Feb. 9, 1937. A. L. KENNEDY 2,070,436

TERRACER

Filed May 11, 1935 6 Sheets-Sheet 1

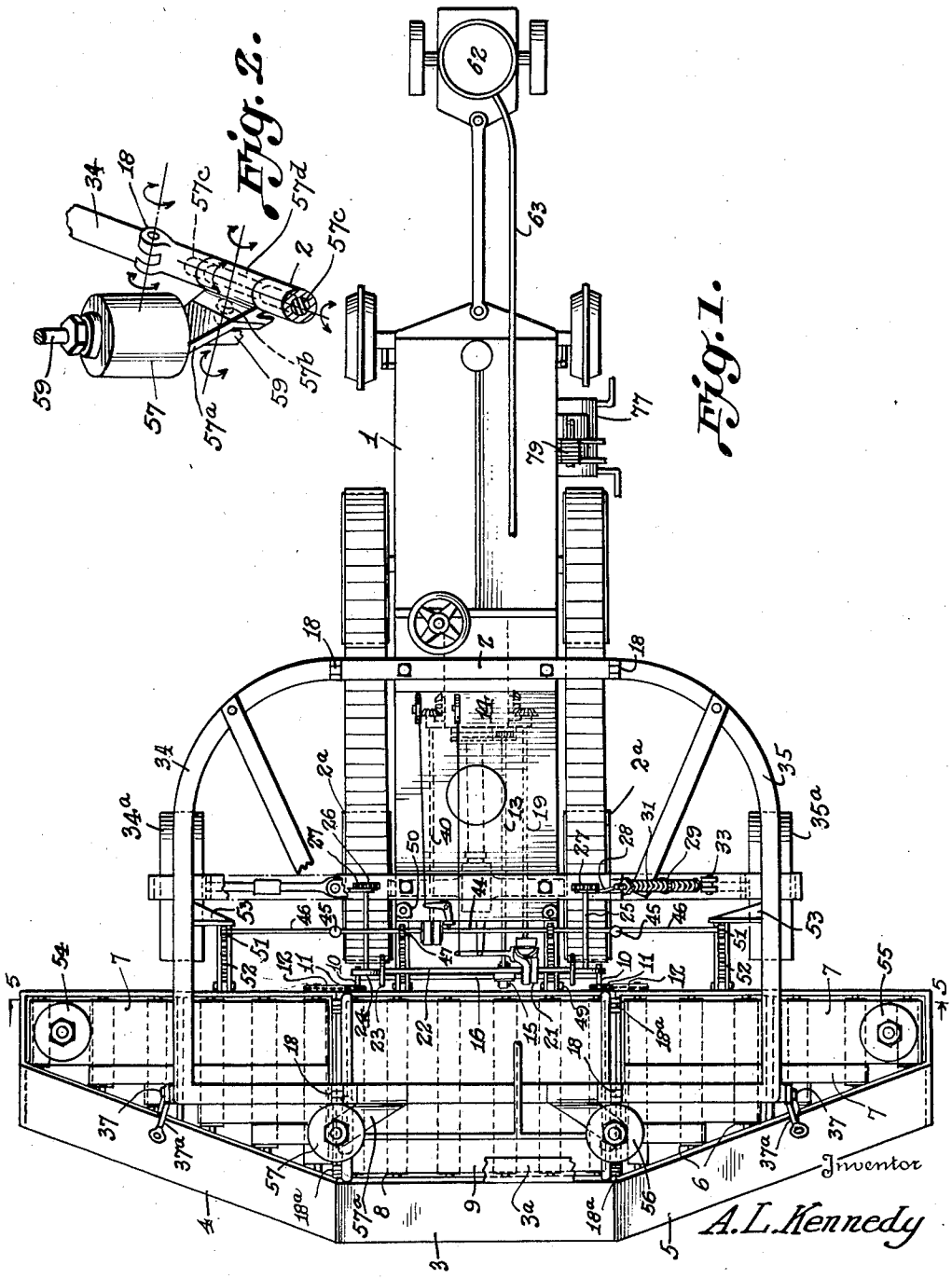


Fig. 2.

Fig. 1.

Inventor
A. L. Kennedy
By Lester L. Sargent
Attorney

Feb. 9, 1937. A. L. KENNEDY 2,070,436

TERRACER

Filed May 11, 1935 6 Sheets-Sheet 2

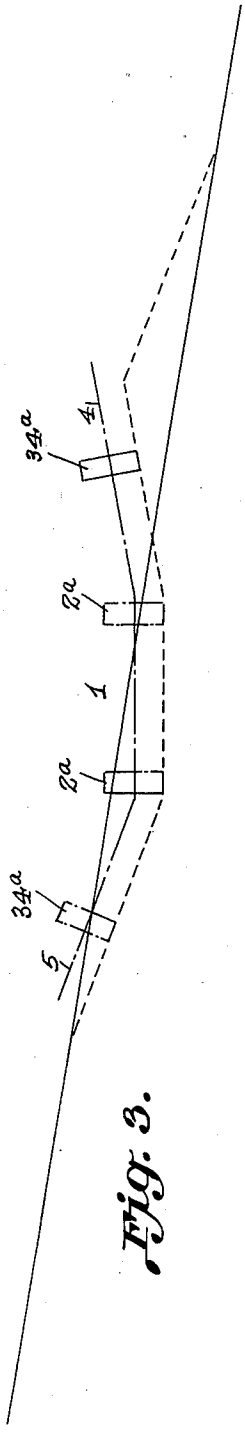


Fig. 3.

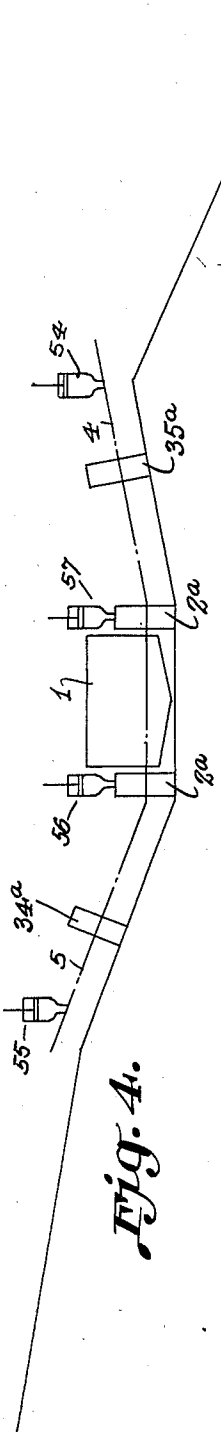


Fig. 4.

