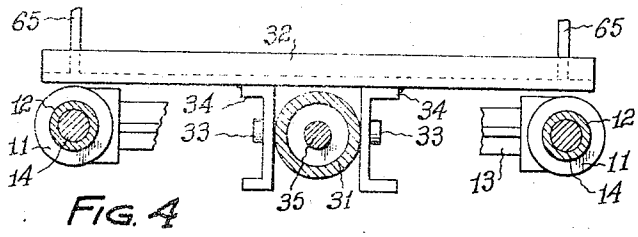


FIG. 4

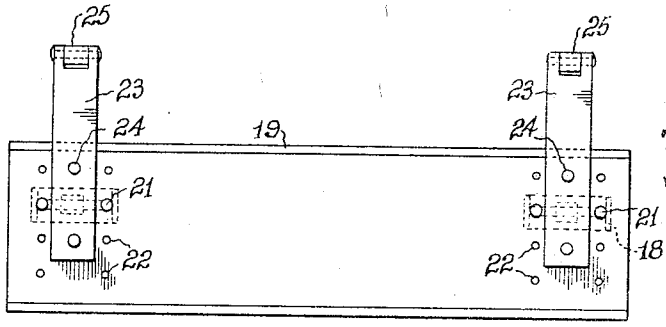


FIG. 5

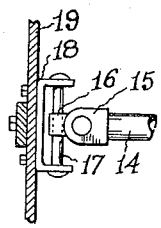


FIG. 7

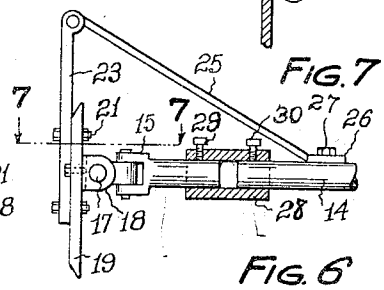


FIG. 6

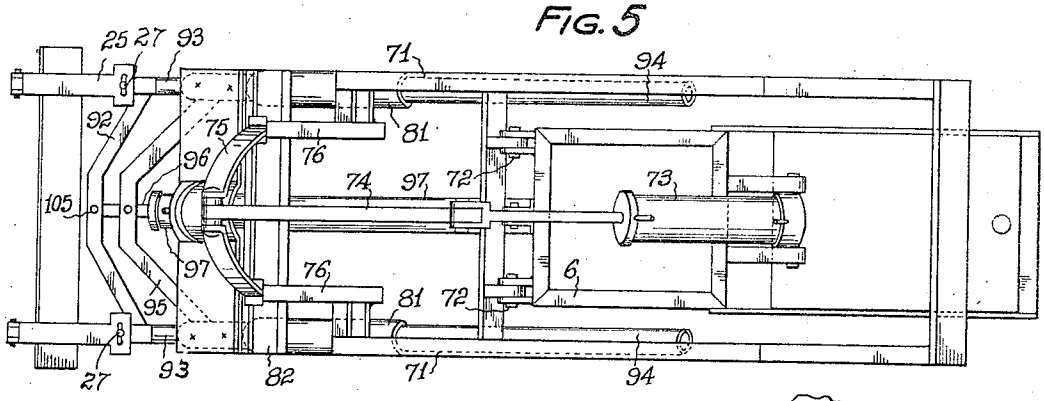


FIG. 8

