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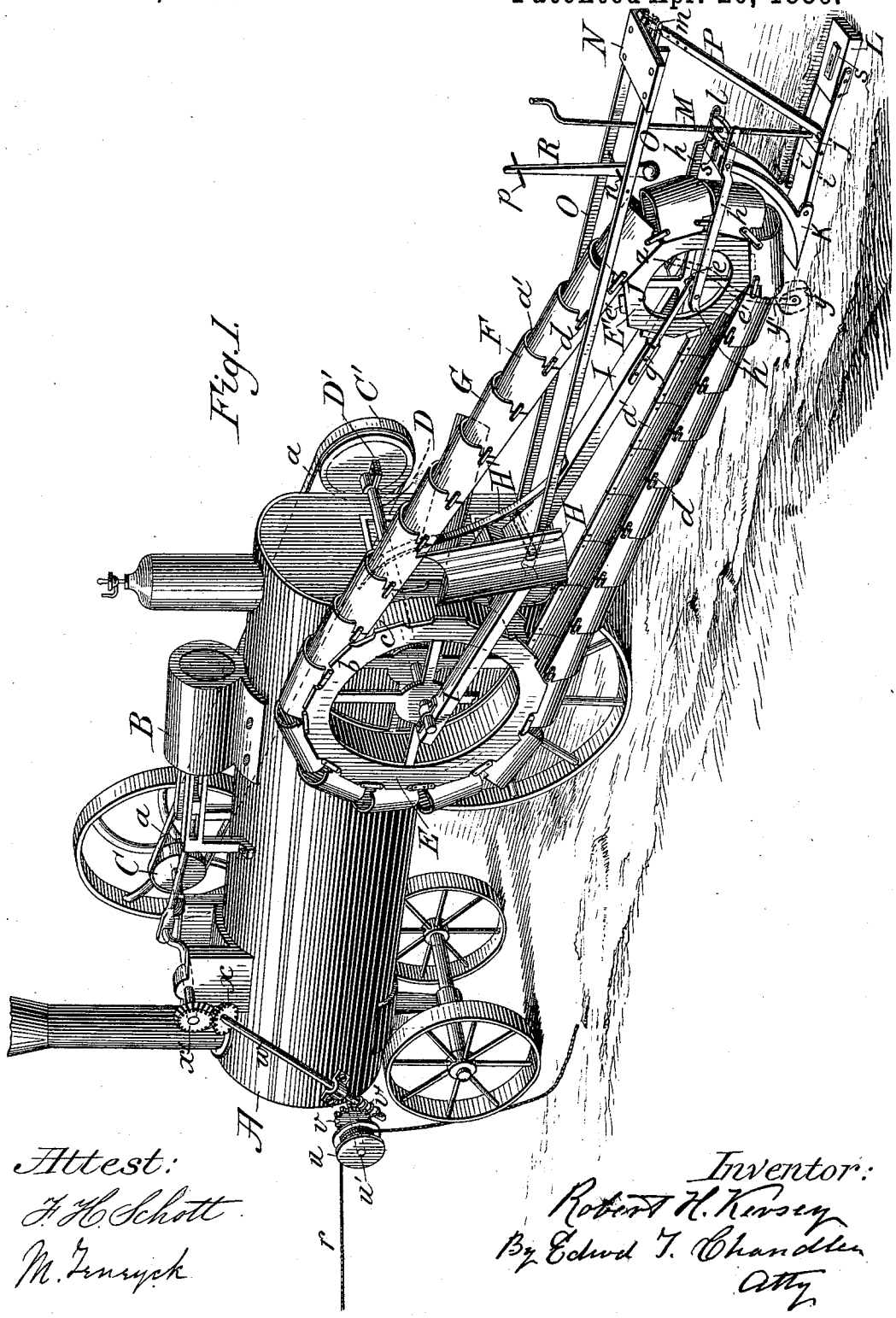
R. H. KERSEY.

DITCHING MACHINE.

No. 340,128.

Patented Apr. 20, 1886.

Fig. 1.