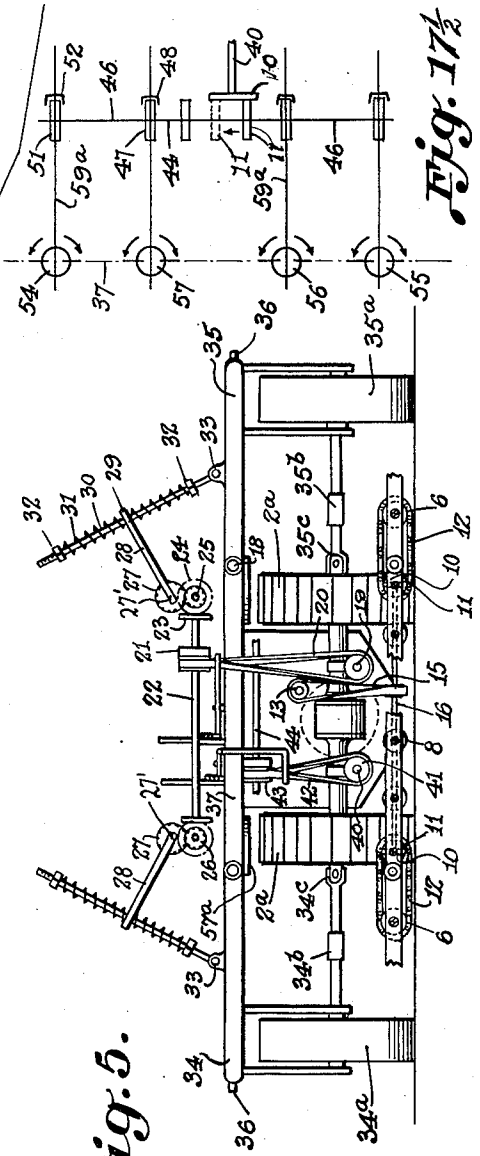


Fig. 5.

Fig. 17½

Inventor
A. L. Kennedy

By Lester L. Sargent

Attorney

Feb. 9, 1937. A. L. KENNEDY 2,070,436

TERRACER

Filed May 11, 1935 6 Sheets-Sheet 3

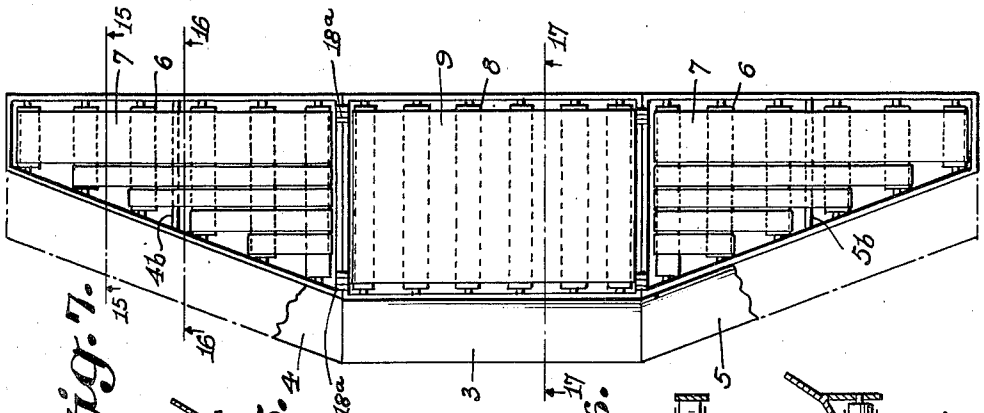


Fig. 7.

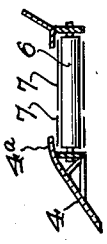


Fig. 15.

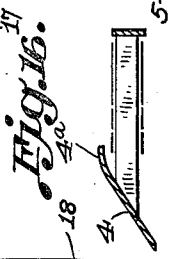


Fig. 16.

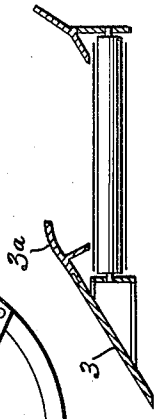


Fig. 17.

Fig. 6.