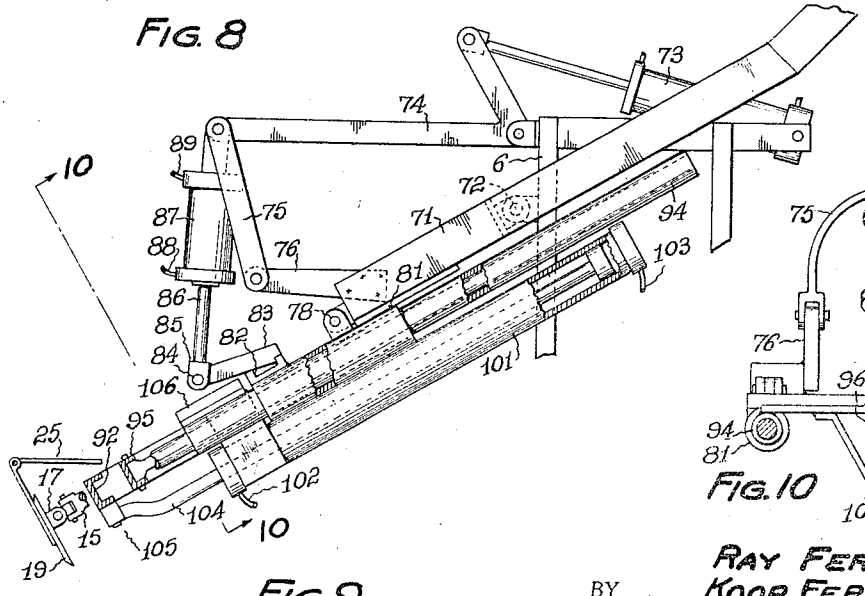


FIG. 9

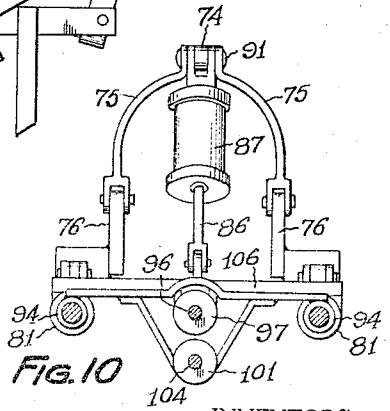


FIG. 10

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MATERIAL MOVING DEVICE

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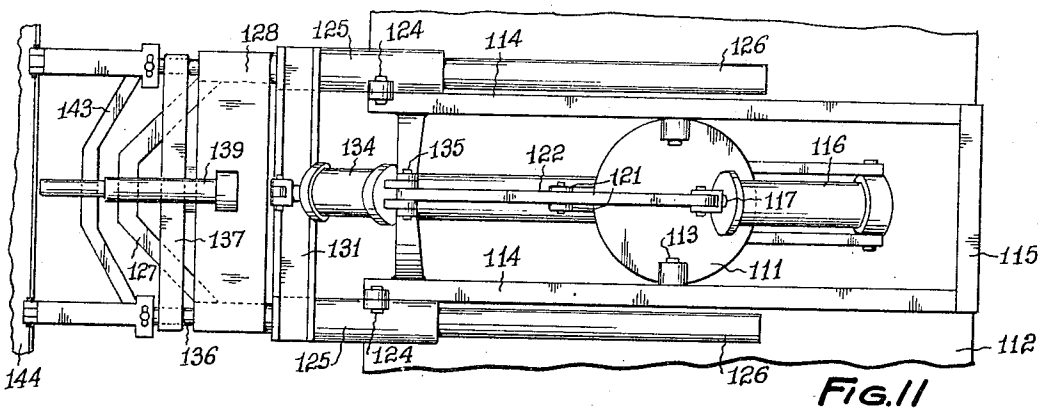