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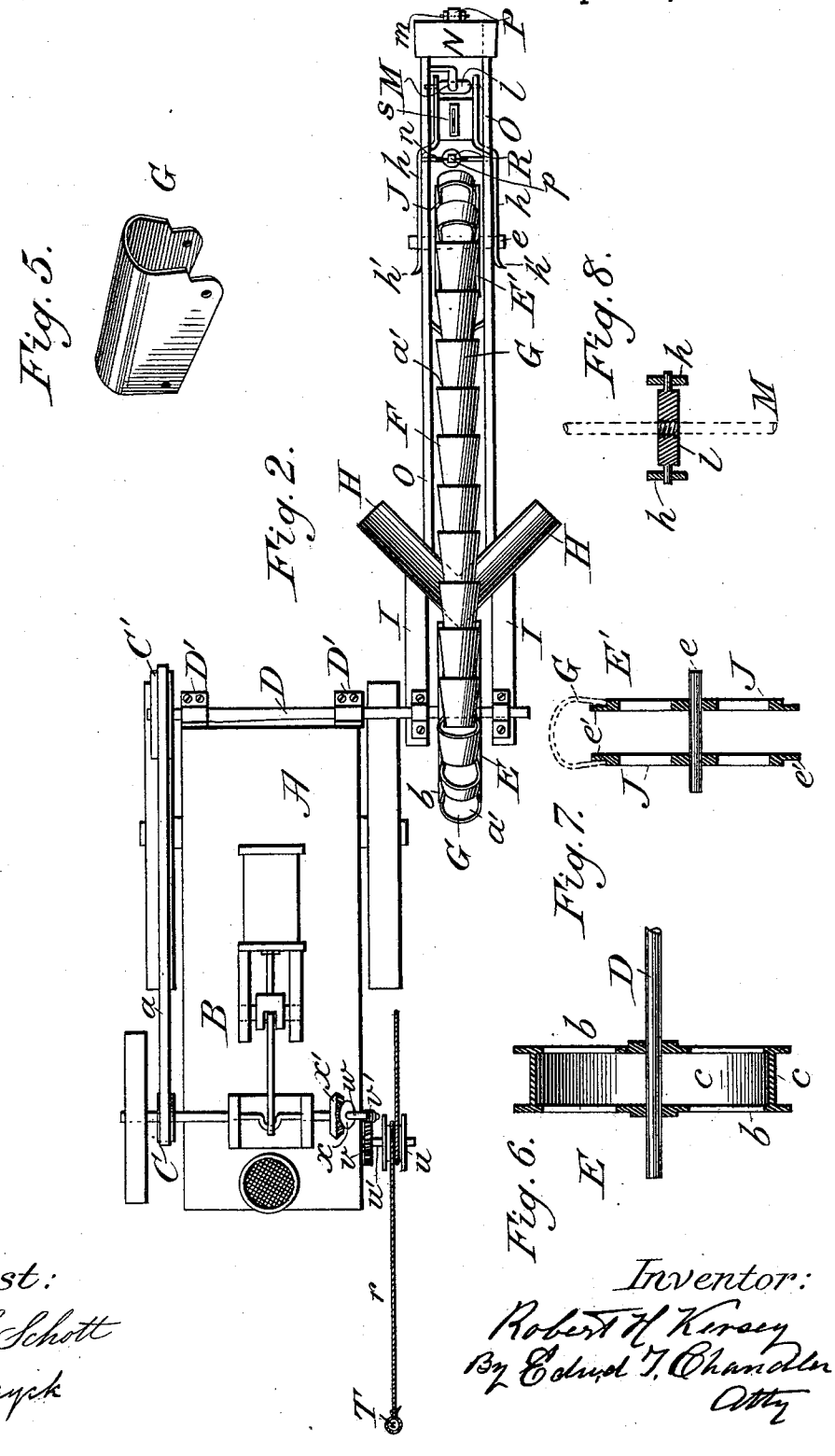
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R. H. KERSEY.

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Fig. 3.