Inventor

A. L. Kennedy

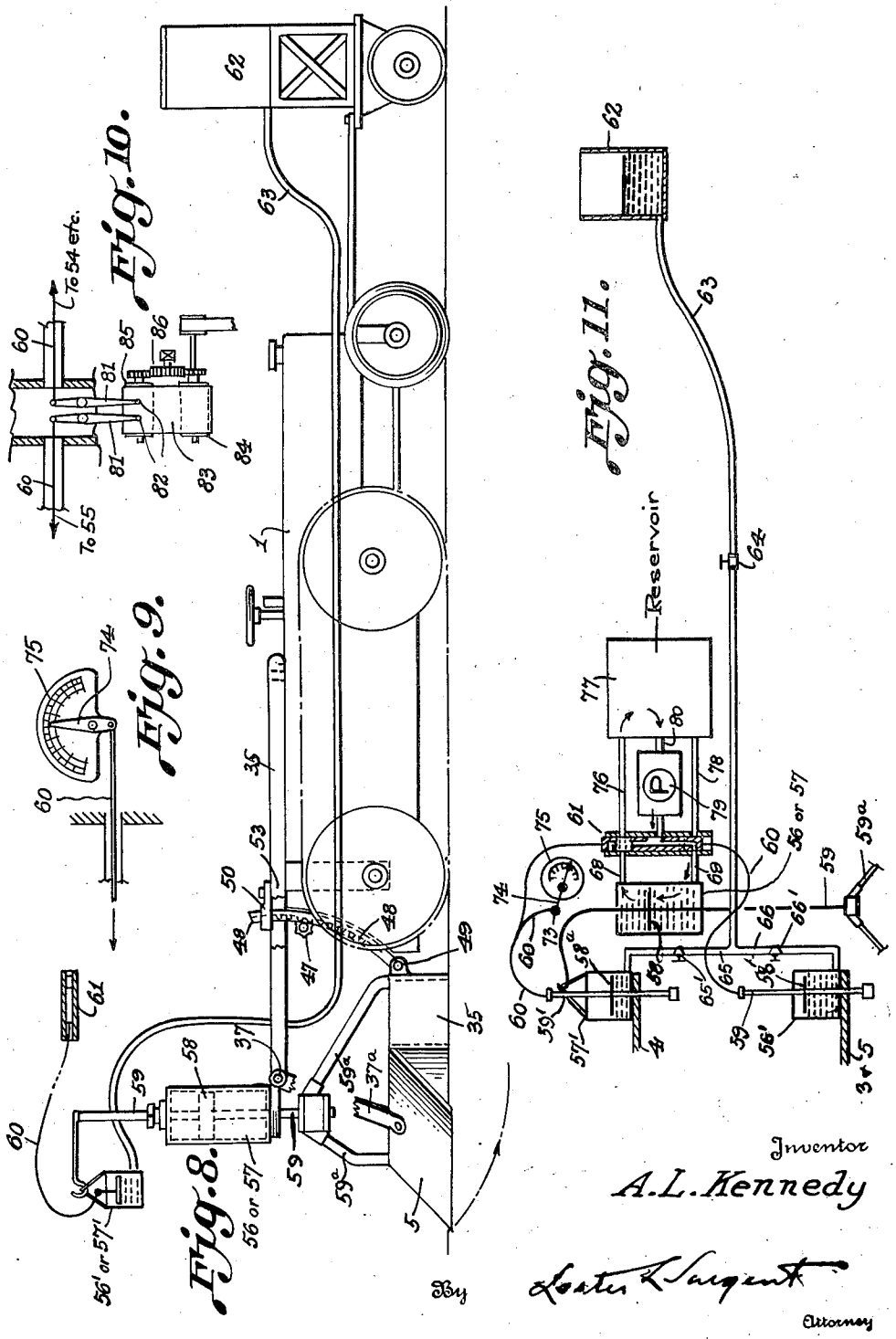
By Lester L. Sargent

Attorney

Feb. 9, 1937. A. L. KENNEDY 2,070,436

TERRACER

Filed May 11, 1935 6 Sheets-Sheet 4



Feb. 9, 1937. A. L. KENNEDY 2,070,436

TERRACER

Filed May 11, 1935 6 Sheets-Sheet 5

Fig. 12.

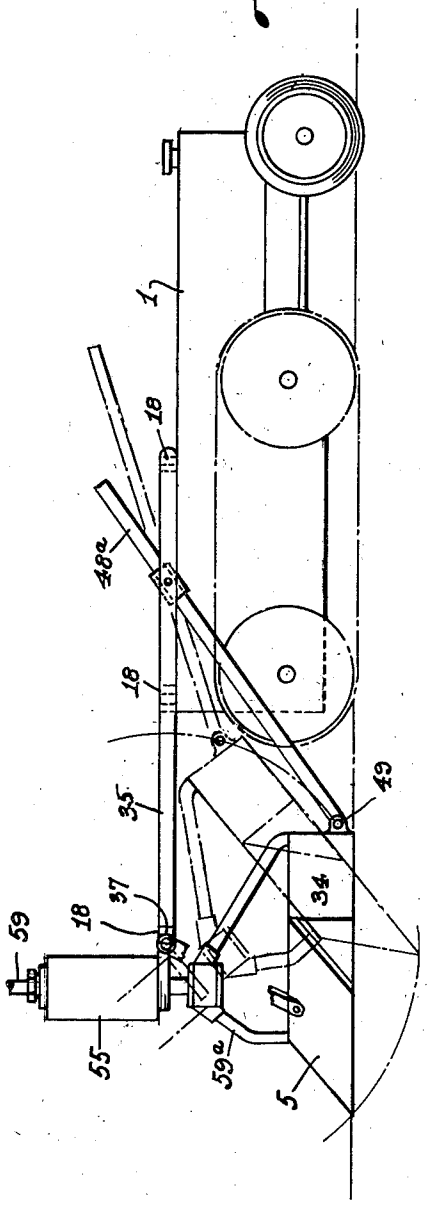


Fig. 14.

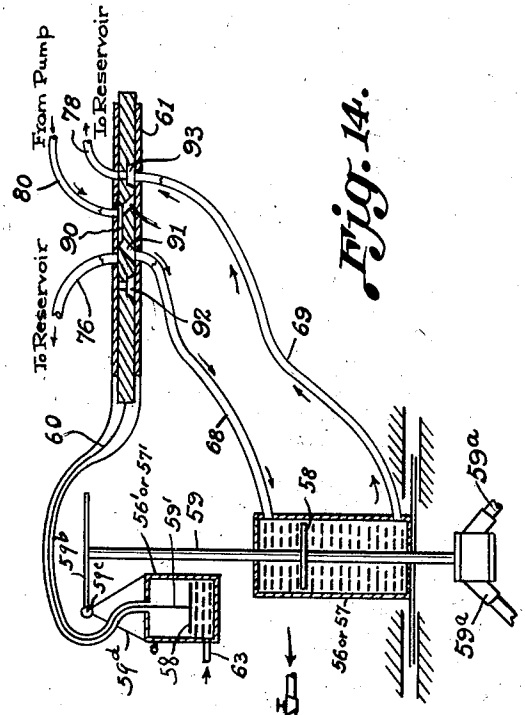
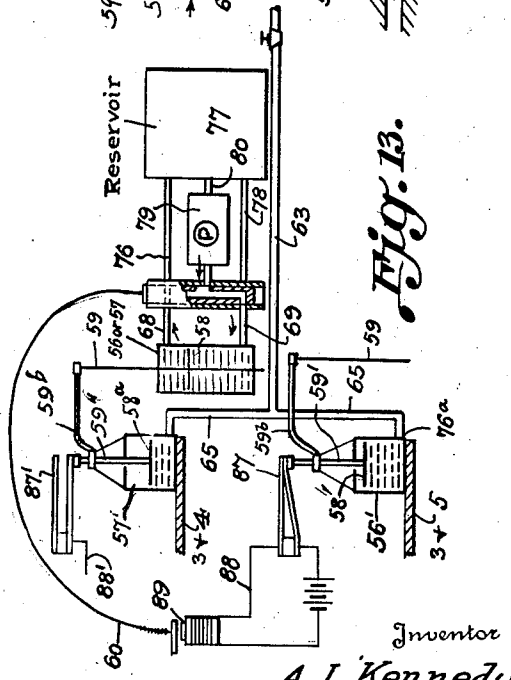


Fig. 13.



Inventor

A. L. Kennedy

By Lester L. Sargent

Attorney

Feb. 9, 1937. A. L. KENNEDY 2,070,436

TERRACER

Filed May 11, 1935 6 Sheets-Sheet 6

Fig. 19.