FIG. 11

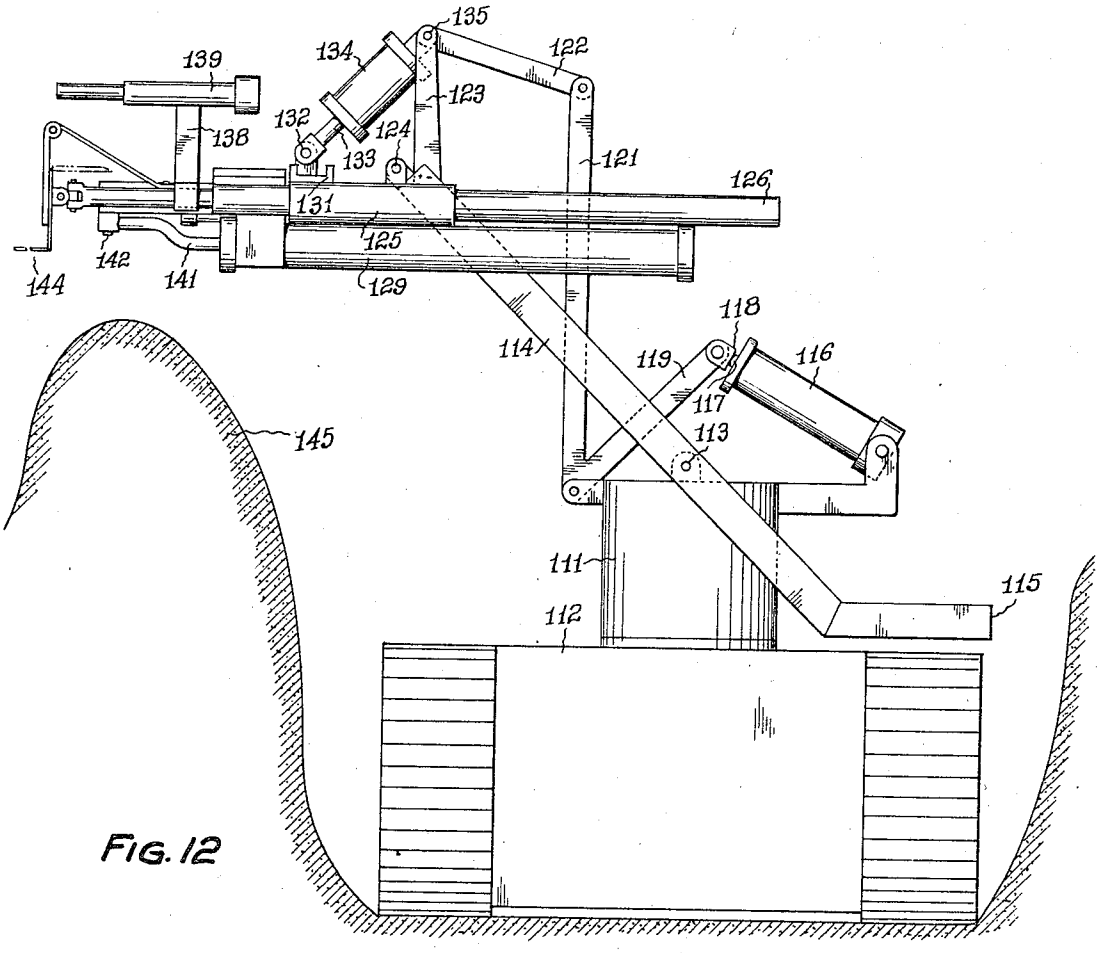


FIG. 12

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UNITED STATES PATENT OFFICE

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MATERIAL MOVING DEVICE

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Application August 19, 1940, Serial No. 353,212

9 Claims. (Cl. 37—143)

This invention, as indicated, relates to a material moving device. More particularly, it comprises a machine adapted to perform a variety of operations which includes the displacement of material, and especially in relation to the shaping of earth surfaces in connection with the construction of roadways and embankments, the digging of ditches and the making of excavations of various types. The invention also has in view the construction of a self-contained military unit adapted to embody a number of features found in tank constructions of conventional design and also to combine therewith means adapted to provide a degree of protection and partial or total concealment for the military unit.

The principal object of the present invention is to provide an improved type of material moving device of sturdy construction and high efficiency.

Another object of the invention is to provide an apparatus adapted for earth working of various types, including the shaping of earth surfaces in connection with roadways, embankments and various types of excavations.

Another object of the invention is to provide a self-contained military unit carrying ordnance, and also carrying an earth working unit adapted to provide a depression or an elevation for the suitable positioning of such military unit for more effective service.

Another object of the invention is to provide an earth working unit having an operative element adapted to be positioned throughout a wide variety of operative angles and supporting in operative relation to the work various types of earth working and earth modifying implements.

Another object of the invention is to provide an apparatus adapted to operate from a stationary platform or from a mobile vehicle platform through a wide range of action, and with an increased degree of effectiveness over devices at present available for like purposes.

Another object of the invention is to provide an earth working apparatus operated chiefly by hydraulic units of high capacity and adapted to operate over relatively large areas under heavy duty conditions.

Another object of the invention is to provide an earth working unit hydraulically operated and adapted to be associated with other supporting and positioning elements whereby said hydraulic unit may operate under high duty conditions to modify adjacent earth surfaces at low cost and with high efficiency.