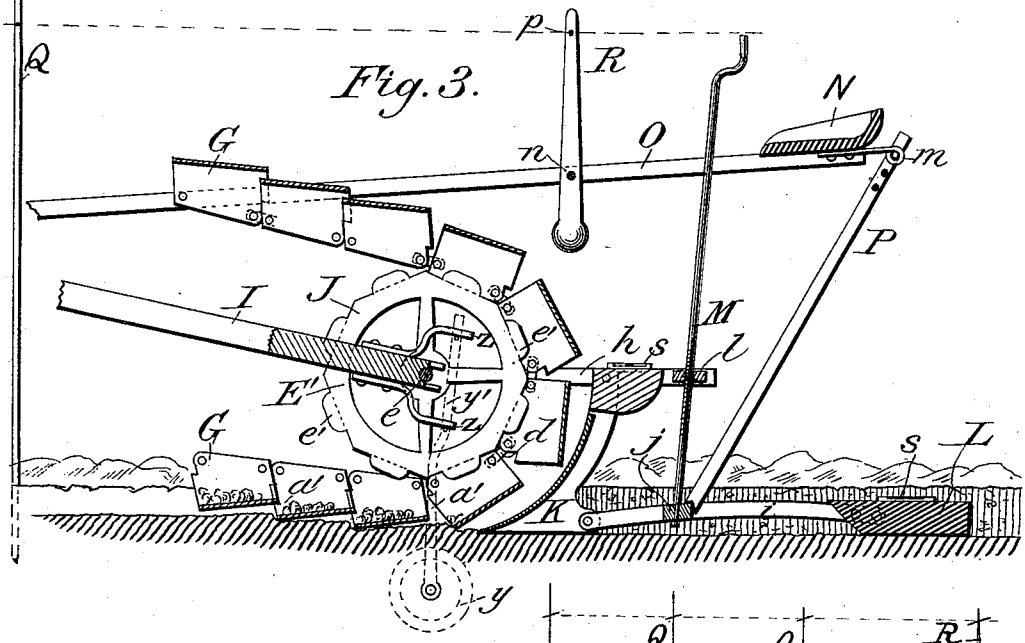


Fig. 4.

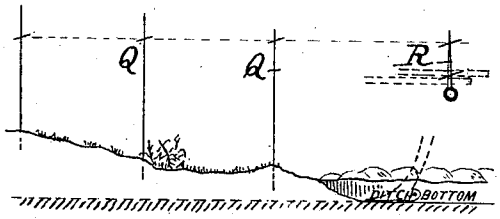
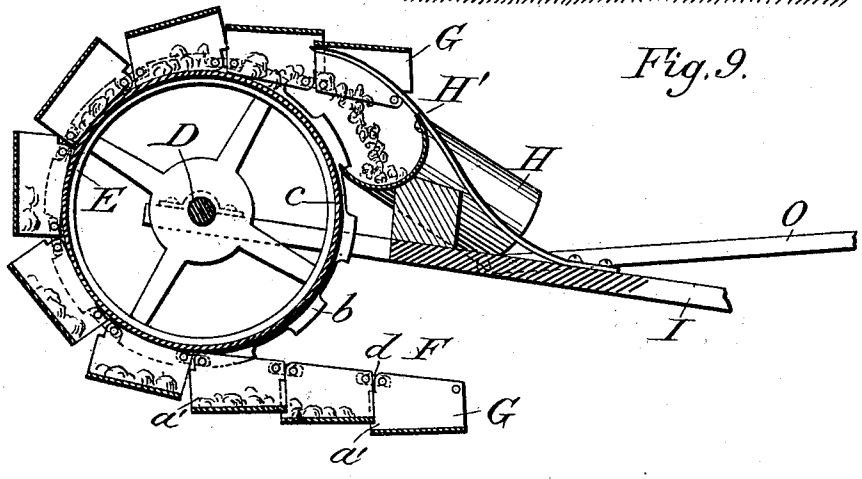


Fig. 9.



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UNITED STATES PATENT OFFICE.

ROBERT H. KERSEY, OF LEBANON, INDIANA.

DITCHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 340,128, dated April 20, 1886.

Application filed October 31, 1885. Serial No. 181,467. (No model.)