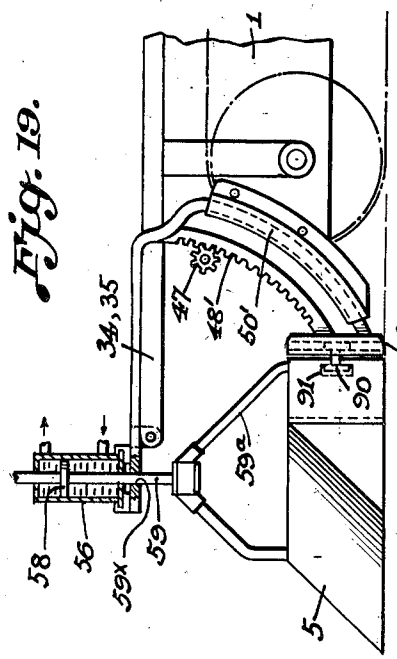


Fig. 20.

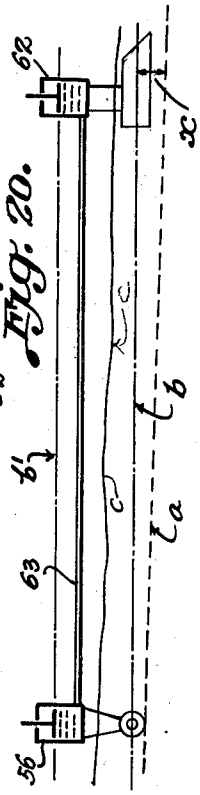


Fig. 22.

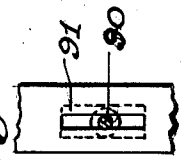


Fig. 21.

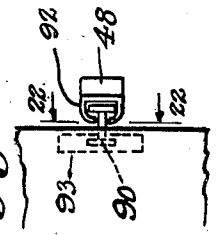
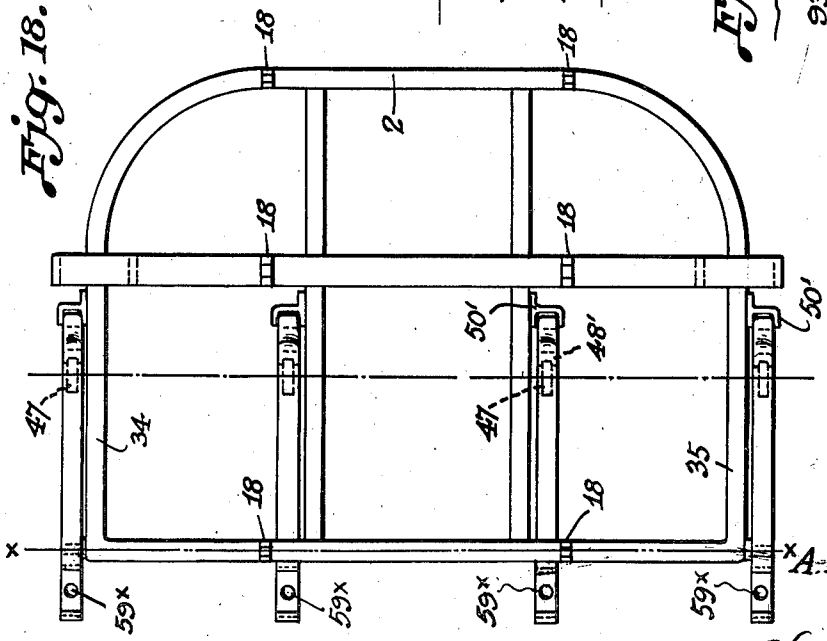


Fig. 18.



Inventor

A. L. Kennedy

By Lister & Sargent

Attorney

Patented Feb. 9, 1937 2,070,436

UNITED STATES PATENT OFFICE

2,070,436

TERRACER

Ausbie L. Kennedy, Niota, Tenn.

Application May 11, 1935, Serial No. 21,038

15 Claims. (Cl. 37—172)

The object of my invention is to provide a new and useful machine for the use of farmers in cutting and forming terraces on side hills to prevent the erosion of soil and to increase the productivity of land so cultivated.

Within the last two or three years the Government has come to the realization that the Nation's fertile soil is rapidly washing into the rivers and the ocean. Ten soil erosion experiment stations have been established in different parts of the country to determine the amount of erosion under various conditions and the best method of stopping it. It has been determined at these stations that good terraces, almost level and with a vertical distance of three or four feet between them, stops the erosion and is the only safe method on cultivated slopes.

Within the last year or so commercial companies have put on the market a terracer very similar to an ordinary road grader for large scale terracing and drawn by a tractor. These outfits have been leased to counties. While the farmers are favorable to the idea of terracing, most of them refuse to have their land terraced because of the high cost, the difficulty of cultivating terraced land, and because a large percentage of the terraces made in previous years have broken open. To overcome these objections I have provided a terracer which, instead of scraping the dirt up and pushing or dragging it down the hill for the bank of the terrace, pushes its cutting blade under the dirt to be excavated and lets it fall on an endless conveyor that carries it at right angles to the direction of the machine to the bank of the terrace. It makes a good broad terrace at one trip across the field and leaves the terrace of the proper shape and slope.

A given field can be terraced several times cheaper, quicker and better with my new machine than with the machines now in use.

It is also an object of my invention to provide mechanism for automatically controling the grade; and to provide a grade indicator whereby the grade controls can be operated manually instead of automatically if desired.

I attain the objects of my invention mainly by the means illustrated in the accompanying drawings, in which—

Figure 1 is a top plan view of the entire machine and the tractor to which it is attached;

Fig. 2 is a detail perspective view of one of the mercury cups for adjusting the machine and the associated mechanism;

Fig. 3 is a cross section of a hillside, the dotted line representing the terrace on which the terracer is operated, the wheels of the machine only being shown in this view;

Fig. 4 is a similar view showing the appearance of the hillside when the terrace has been completed;

Fig. 5 is a rear elevation of the terracer looking in the direction of the tractor from a plane approximately on line 5—5 of Fig. 1;

Fig. 6 is a top plan view of the main frame of the machine, which is made in three parts, the middle part being adapted to be fastened to the top of the rear end of the tractor and the two other parts hinged to the sides of the middle part;

Fig. 7 is a top plan view of the platform and plows of the terracer, a portion of each of the side plows being broken away;

Fig. 8 is a side elevation of the terracer and tractor to which it is attached, the control valve 61 being shown in section;

Fig. 9 is a detail plan view of the grade gauge;

Fig. 10 is a detail plan view of the grade register;

Fig. 11 is a diagrammatic view of the hydraulic control mechanism for controlling the elevation of the wing or side parts;

Fig. 12 is a side elevation of a modified form of the invention;

Fig. 13 is a diagrammatic view of a modified form of the invention in which electrical means are provided for automatic electrical control of the hydraulic means;

Fig. 14 is a view partly in diagram and partly in section and partly in elevation of the hydraulic control mechanism and control valve;

Fig. 15 is a section on line 15—15 of Fig. 7;

Fig. 16 is a section on line 16—16 of Fig. 7;

Fig. 17 is a section on line 17—17 of Fig. 7;

Fig. 17½ is a diagrammatic view of a modified friction drive in place of the belt and pulleys 41, 42 and 43;

Fig. 18 is a top plan view of the main frame of the machine showing a slight modification from the construction illustrated in Fig. 6;

Fig. 19 is a side elevation illustrating the mechanism for tilting the platform;

Fig. 20 is a diagrammatic view illustrating the gravity grade register mechanism;

Fig. 21 is a detail view of the means for lateral motion of a section of the platform with respect to members 48; and

Fig. 22 is a detail rear view of the platform on line 22—22 of Fig. 21, showing the relation of members 90 and 91.