Other and further objects of the invention will appear in the course of the following description.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawings and the following description setting forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but several of various forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a top plan view of one type of material moving apparatus embodying the principles of the invention;

Fig. 2 is a side elevation of the structure shown in Fig. 1;

Fig. 3 is a fragmentary view partly in section taken along the line 3—3 shown in Fig. 1 looking in the direction of the arrows;

Fig. 4 is an enlarged sectional view of the structure shown in Figs. 1 and 2, as seen along the line 4—4 in Fig. 2 looking in the direction of the arrows;

Fig. 5 is a front view of the earth working blade with its adjusting members;

Fig. 6 is a side elevation of the structure shown in Fig. 5;

Fig. 7 is a detailed view partly in section showing the blade support as seen along the line 7—7 shown in Fig. 6 looking in the direction of the arrows;

Fig. 8 is a top plan view of a modified form of structure embodying the principles of the invention;

Fig. 9 is a fragmentary side elevation, partly in section, of the structure shown in Fig. 8;

Fig. 10 is a detailed view taken along the line 10—10 shown in Fig. 9, showing the extension frame positioning mechanism;

Fig. 11 is a plan view of a combined military unit and earth moving device as supported on an armored tank; and

Fig. 12 is a side elevation of the structure shown in Fig. 11.

As is clearly shown in Figs. 1 to 3, inclusive, the apparatus comprises a platform 1 upon which is mounted a turn-table 2 movable to any desired angular horizontal position by means of a rack 3, and worm wheel 4 operated by a hydraulic motor 5. The turn-table carries a supporting frame 6 provided with pivots 7 for a main frame 8 having a rearward cross-bar 9 upon which a counterweight may be supported. At the forward end of the main frame a pair of guide sleeves 11 are provided within which are engaged tubular slide members 12 of an extension frame having a cross-

head 13. The tubular slide members 12 have telescopically engaged therein extension frame members 14 having terminals 15 pivotally connected with the sliding sleeves 16 engaging a bar 17 supported in a bracket 18 which may be secured to the blade 19 in a variety of positions through the use of bolts 21 engaged through various apertures 22 adjacent each of the blade ends, respectively. Supporting arms 23 are secured to the respective ends of the blade by means of bolts 24, and pivoted straps 25 having slotted ends 26 with securing bolts 27 are connected with said arms to permit a range of adjustment corresponding to the range of adjustment provided for the blade through the series of holes 22 heretofore referred to. It is obvious that tilting, as well as laterally positioning of the blade, is provided for by the adjustment referred to. By means of a sleeve 28, shown in Fig. 6, engaged over one of the extension members 14 formed in sections to permit sliding adjustment within the sleeve a variation in the angular position of the blade may be obtained through the use of the set screws 29, 30. Through the mechanism just described, the blade, preliminary to operation on any particular surface, may be adjusted to a suitable angle of contact with such surface so as to bring about a predetermined displacement of earth at such point.

The means for operating the tubular slide member 12 and the blade member supported thereon may take various forms, but as shown, comprises a hydraulic cylinder 31 supported on a cross-bar 32 by means of trunnions 33 engaging suitable apertures in a pair of spaced angle plates 34. The piston rod 35 is pivotally connected to the cross-head 13 by means of a pin 36. The hydraulic cylinder is supplied with hydraulic pressure by means of a conduit 37 communicating with one end thereof and a conduit 38 connected with the opposite end thereof, each controlled by a valve mechanism 39 mounted on said supporting frame 6. The hydraulic mechanism just described provides means for reciprocating the blade within the guide sleeves 11 at whatever angle of adjustment such guide sleeves are held at through the angular adjustment of the main frame 8 heretofore described. The adjustment of the main frame on its pivots 7 is accomplished by means of an extension arm 41 mounted on a pivot 42 adjacent the upper portion of the supporting frame and actuated by means of a short extension arm 43 having a plurality of apertures 44 for connection with the terminal member 45 on the piston member 46 of a hydraulic cylinder 47 having pivots 48 at its rearward end engaged with an extension arm member 49 at the upper end of the supporting frame. By means of conduits 51, 52, connected with the respective ends of the cylinder 47 hydraulic pressure may be admitted at either end of the cylinder by means of the valve mechanism 53 mounted at the upper end of the supporting frame.