To all whom it may concern:

Be it known that I, ROBERT H. KERSEY, a citizen of the United States, residing at Lebanon, in the county of Boone and State of Indiana, have invented certain new and useful Improvements in Ditching-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to that class of excavating machinery employed in forming ditches for the reception of gas or water pipes or for land-drainage, and known as "ditching-machines." These machines have heretofore commonly been constructed by applying a chain of buckets over two sprocket-wheels, one of which has a vertical movement to regulate the depth of the excavations formed by the buckets, and the other forming the driver and receiving motion from animal-power, or in some cases from steam-engines. These machines have had certain defects, among which may be enumerated the use of the bucket as an excavator, which in clay or sticky soils will not deliver the earth it excavates promptly, as it sticks to the interior of the buckets, from which it can only be removed by stopping the machine and digging it out; and, further, they have not left the ditch clean and of perfect shape ready to receive a pipe or tile without cleaning and trimming by hand.

In order to avoid the above-named defects, I construct the excavating device of a chain of scoops of U form in cross-section. These scoops are somewhat larger at one end than at the other, so that when they are connected together they present a series of sharp cutting-edges with a throat like a carpenter's plane, formed by the rear or small end of one scoop not quite filling the forward or cutting end of the next one in the series. This chain of scoops is placed over two wheels, the smaller of which is only a carrier and receives its motion from the endless chain of scoops and operates as a tightener-pulley to keep the chain distended, and by means of certain devices to regulate the position of its lower part or the portion which is cutting in the excavation. The larger wheel acts not only as a carrier, but also as a driver, and may receive motion from any suitable motor—such as a portable engine—by gearing direct, as shown in the drawings, forming a part of this specification, or from a stationary engine or other source of power, the connection being made by a belt, wire rope, or other suitable means. This driving-wheel is constructed with flanges to retain the scoop-chain in position, which flanges have notches or recesses to engage with projections on the scoops to avoid slipping and give a positive motion to the chain. Between the flanges, at its sides, the face of this driving-wheel is left plane from side to side, so that when surrounded by the chain of scoops this plane surface completely closes their open sides at all points where the wheel is embraced by the chain, thus forming a continuous pocket for the excavated clay or earth from the point where the chain comes in contact with the periphery of the wheel at its under side to the place where it is discharged after passing the top, at which point a scraper is attached to the frame of the machine, which enters the scoops and forces their contents into the chutes, by which it is delivered on either or both sides of the ditch, as may be desired. The shaft of the driving-wheel is carried by brackets attached to the engine-frame or boiler (when the machine is carried directly by the engine) at such a height as to ordinarily cause the periphery of the wheel to be above the surface of the earth at its lowest point. A frame journaled at one end upon the shaft of the driving-wheel carries at its opposite end a sprocket-wheel of peculiar construction, around which the endless chain of scoops passes. It will be evident that this allows the free end of the frame to swing upon the driving-shaft as a pivot and to carry the scoop-chain with it, so that if its movements were not restrained this free end of the frame and the adjacent scoops would sink into the earth until it, together with the chain, had assumed as nearly a vertical position as the carrying capacity of the bottomless scoops would admit. Therefore, in order to regulate the depth of the cut to be made by the machine, some means must be devised for supporting this free end of the chain-carrying frame at any desired height relatively to the surface of the ground, and this I accomplish by attaching by means of radial arms to the shaft of the small chain-carrying wheel at the

free end of the swinging frame a plow or scraper which projects forward beneath the wheel a little below the scoops. This plow scrapes and gives to the bottom of the excavation the desired shape, while its sides are grooved or cut away by suitable cutters attached or formed integral with the radial arms that connect the plow to the shaft of the carrying-wheel in such manner as to afford passage for said radial arms outside of the regular excavation, the earth dislodged and loosened by these means being picked up and carried forward by the scoops.

Hinged to the rear of the plow by suitable connections is a guide-block which rests upon the bottom of the ditch and is drawn forward with the machine. This block forms the fulcrum against which the regulating-screw that governs the vertical movements of the plow acts, said screw being carried through a swiveling-nut attached to the rear of the plow-frame, thence passes upward and is provided at its upper end with a suitable crank or hand wheel within easy reach of the person who guides the machine, and who is preferably seated upon a seat carried by the swinging frame at one end and a support attached to the guide-block at the other.