Like characters of reference designate like parts in each of the several views.

Referring to the accompanying drawings, 1 designates a conventional track type tractor to the top of the rear end of which is attached the supporting frame of my terracer which is made in three sections. The main middle frame 2 has side frames 34 and 35 which are hingedly connected to the middle frame 2 by suitable hinges 18. A central plow 3 is attached to the adjacent portion of the main or middle frame 2. A side or wing plow 4 is attached to the adjacent side frame 34 and movable with said frame. An opposite side or wing plow 5 is attached to the adjacent opposite side frame 35 and movable with said frame. The two side frames have side supporting and traction wheels 34*a* and 35*a* under them in line with the main traction wheels 2*a* to which they are connected by means of shafts 34*b* and 35*b* and universal joints (and clip joints if desired) 34*c* and 35*c*.

The above described frame as a whole projects out from the end of the tractor to suspend a long platform with an endless conveyor and plow blades at the front. To form this conveyor there are provided, rearwardly of the side plow 5 and suitably mounted, a series of rollers 6 of graded sizes, as shown, on which are mounted a series of conveyor belts 7. On the opposite wing, rearwardly of plow 4, are similar rollers 6 and conveyor belts 7, and rearwardly of central plow 3 are a series of rollers 8 of uniform length on which are mounted a conveyor belt 9. As shown in Figs. 15 and 16, a flange or rear portion 4*a* of the plows 4 and 5 overlap the ends of the rollers 6. Plow 3, as shown in Fig. 17, is provided with an extension 3*a* which raises the layer of soil cut by the middle blade up over the dirt that is already on the platform. Without this the dirt would push against the dirt on the platform and cause dragging. This extension is removable.

Together these three sets of rollers and conveyor belts form a continuous endless conveyor from the end of one side frame across the middle frame to the end of the other side frame. The rollers 8 of the middle frame are operated by a chain from a friction drive to be presently described. The conveyor belt of the middle section is one piece and the side edges are arranged so that dirt can not get under it. The conveyors for the side platforms are in narrow strips or belts to permit the ends to come as close to the edge of the slanting plow blade as possible. The edge of the longer conveyor belt laps over the edge of the shorter conveyor belt to prevent dirt from getting under the elevator.

I provide inner rollers 6 on each of the wings of the terracer which are driven by chain 12 from sprockets 11 on the shaft of the rollers 8, the rollers 8 being driven by suitable means from the power plant of its tractor, as by cross shaft 16 which is rotated by belts and pulleys 15 through the shaft 13 by the power plant 14 of the tractor. Or I may utilize friction discs driven by shaft 40, as shown in Fig. 17½, to transmit power to the rollers and conveyor belts of the side frames. The aforesaid mechanism is reversible by shifting gears, as shown in Fig. 1, for driving rollers and conveyor belts in a reverse direction when desired.

As shown in Fig. 5, I provide means for elevating and lowering the side frames 34 and 35 and their corresponding side plows 4 and 5. In Fig. 1 the shaft 19 operating only one of the side plows is illustrated for sake of clearness, in view of the small size of the parts in this figure. Like mechanism similarly positioned and on the opposite side is used for elevating and lowering side frame 34 and plow 4. These side frames are to be made heavy enough to give stability to the corresponding side platforms to which they are connected, but provision is made for applying pressure from the tractor by means of a power transmission arrangement as indicated in Fig. 5.

Referring to Fig. 5, there is illustrated a belt 20 driving shaft 19 from pulley 21 on cross shaft 22. Cross shaft 22 carries a friction gear or disc 23 which is frictionally driven by a friction gear or disc 24 mounted on shaft 25. On the end of shaft 25 nearest the tractor is a gear 26 meshing with friction slide gear 27 disposed above it. Friction slide gear 27 turns an axis 27′ and actuates arm 28, which is rigidly affixed to gear 27. Arm 28 is provided with an eye 29 through which the pull rod 30 extends. Suitable coil springs 31 encircle rod 30, and at one end springs 31 engage the arm 28 and at the other end engage the nuts 32 which have a screw-threaded engagement with the rod 30 to permit adjustment of the tension of the springs. Pull rod 30 has a hinge connection 33 with the adjacent end of the side frame. Arm 28 presses against the springs 31 to raise or lower the side frame to which it is connected. The side frames 34 and 35 of the frame are pivotally connected with the middle frame by the pivot connections or hinges 18,—see Fig. 6. The side platforms are pivotally connected to main platform by hinges 18*a*,—see Fig. 7.

As shown in Figs. 1 and 8, numeral 37 designates the tilting axis of the central and side plows of the machine. The respective plows 4 and 5 are secured by links 37*a* to the projections 36 on the ends of side frames 34 and 35, respectively.

Referring to Fig. 1 of the drawings, I provide a shaft 40 operatively connected with the power plant 2 of the tractor and carrying the pulley 41, which is connected by belt 42 to pulley 43 on cross shaft 44, as shown in Figs. 5 and 1. Shaft 44 is connected by universal joints 45 with stub shafts 46, which carry pinions 47 which mesh with the arcuate racks 48 for the middle frame and plow, (see Fig. 8). Said arcuate racks have a hinge connection 49 with the respective side frames 34 and 35.

The arcuate gears 48 are held in operative engagement with pinions 47 by the collars 50 which are mounted on the side frame extension members 53, as shown in Figs. 1 and 8. As shown in Fig. 1 pinions 51, and arcuate racks 52 operate side frames 34 and 35 and their plows, pinions 47 and 51 all being mounted on shaft 46.