The source of hydraulic power for the hydraulic cylinder above described may be of any conventional type, that illustrated comprising a gas engine 54 driving a pump unit 55 and an auxiliary pump unit 56 connected with a reservoir 57 and having pressure lines 58, 59, connected with the valve control mechanisms 39 and 53 hereinabove referred to. Such pressure lines also extend to the hydraulic motor 4, heretofore described, having conventional valve mechanism for controlling the angular position of the turntable.

From what has been above stated it will be noted that the hydraulic cylinder 47 may be operated to raise the supporting arm 41 and through its associated link 61 connected thereto by pivot pin 62 and connected at its free end by means of a pivot pin 63 with an extension support 64 and brace 65 secured to the main frame 8 and cross-bar 32, respectively. When the desired height of adjustment of the main frame is provided for the blade is reciprocated to the extent desired by means of the hydraulic cylinder 31 and its associated mechanism. Through the control of each of the valve units 39 and 53 composite movement of the blade may be brought about.

The adjustment of the blade to various angles, as well as the substitution for the blade illustrated in Figs. 1 to 3 of various types of material moving implements, such as shovels, scoops, rakes and rollers, tongs, and other implements, may be readily arranged for by supporting such specialized implements on the brackets 18, heretofore described.

In order to provide for an adjustment of various angular positions of the working cylinder and associated mechanism for operating the blade, the apparatus may embody means for carrying such mechanism in pivoted relation to the main frame. A construction of this character is illustrated in Figs. 8 to 10, inclusive, and comprises a main frame 71 pivotally mounted on the supporting frame 6 by means of pivots 72 and adjusted on such pivots by means of a cylinder 73 and associated mechanism, including the pivoted arm 74 and arch support 75 connecting said arm with an extension bracket 76 secured to the lower end of the main frame. At the lower end of the main frame pivots 78 are provided upon which the sleeves 81 are pivotally supported, such sleeves being connected by a cross-frame member 82 having a bracket arm 83 with a pivot pin 84 connecting the same to a terminal 85 on the end of a piston 86 of an angle adjusting cylinder 87. The cylinder 87 may have hydraulic conduits 88, 89, connected thereto and separately controlled by means of a valve mechanism connected with a source of hydraulic power similar to the valve mechanism 39 and 53, heretofore described, and carried at the upper end of the supporting frame 6. By means of the mechanism just described the main frame may be tilted to various angular positions about the pivot 72, and the adjustment between the mechanism carried by the sleeves 81 to a secondary angular position may be brought about through control of the hydraulic cylinder 87 and its associated mechanism. The hydraulic cylinder 87, it will be noted, as shown more particularly in Fig. 10, is pivotally supported at its upper end within the arch support 75 by means of a pivot pin 91.

In order to provide for a greater length of stroke for the operating blade without unduly elongating the operating cylinder, a telescopic extension frame may be provided. Such frame may comprise a cross-head 92 having tubular slide members 93 engaged within the tubular slide members 94 sliding within the sleeves 81, and having a cross-head 95 connected with the piston 96 of the operating cylinder 97, similar to such mechanism heretofore described in connection with Figs. 1 to 4, inclusive. By reference to Fig. 9, it will be noted, that an additional operating cylinder 101 is positioned beneath the cylinder 97 and has conduits 102, 103, connected with the respective ends thereof whereby hydraulic pressure may be supplied thereto, and valve control

mechanism similar to the valve control mechanism 39 and 53 heretofore described and mounted at the upper end of the supporting frame 6. This cylinder may be operated simultaneously with the cylinder 97, or in successive manner in connection with said cylinder, as may be desired, and the stroke of the blade will be approximately twice the length of the stroke which could be supplied by a single cylinder. The cylinder 101 carries a piston rod 104 connected by means of a pivot-pin 105 with the cross-head 92, heretofore described. The cylinder 101 is mounted on a cross-frame member 106 carried adjacent the forward ends of the tubular slide members 94 operating within the sleeve 81.