In order to enable the operator to follow any predetermined grade which has been marked by suitable stakes, previously set on the line of the proposed ditch at such distances from each other as will allow the operator to see the tops or grade-marks on two or more of them at the same time, a pendulum is suspended to the frame just forward of the operator's seat, said pendulum being provided with a transverse sight-bar. The operator by sighting from this bar to the tops of or marks upon the stakes is enabled to keep the machine upon the desired grade. A spirit-level may also be placed upon the frame at a point where it is beneath the operator's eye, to assist in keeping the machine in the desired line of travel.

In order to advance the machine as the ditch is formed, I prefer to place an anchor in advance and on the line of the proposed ditch. To this anchor a chain or rope is attached, which is carried to the machine and winds upon a drum put in motion by suitable gearing connected with the engine which drives the excavator.

This invention therefore consists, primarily, in the combination of a chain of bottomless, endless, tapering, and overlapping scoops pivotally connected with each other, so as to form an endless trough for cutting and removing the excavated material with a carrying-wheel, the periphery of which forms a bottom to those scoops in contact with it; secondly, in the combination, with the devices just named, of the means employed to remove the earth from the scoops; thirdly, in the devices by which the rear or excavating end of the chain of scoops is raised or lowered; and, finally, in certain details of construction which will be hereinafter described, and then specifically pointed out in the claims.

In the accompanying drawings, in which similar letters indicate like parts in the different figures, Figure 1 is a perspective view of the machine attached to a portable steam-engine and driven by the same. Fig. 2 is a plan, also showing the means by which the machine advances. Fig. 3 is a side view, partly in section, of the carrying-wheel and its connections upon an enlarged scale. Fig. 4 is a similar view of the driving-wheel and part of the scoop-chain, showing the means by which the earth is removed from the scoops. Fig. 5 is a perspective view of one of the scoops. Figs. 6, 7, and 8 are enlarged detail views of different parts of the machine. Fig. 9 is a detail view showing the sight-stakes and pendulum.

In describing the machine I shall take the style which I prefer for general use—that is, the one in which the excavating apparatus is mounted upon an ordinary portable steam-engine, and is operated, and it, as well as the engine, advanced in the desired line by the power developed by said engine, although it is evident the machine may be mounted upon any suitable frame and operated by animal-power, if desired.

A represents the boiler of a portable engine mounted upon suitable wheels and carrying the engine B. Secured upon the shaft of this engine, either by a key or movable clutch, as desired, is the sprocket or chain wheel C, which is connected by a drive-chain, *a*, with the chain-wheel C′, secured to the outer end of the shaft D, carried in suitable bearings on brackets, D′, attached to the boiler. This shaft D crosses the end of the boiler above the fire-door, and as the brackets upon which it is carried are at opposite sides of the boiler its bearing is firm, enabling it to carry upon its projecting end the drive-wheel E. This wheel is formed of two rims or fellies, *b b*, placed at such distances apart as to receive the scoop-chain F between them, and united by a band, *c*, which closes and covers the open side of the scoops as they pass around the wheel.

In order to make the movement of the scoop-chain positive, the rims *b b* are provided with notches at suitable distances apart in their peripheries which receive the hinge-pivots or other projections upon the sides of the scoops G. These scoops, as shown in Fig. 5 of the drawings, are of U form in cross-section, open at both ends and one side. They are of greater depth at one end than the other, so that when a series of them are united by the pivot-straps *d*, with the edges of their open sides in line, the opposite or closed side presents a series of openings, as *a′ a′*, through which the earth passes as the scoops are drawn forward. Once within the chain of scoops, the earth is readily carried by it up the slight ascent formed by the inclination of the chain until it reaches the drive-wheel E, when, as the inclination

becomes greater as the chain goes over the wheel, the band *c* forms a bottom to the open side of the scoops and prevents the escape of the inclosed earth until after it passes over the top of the wheel, when it falls upon the chutes H, and is delivered by them upon either or both sides of the ditch, as may be desired.