The whole platform must tilt about only one assumed axis, which is indicated by the dot and dash line *x*—*x* shown in Figs. 6 and 18 of the drawings. Otherwise the platform will be twisted. Except for the tilting about the axis *x*—*x*, the members 48 are rigid with respect to their respective frames. They do not move up and down with the platform. This would cause twisting of the platform and members 48 could be considered a part of the frame.

Fig. 12 shows a modification of the invention in which a member 48*a* (in lieu of arcuate gear 48) is hingedly connected to the plow side frame 34 to tilt same as indicated in dotted lines.

In Fig. 8 there is illustrated more in detail the up and down motion and the tilting motion of the conveyor platform. The members 59 supporting the conveyor platform (and there are four of these supports, one for each hydraulic cylinder) are forked at the lower end as at 59*a*, to support or be affixed to the front and rear

of the platform, as shown in Fig. 8. The top part or rod 59 is straight and round and is rigidly fastened to the piston 58 in the hydraulic cylinder. Rod 59 slides through a round aperture of similar size in the frame. This prevents any side motion. The bottom of the cylinder is attached to the frame and moves with the frame on the axis 37.

As shown in Fig. 2, the hydraulic cylinder 57 at its bottom portion is attached to an arm 57*a* which has a pivotal connection 57*b* with the member 57*d* to permit of lateral pivotal movement, and the rod 57*c* rotatably seats in the channeled cylindrical element 57*d* which engages the end which is grounded longitudinally in frame member 2, to permit of up and down tilting movement and also lateral twisting movement as indicated by the arrows in Fig. 2. Cylinder 56 is connected in like manner to frame member 2. These cylinders can be fastened rigidly to member 2 to allow up and down tilting movement only.

Referring to Figs. 8 and 11, each of the mercury cylinders 56' and 57' is provided with a piston 58' and 58*a*, respectively, floating on the mercury (or other heavy liquid) in the cylinder. The pistons 58' and 58*a* are each connected by piston rods 59 and 59' to a flexible shaft 60 which is affixed to the control valve 61 to actuate it. As shown in Fig. 11, when either or both ends of the middle plow of the terracer drops lower than the trailer, mercury will be fed by gravity from the mercury container 62 through a pipe 63 (which is provided with a regulating valve 64) and to branch pipes 65 and 66 which extend respectively to the mercury chambers 56' and 57' mounted on the middle frame, raising the plunger with it, which pushes flexible wires 60 and in turn operates valve 61. Pipe 66 has a suitable manually operated valve 66' and pipe 65 has a suitable manually operated valve 65' as shown.

The hose 63 is forked to go to the two controls of the middle plow 3, and of course this operates the inside ends of the side plows. There are four controls or supports for the platform and plows 54, 55, 56, and 57. In my terracer I choose the hydraulic system of operation. The four cylinders 54, 55, 56, and 57 are identical and their operations by the power plant by means of a pump and liquid (usually oil), are identical. But the control of the operation of members 54 and 55 is different to the control of the operations of members 56 and 57. The control of operation of members 54 and 55 is manual as employed on the conventional grader. The control of the operation of members 56 and 57 is automatic, made possible by my gravity grade register system.

Referring to Fig. 14, there is illustrated a grade register indicator and grade register in which, control valve 61 is connected by pipes 68 and 69 with the upper and lower ends of hydraulic cylinder 56 or 57, in which is a piston 58 carrying a piston rod 59. Pipe 76 extends from the upper portion of valve 61 to a reservoir 77, and pipe 78 extends from the lower portion of the reservoir 77 to the lower end of the control valve 61. A pump 79 is connected by pipes 80 with the central portion of the reservoir to the central portion of the control valve.

The elevation of pistons 58 and 58*a* in hydraulic cylinders 56' and 57' determines the position of the plow blade 3 with respect to the trailer and hence the grade.

Fundamentally the gravity grade register system has only two terminals—one on the plow directly in front of the tractor and one on a trailer directly behind the tractor. The greater distance apart of these two terminals makes possible more accuracy. These two terminals consist of hydraulic cylinders connected by a hose. Gravity keeps the level of the liquid in these two cylinders at these two terminals exactly the same. Now if the plow started to go deeper or not as deep thereby lowering or raising the cylinder with respect to the cylinder on the trailer at the rear terminal, the liquid would rise in the cylinder on the plow if the plow was lowered and it would be lowered with respect to the cylinder on the plow if the plow was raised. Now if these two cylinders at these two terminals are made fairly large in cross section and if mercury is employed as the liquid and if we float pistons on top of the mercury in the two cylinders, the pressure exerted on these pistons (one at a time) will be great enough to operate our power controls when the blade is raised or lowered to an excess amount.

In Fig. 20 the line *a* is the bottom of the terrace, *c* is the top of the bank of the terrace, and *b* and *b'* are level lines. The amount *x* that *a* has been lowered or raised with respect to *b* from the trailer is the grade. Now if the plow was lowered two inches with respect to the trailer it would be two inches off the grade line, the level of the liquid in the cylinder on the plow would rise one inch. In rising it would raise the piston which in turn would operate the power controls so that the power could be applied to raise the plow back to the grade line.

The placing of the front cylinder on a projection of the piston rod 59 is the same as placing it directly on the plow and it gets it up high out of the way of the moving dirt.

Since the middle plow is supported at two points and operated at two points I fork the hose from the trailer to go to a mercury cylinder at each of the two points. Since the two points under consideration are the same distance from the trailer, gravity will continue to operate at these two points. If it is desired to operate or control the operation of one of these points manually it can be done by closing the valve on the hose to the respective point.

The pressure exerted on the plunger in the mercury cylinder is determined by the cross section area of the cylinder, the density of the liquid, and the difference in elevation of the level of the liquid of the various cylinders connected together. For a very accurate grade a difference in the levels of the liquid of a small fraction of an inch should set the controls to bring it back on a level. For a small practical size cylinder, mercury or some other heavy liquid would have to be used.

There are other ways of registering the difference in elevation. One method would be to have the liquid close an electric circuit when it came to a certain height in the cylinder. However, the method described will give the smoothest operation. By this method the rate of the lowering or raising of the blade would be determined by the difference in the elevations of the liquid in the cylinders, the greater the difference the faster the movement of the blade to make the correction. Since a few pounds will operate the controls of a hydraulic system or a motor control system it is believed that plunger method will work. Means would have to be provided for the plunger to return when the liquid under it is lowered. This could be done by a weight on the plunger with a

similar weight on the other pistons of the cylinders connected with it.

Referring to Fig. 11, in operation piston rod 59' pushes the flexible shaft 60 which in turn operates the hand 74 of the grade indicator 75 at the pivot connection 73.