With the mechanism just described any desired angle about the pivot 72 may be provided for through the operation of the cylinder 73 and its associated mechanism, and thereafter additional adjustment of the angle of the working stroke may be provided through the operation of the cylinder 97 and its associated mechanism. Thereafter the reciprocating stroke of the blade, or other implement which it is desired to operate with, is brought about through control of the cylinders 97 and 101 and their associated mechanism, either simultaneously or successively, as desired. This control may be accompanied by supplementary control through either the cylinder 73 or the cylinder 97 at the same time, and thus practically any desired contour of the surface operated on can be brought about with a minimum of effort and with a satisfactory finished effect. The mounting of the blade mechanism in the modified form of construction just described may be identical with that just described in Figures 1 to 4, inclusive, and the same reference characters have been applied to said members.

In order to meet the requirements of modern mechanized warfare wherein large numbers of tank units are employed and wherein defense operations involving the digging of ditches and pits into which tanks will be entrapped are extensively employed, it is desirable to provide suitable means on such tank units to prevent loss of such apparatus through such defense practice. In order to meet such conditions a tank unit may be provided with a combined excavating and military unit which will permit a tank to provide a path for escape from a ditch when such procedure is called for, and which at the same time will be able to provide a place of partial concealment to remove the main body portion of the tank from danger or injury from enemy projectiles. Such excavating mechanism is of a heavy construction and may readily carry any suitable pieces of ordnance found desirable for operation from the point of concealment. Thus such ordnance will have in effect the advantages of guns carried on disappearing mounts, such as are commonly used in coastal fortifications.

To accomplish the object just mentioned the structure is preferably mounted on a turret 111 carried on a tank body 112 of conventional design, such turret providing pivots 113 for the main frame 114 having a rearward cross-bar 115 which may carry suitable counter-weights, if desired. The main frame is adjusted as to position by means of a hydraulic cylinder 116 connected by means of a piston 117 and terminal member 118 with the operating extension 119 of a supporting arm 121 connected by means of a link 122 with an arch support 123 secured to the free ends of the main frame. Pivots 124 are carried on the main frame members and support guide sleeves 125 through which tubular slide members 126 are operatively engaged, such slide members being connected with a yoke 127. A cross-bar 128 secured to said slide members supports an auxiliary operating piston 129 corresponding in action with the auxiliary cylinder 101, heretofore described. The guide sleeves 125 are connected by cross frame member 131 having a pivot member 132 connected with the piston 133 of a positioning cylinder 134 pivotally mounted at the free end of the arch support 123 on a pivot pin 135. The tubular slide members 126 have engaged therein auxiliary slide members 136 connected by means of a cross-member 137 to provide a support for a standard 138 upon which is adjustably mounted a piece of ordnance 139 adapted to be held above the upper portion of the tank in a position to fire over an embankment. The auxiliary cylinder 129 is provided with a piston rod 141 connected with a pin 142 which moves the auxiliary cross-head 143 forward when such auxiliary cylinder is actuated. The implement 144 carried at the front end of the apparatus is indicated as having a horizontal extension so that the device may be used as a shovel when so mounted, and may be used as a scraping blade when reversed to present the shovel portion in dotted line position. Thus the tank may provide a point of defense by pushing the earth away from the tank, or by scraping earth toward the apparatus, or by means of a shoveling operation.

Where a tank builds an entrenchment the earth obtained from the digging may be turned up as an embankment 145, as shown in Figure 12,. The operation of the device will be readily understood from what has been stated with reference to other modified forms of this apparatus. It is to be understood that where desired the mechanism may very closely approach the tank body in order to permit protected operation of the units carried by the framework.

Other modes of applying the principle of our invention may be employed instead of those explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated be employed.

We therefore particularly point out and distinctly claim as our invention:

1. An apparatus of the character described having in combination a platform, a rotatable support on said platform, an outwardly projecting unit providing a guide portion and having an extension member pivotally mounted on said support, a material moving blade supported for adjustment about a transverse axis on said extension member, adjustable means acting between the support and the guide portion of said unit whereby said material moving blade is supported for sliding movement at a predetermined angle to the surface to be operated on, means for holding said blade in adjusted relation to the extension member, and means for moving said extension member and associated material moving blade along said path of sliding movement.