When the excavated material is wet, it has a tendency to stick to the scoops after passing the top of the wheel, and would therefore be carried beyond the chutes. To prevent this a spring scraper, H′, is attached at some convenient point to the frame I, its free end entering and resting upon the bottoms of the scoops directly over the chutes. It is evident that this scraper will effectually remove all material from the inside of the scoops, leaving them in condition to receive another load as they pass through the excavation.

Journaled upon the driving-shaft on opposite sides of the wheel E is the bifurcated vertically-swinging frame I, its bifurcated end embracing the wheel and carrying the chutes and scraper, while its opposite end carries the shaft of the carrying-wheel E′. This wheel E′ consists of two separate and distinct disks or wheels, J, secured to each end of the shaft *e*, which, as before stated, revolves in a suitable bearing at the end of the swinging frame I. The periphery of these disks or wheels J is made with plane surfaces, which receive the straight edges of the scoops, and with projecting flanges *e′*, that enter the scoops and by their position with relation to the straps *d* keep the carrying-wheel in its proper position with relation to the scoop-chain.

Attached to the swinging frame I and embracing the wheel E′ are straps *g*, that encircle the shaft *e* and hold it firmly to the swinging frame. By means of the straps *h*, which are pivoted to the opposite ends of the shaft *e*, is attached to the machine the plow or scraper K. This plow may be carried a certain distance below the wheel J, so as to scrape and form the bottom of the ditch, while the forward ends of the straps *h* project beyond their point of attachment to the shaft *e*, said projecting ends being turned outward and formed as a cutting-blade, *h′*, in such manner as to cut their passage through the earth outside of the regular excavation, thus, in conjunction with the plow K, giving a proper form to the excavation, while the earth displaced by both plow and trimming-blades is carried out by the scoops.

It will be apparent that the cutters *h′*, instead of being made integral with the straps *h*, may be formed separately and attached thereto.

In order to regulate the depth to which the machine shall excavate, a block or sledge, L, is placed in the rear of the plow and pivotally connected to the same by straps or bars *i i*. This sledge forms the fulcrum upon which the adjusting-screw M acts, the lower end of the screw being carried by a cross-bar, *j*, which extends across the space between the bars *i i* about midway between the plow and the sledge, the screw extending upward and its threaded part passing through a swiveling cross-bar, *l*, which is provided with a suitable nut to receive the thread. This cross-bar *l* connects the rear end of the straps *h*, which carry the plow. It is therefore evident that by turning the screw the plow which determines the depth of the excavation will be tipped or inclined at its point where it rests on the bottom of the ditch with relation to the sledge, and as that rests upon the bottom of the ditch in the rear of the plow the predetermined grade of said ditch-bottom may be maintained without regard to the inequalities of the surface.

In order to afford a convenient means of operating the regulating-screw, it is carried up a short distance above the cross-bar or nut *l*, and provided at its upper end with a suitable crank or hand wheel, which may be readily manipulated by the operator seated upon the seat N, carried upon the rear ends of the bars O O, which are pivoted at their forward ends to the frame I and supported at the rear by the adjustable support P, the lower end of which is carried by the cross-bar *j*, and its upper end made vertically adjustable in the clamp *m*, which connects the rear ends of the bars O.

In order to enable the operator upon the seat N to follow the grade of any line of ditch which may have been properly staked out, a pendulum, R, is hung upon a rod, *n*, passing through the bars O O in front of the operator's seat. This pendulum is provided with a sight-bar, *p*, passing through it transversely about on a level with the eyes of the operator as he occupies the seat N. It will be evident that if this sight-bar is kept in line with the tops of the grade-stakes Q as the machine advances the bottom of the ditch will correspond with said line.

If desired, spirit-levels, as *s*, may be placed on the sledge L, or other parts of the machine, to aid in determining the grade upon which the machine is advancing.

It is evident that the forward movement of the machine may be communicated thereto in many ways, but I prefer that shown in the drawings, in which a stake or anchor, T, is fixed at any desired point in advance of the machine, and a chain or wire rope, *r*, attached thereto, the opposite end of which is brought to the sprocket wheel or spool *u*, mounted upon the shaft *w′*. This shaft is turned through the agency of the worm-gear *v*, secured on said shaft, and the screw *v′* on the shaft *w*, which receives motion from the engine-shaft through the bevel-gears *x x′* or their equivalents.