Referring to Fig. 10, there is illustrated a register comprising pivoted hands 81 connected at one end to the respective flexible shafts 60, and at the other end carrying pencils, or the like, 82, which continuously mark on the paper roll 83 to continuously record the relative position of the middle plow with the trailer. The strip of paper 83 starts to unroll from one roller 84 to the other roller 85 by means of suitable gearing 86, as shown in Fig. 10, operatively connected with one of the driving shafts of the apparatus. Both the operator's grade indicator and grade register have an arm hinged near the middle with one end connected to the flexible wire from the plunger of the mercury cylinder and the other end pointing to graduations in the case of the indicator and marking on a rotating strip of paper in the case of the register. The strip of paper has lines parallel with its length for level lines and cross section lines graduated for distance. This long strip of paper rolls off of one roller on to another roller. It is accessible to the operator for making notes. He could write at the beginning of each operation the name of the field or even the number of the terrace in the field or any other information so that the grade lines could be read with intelligence later.

Referring to Fig. 13, there is illustrated means for automatic control of elevation of the middle plow comprising an electric switch 87 which is shown held in a closed position by means of the piston rod 59' pressed against the resilient member of the electric switch by the mercury in chamber 56', lifting piston 58'. When the middle plow (or either side or end of the middle plow) of the terracer drops, with respect to the trailer, thereby allowing more mercury to flow into the chamber 56' or 57' or both by gravity, this action closes the electric circuit 88 and actuates the solenoid 89 which operates the flexible rod 69 and the attached plunger which lets the pump raise the lowered part.

Fig. 21 illustrates a detail of the means for lateral movement of a section of the platform with respect to member 48.

For terracing the procedure and the operation is as follows:

The engineer in charge surveys and stakes the first line in a field to be terraced. He then puts up a stake at each end of the other assumed lines. He finds the right point by means of the vertical distance. There may be special lines that the engineer will need to survey due to irregular contour. In all cases just enough stakes are necessary to show the operator where the terrace begins, and indicate in general how it is going to run.

Once the grade has been decided upon and the adjustments made accordingly the operator's job is to guide the machine, and make the proper manipulations of the controls at his disposal to make a nice uniform size terrace. He can raise or lower the upper cutting blade to supply him more or less dirt as needed. He can slow down the speed of the elevator or conveyor to carry extra dirt on the platform to weak points ahead. At the weak points he speeds up the conveyor to supply an extra mount of dirt. By means of these two features he can straighten a terrace considerably, cutting deep in high places and filling in low places and draws. He keeps a watch on the grade indicator to check the automatic controls. He also watches the height indicator, the indicator registering the height of the terrace above the bottom of the ditch above.

A diagrammatic view of the portion of the terracer is shown in Figs. 3 and 4. In Fig. 3 the slanting line represents the cross section of the hillside, and the dotted line represents the terrace on which the terracer is operated, the wheels of the machine only being shown in view. In Fig. 4 the outline of the terrace hillside after the terracer has passed is shown in full lines, and a diagrammatic view of the rear of the terracer is shown.

The operator determines to some extent the shape of the terrace, whether narrow or wide. A higher speed of the elevator will throw the dirt farther down the hill. This feature does not conflict with the feature of varying the speed of the elevator for uniformity in size. As a matter of fact, the two work together. Extra dirt is needed below a high fill and the speeding up of the elevator to supply the extra dirt for the fill also does the other feature of throwing some of it farther down the hill. For a deep cut a smaller bank is thrown up below and hence it does not need to be so wide.

He also determines to some extent the distribution of the dirt by the position of the platform with respect to the surface. With the platform pitched forward more dirt will be dumped on the upper side of the terrace. With the platform parallel with the surface or with the rear lower than the front, more dirt will be shifted to the rear portion and will be dumped at the extreme end of the platform.

This machine is unique for terracing, and it is also intended as a general purpose excavator and grader. The long elevator grader makes it especially good for building roads on hillsides where the upper side has to be cut and the lower side filled. The side wings make it especially good for grading and dressing the banks of a road whether they be the banks of a fill below the surface or the banks of a cut above the surface.

As shown in Figs. 1 and 17, the central portion of the machine has a series of rollers 8 on which is mounted an endless belt 9. Dirt excavated by the side plow adjacent the upper side of the hillside is carried by the endless belt 7 operated by rollers 6 on that section of the terracer to the middle section of the terracer, where the dirt is transferred to the endless belt 9, which is operated by the rollers 8, and thence conveyed to the endless belt 7 on the rollers 6 on the wing of the terracer adjacent the lower side of the hillside and dumped to build up the terrace on the lower side of the machine. The large dirt-carrying capacity of the platform with its arrangement for dumping the dirt at either end or in front makes it especially good for carrying dirt and making fills for roads, dirt dams, etc. The long elevator grader with its side delivery renders the machine unique for filling gullies in connection with terracing. It is also good for back filling, trenches, etc. It can be used for cutting any kind of a ditch or canal. The long blade, the large platform and the grade features could be used to great advantage in dressing and finishing roads, and in leveling ground for buildings and irrigation purposes.

My invention has several advantages over present terracers. It is a more efficient excavator and dirt mover. The ordinary grader blade is set

practically vertical. With respect to a line joining the lower edge and the upper edge it is vertical and oftentimes pitched forward. The blade of the terracers now in use is disposed in a substantially vertical position. A blade thus set instead of slicing off a layer of soil has to scrape it up. When the blade is in the ground to its full depth the dirt in front must be crushed before the blade can move forward, and this is just like pushing against a bank so far as the expenditure of power is concerned. On the other hand, the blade of my machine is set at such an angle or inclination that it slices and runs under a layer of soil of any depth desired.

It requires five times more energy to push the dirt on the ground for a terrace than it does to carry it in place on a conveyor. The total energy required to make a terrace would be from five to ten times less with my machine than with the machines now in use.

My terracer operates with less labor. The operation of my machine requires only one man instead of two. It also eliminates the surveying and staking of the lines by an engineer and an assistant. In all it requires from one-third to one-fourth the labor required by prior machines.

My terracer requires less time for the work. It will make a terrace with one trip across the field, or two terraces for each round. The present machines require ten trips or five rounds for each terrace, and they would require about twenty trips to make a terrace as large and as wide as my terracer will make in one trip.

It has more flexibility. My terracer is compact and controlled by only one operator; and it can be turned, backed, etc. much more readily than prior machines. The machines at present in use are very awkward about turning, and backing into place. With my machine the terrace can be completed right out to the end of the field. This is important, especially during the season of heavy rains when the terraces are apt to be overflowed before the farmer has time to make the outlets.