2. An apparatus of the character described having in combination a platform, a rotatable support on said platform, an outwardly projecting unit providing a guide portion and having multiple extension members pivotally mounted on said support, a material moving blade supported for adjustment about a transverse axis on said extension members, adjustable means acting between the support and the guide portion

of said unit whereby said material moving blade is supported for sliding movement at a predetermined angle to the surface to be operated on, means for holding said blade in adjusted relation to the extension member, and means for moving said extension members and associated material moving blade along said path of sliding movement.

3. An apparatus of the character described having in combination a platform, a support mounted on said platform, means for rotating said support acting between said support and said platform, an outwardly projecting unit providing a guide portion and having an extension member pivotally mounted on said support, a material moving blade supported for adjustment about a transverse axis on said extension member, adjustable means acting between the support and the guide portion of said unit whereby said material moving blade is supported for sliding movement at a predetermined angle to the surface to be operated on, means for holding said blade in adjusted relation to the extension member, and means for moving said extension member and associated material moving blade along said path of sliding movement.

4. An apparatus of the character described having in combination a platform, a rotatable support on said platform, an outwardly projecting unit comprising a frame having parallel side rails pivotally carried by said support, an extension member mounted for sliding movement on said side rails, hydraulic means for actuating said extension member, a material moving blade carried on said extension member, adjustable means whereby said material moving blade is supported for sliding movement at a predetermined transverse angle around the axis of the extension member and for angular variation in relation to the extension member, and means acting between said support and said frame for changing the angular position of said frame and said extension member with reference to said platform.

5. An apparatus of the character described having in combination a platform, a rotatable support on said platform, an outwardly projecting unit comprising a frame having a slideway pivotally carried by said support, an extension member mounted for sliding movement on said slideway, means for actuating said extension member, a material moving blade carried on said extension member, adjustable means whereby said material moving blade is supported for sliding movement at a predetermined transverse angle around the axis of the extension member and for angular variation in relation to the extension member, and hydraulic means acting between said support and said frame for changing the angular position of said frame and said extension member with reference to said platform.

6. An apparatus of the character described having in combination a platform, a rotatable support on said platform, an outwardly projecting unit comprising a frame having a slideway pivotally carried by said support, an extension member mounted for sliding movement on said slideway, hydraulic means for actuating said extension member, a material moving blade carried on said extension member, adjustable means whereby said material moving blade is supported for sliding movement at a predetermined transverse angle around the axis of the extension member and for angular variation in relation to the extension member, and hydraulic means acting between said support and said frame for changing the angular position of said frame and said extension member with reference to said platform.

7. An apparatus of the character described having in combination a platform, a support pivotally mounted on said platform, hydraulic means for rotating said support acting between said support and said platform and operative through an angle of not less than 180° of circular movement around its pivot, an outwardly projecting unit comprising a frame having a slideway pivotally carried by said support, an extension member mounted for sliding movement on said slideway, hydraulic means for actuating said extension member, a material moving blade carried on said extension member, adjustable means whereby said material moving blade is supported for sliding movement at a predetermined transverse angle around the axis of the extension member and for angular variation in relation to the extension member, and hydraulic means acting between said support and said frame for changing the angular position of said frame and said extension member with reference to said platform.

8. An apparatus of the character described having in combination a platform, a rotatable support on said platform, an outwardly projecting unit providing a guide portion and having at least one extension member pivotally mounted on said support, a material moving blade supported for adjustment about a transverse axis on said extension member, means acting between the support and the guide portion of said unit whereby said material moving blade is supported for sliding movement at a predetermined angle to the surface to be operated on, means for holding said blade in adjusted relation to the extension member, and means for moving said extension member and associated material moving blade along said path of sliding movement.

9. An apparatus of the character described having in combination a platform, a rotatable support on said platform, an outwardly projecting unit providing a guide portion and having at least one pair of extension members pivotally mounted on said support, a material moving blade supported for adjustment about a transverse axis on said extension members, means acting between the support and the guide portion of said unit whereby said material moving blade is supported for sliding movement at a predetermined angle to the surface to be operated on, means for holding said blade in adjusted relation to the extension member, and means for moving said extension members and associated material moving blade along said path of sliding movement.

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