When it is desired to remove the machine from place to place, its rear end may be carried upon the caster-wheel *y*, (shown in dotted lines in Fig. 1,) the shank *y′* of which is passed through the opening *a′* between two buckets, and thence through suitable orifices in the extremities of two arms, *z z*, secured to the rear end of the frame I within the wheel E′, the

drive-chain *a*, which connects the motor with the excavating apparatus, being of course removed.

I am aware that excavating-machines have been invented in which chains of scoops and scrapers of various forms were used, one of them having scoops open at one side and both ends, but when in use provided with a removable bottom carried by a separate belt or chain, and that a scraper was used to clear such scoops of their contents; but I am not aware that any chain of scoops like mine, open at both ends and one side, one end of each made smaller than the other, so as to enter the large end of the next adjacent scoop, thus forming, when pivoted together, a continuous trough to carry the excavated material up an incline without the aid of bottoms or other equivalent devices to retain the material within said scoops has ever previously been constructed. Neither could spring-scrapers like mine be used with any chain having intervals between its scoops, as the scrapers would enter such intervals and stop the further working of the machine.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent, the following:

1. As an improvement in ditching-machines, the bottomless and endless scoops G, having a U-shaped cross-section smaller at one end than the other and united by pivotal connections to form a continuous chain or trough, substantially as shown and described.

2. The series of bottomless, endless, and tapering scoops united by pivotal connection, forming an endless and continuous trough, in combination with the wheel E, which closes the open side of the scoops during the time their contents are in contact with the periphery of said wheel while being elevated to the discharging-point, as set forth.

3. The continuous chain of bottomless and endless tapering and overlapping scoops, in combination with the spring-scraper arranged and operating substantially as and for the purpose described.

4. The continuous chain of bottomless, endless, and overlapping scoops, in combination with the spring-scraper and discharging-chutes arranged to discharge the earth upon one or both sides of the ditch, and operating conjointly, in the manner specified.

5. In a ditching-machine, the sprocket driving-wheel E, provided with recessed side flanges, *b b*, and connecting web or bottom *c*, arranged to carry the scoop-chain and form a bottom for its open side while the chain is in contact with the wheel, as set forth.

6. The scoop-chain or trough F, in combination with the wheels E E′, constructed as described, and inclined bifurcated swinging frame I, extending between the wheels and forming a support for the spring-scraper and discharging-chutes, as set forth.

7. The combination, with the scoop-chain and its supporting devices, of the vertically-adjustable plow K, bars *h*, swiveling-nut, and adjusting-screw, constructed and arranged to carry and adjust the plow and shape the bottom of the ditch, as set forth.

8. The combination, with the scoop-chain and plow K, of the straps or bars *h*, provided with cutters *h′*, for trimming the sides and edges of the ditch, as set forth.

9. The combination of the plow K with the fulcrum-block or sledge L, connected to the plow by jointed bars *i*, and the adjusting-screw M, for tipping the plow-point, all arranged and operating conjointly, for the purpose specified.

10. In a ditching-machine, the excavating mechanism, in combination with the adjusting devices, a pendulum provided with a sight-bar, and a spirit level or levels attached to the machine to aid in keeping the predetermined line and to show the inclination or grade of the bottom of the ditch as excavated.

11. In a ditching-machine, the combination, with the swinging frame provided at its rear end with arms *z z*, of the removable caster-wheel *y*, having shank *y′*, for connection with said arms, in the manner and for the purpose described.

12. The plow K, provided with straps *h h*, having swiveled cross-bar *l*, adjusting-screw M, cross-bar *j*, bars *i i*, and sledge L, as shown and described, for changing the inclination of its point, in combination with a spirit-level for determining the amount and direction of such inclination, substantially as shown and described.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

ROBERT H. KERSEY.

Witnesses:

WILLIAM WILLIAMS,

T. E. CHANDLER.