It has more stability. In my terracer the weight of the tractor is utilized to give stability to the terracer, and the blade stays right where the operator wishes. The present terracers are top heavy, and they are very bad about keeping on the ground as desired and about turning over. In this respect they are really dangerous, as was shown when one crushed several ribs of one of our operators in the Tennessee Valley development. In rough gullied land the blade tends to dip in and out of the ground, in the present machines.

My terracer makes a better terrace, with more uniformity in grade and size, producing a terrace that is straight and better looking, large and wide. Prior machines of this type are limited in the size of the terrace they can make.

My terracer checks the grade for the operator and the engineer in charge. This is more than a matter of saving labor. With the present method the trouble of checking the terraces is so much that they go without checking, and as a result some of them break over.

One man can coordinate the controls and make terraces with my machine with much more ease than two with prior machines, especially when the two men are not close enough together to hear one another for the noise of the tractor.

My terracer will help a greater number of farmers. Summing up the advantages already given, my machine will make terraces cheap enough so that every farmer can have his land terraced as the machine comes to him. This saves chasing from one section to another to pick up scattered jobs.

My terracer is fastened to the rear of a tractor rather than the front for more stability; because the engine is not in operator's way and because it is close to the power supply.

What I claim is:—

1. In a terracer, the combination of a middle frame, a plow tiltably mounted on said frame for rearward and downward tilting movement, side frames pivotally connected with the middle frame, side plows laterally tiltable on the side frames for rearward and downward tilting movement, and means for attaching the middle frame to a tractor.

2. In a terracer, the combination of a middle frame, a plow tiltably mounted on the forward portion of said frame, side frames pivotally connected with the middle frame, side plows tiltably mounted on the side portion of the middle frame, means for attaching the middle frame to the rear end of a tractor and means for continuously conveying dirt from one side frame across the middle frame to the other side frame and to discharge it to form the terrace.

3. In a terracer, the combination of a middle frame, means for attaching said middle frame to a tractor, a plow tiltably mounted on said middle frame, side frames pivotally connected with the middle frame, side plows tiltably mounted on each of said side frames, the plow of the middle frame having a removable extension, continuous conveyors on the side frames and middle frame for conveying earth laterally and continuously across the machine.

4. In a terracer, the combination of a middle frame having a plow, side frames, each having plows extending to the ends of the plow of the middle frame to form a continuous blade the entire length of the terracer for cutting off a layer of soil the entire length of the machine, and conveyor mechanism for conveying said soil from one side frame of the terracer to the other side frame of the terracer and discharging same at the opposite side of the machine to form the terrace.

5. In a terracer, the combination of a middle frame, a plow tiltably mounted on the said middle frame, side frames substantially triangular in outline, slantingly disposed plows on each of said side frames, means pivotally connecting the side frames with the middle frame, means for attaching the aforesaid frames to a tractor, a series of parallel conveyor belts of graduated lengths mounted on the side frames, a single conveyor belt mounted on the middle frame, means for driving said conveyor belts in the same direction for conveying earth from one side frame terracer to the other, transversely to the line of travel of the machine, the side platforms being shaped so that the elevator carries the earth from the cutting blades of the upper side frame and dumps it in front of the blade of the lower side frame which is arranged to ride on the earth and smooth it down on the terrace.

6. In combination with the apertures defined in claim 5, means for reversing the direction of operation of the conveyor belts.

7. In a terracer, the combination of a middle frame, a plow downwardly tiltable on said frame, side frames pivotally connected with the middle frame, side plows downwardly tiltable on the side frames, an endless conveyer for conveying a load of dirt from the end of one side frame across the middle frame to the end of the other side frame,

said conveyor including a series of endless belts of different lengths, disposed to permit the ends to come close to the edge of the slanting plow blade for delivering dirt to build up the terrace, means for attaching the middle frame to a tractor, traction wheels under the middle frame and under each of the side frames, said traction wheels being arranged to have one supporting the cutting blade of the upper side frame while the other is carrying the load of dirt and packing the terrace under the lower side frame when the apparatus is operating on a hillside.

8. In a terracer, the combination of a middle frame, a plow tiltably mounted on said frame, side frames pivotally connected with the middle frame, side plows tiltably mounted on the side frames, means for attaching the middle frame to a tractor, and a conveyor platform of relatively large size comprising a series of rollers and conveyor belts for each of the side frames and for the middle frame whereby earth may be conveyed continuously from the upper side frame across the middle frame to the lower side frame and discharged at the front portion of said side frame to be packed by the traction wheel of said lower side frame in forming the terrace.

9. In a terracer, the combination of a middle frame attachable to the rear end of a tractor, a plow tiltably mounted on said middle frame, side frames pivotally connected with the middle frame and swingable to a vertical position when the apparatus is traveling on the road, plows tiltably mounted to each of the side frames, a continuous conveyor means for carrying material from one side frame across the middle frame to the other side frame and discharging the earth adjacent the plow of said side frame.

10. In a terracer, the combination of a middle frame, a plow tiltably mounted on said frame, side frames pivotally connected with the middle frame, side plows tiltably mounted on the side frames, and means for attaching the middle frame to a tractor, a platform including conveyor belts for each of the side frames and for the middle frame for continuously conveying a large body of earth from one side frame to and discharge it from the other side frame and means for adjusting the position of the platform for dragging and smoothing the surface.

11. In combination with the device defined in claim 1, the middle plow and each of the side frames having arcuate gears connected thereto, a transverse shaft carrying pinions meshing with said gears, and means for actuating said shaft from the power plant of the tractor for tilting the side plows and middle plows.

12. In a terracer, the combination of a middle frame, a normally slanting plow carried by said frame, side frames, normally slanting plows carried by said side frames, a supporting frame adapted to be affixed to a tractor, said supporting frame comprising a main frame portion and side frame members pivotally connected to the main frame portion, means linking the plows of the side frames to said side frame members for a tiltable movement, means for tiltably operating the plow of the middle frame, hydraulic means connected with the middle frame and with the side frames for controlling the position of the respective frames and plows.

13. In combination with the apparatus defined in claim 12, means for continuously registering the position of the plows to indicate the grade.

14. In combination with the apparatus defined in claim 12, the middle plow having a removable extension for carrying earth past the edge of the conveyor of the middle frame.

15. In combination with the apparatus defined in claim 1, hydraulic devices carried by the frames and operatively connected with the side plows thereof, and automatic level control and connecting mechanism operatively connected with said hydraulic devices for automatically controlling the operating level of the respective side plows.

AUSBIE L. KENNEDY.