June 10, 1952 D. F. PRZYBYLSKI 2,599,778

TRENCH EXCAVATOR

Filed Nov. 23, 1945 5 Sheets-Sheet 1

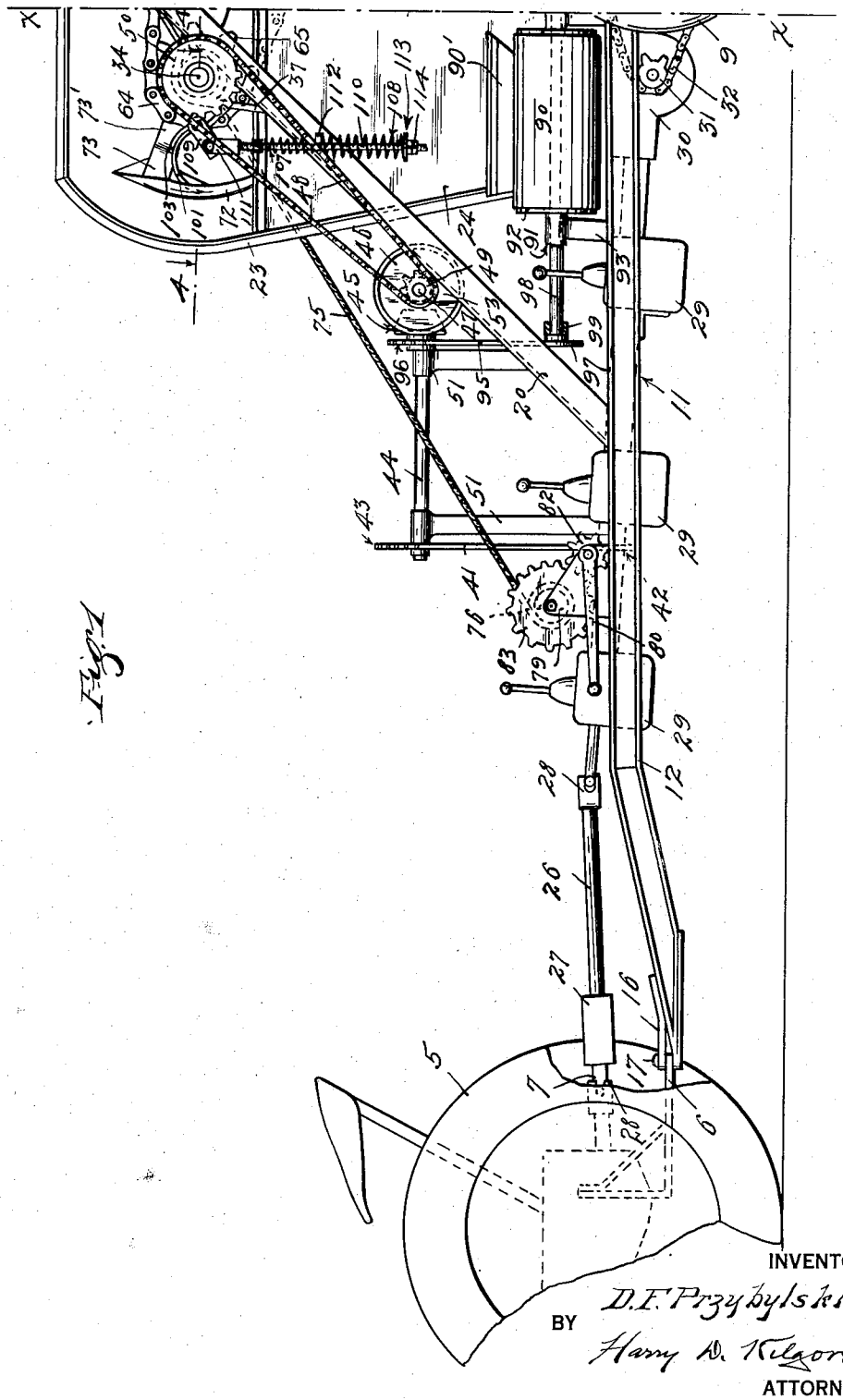


Fig. 1

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TRENCH EXCAVATOR

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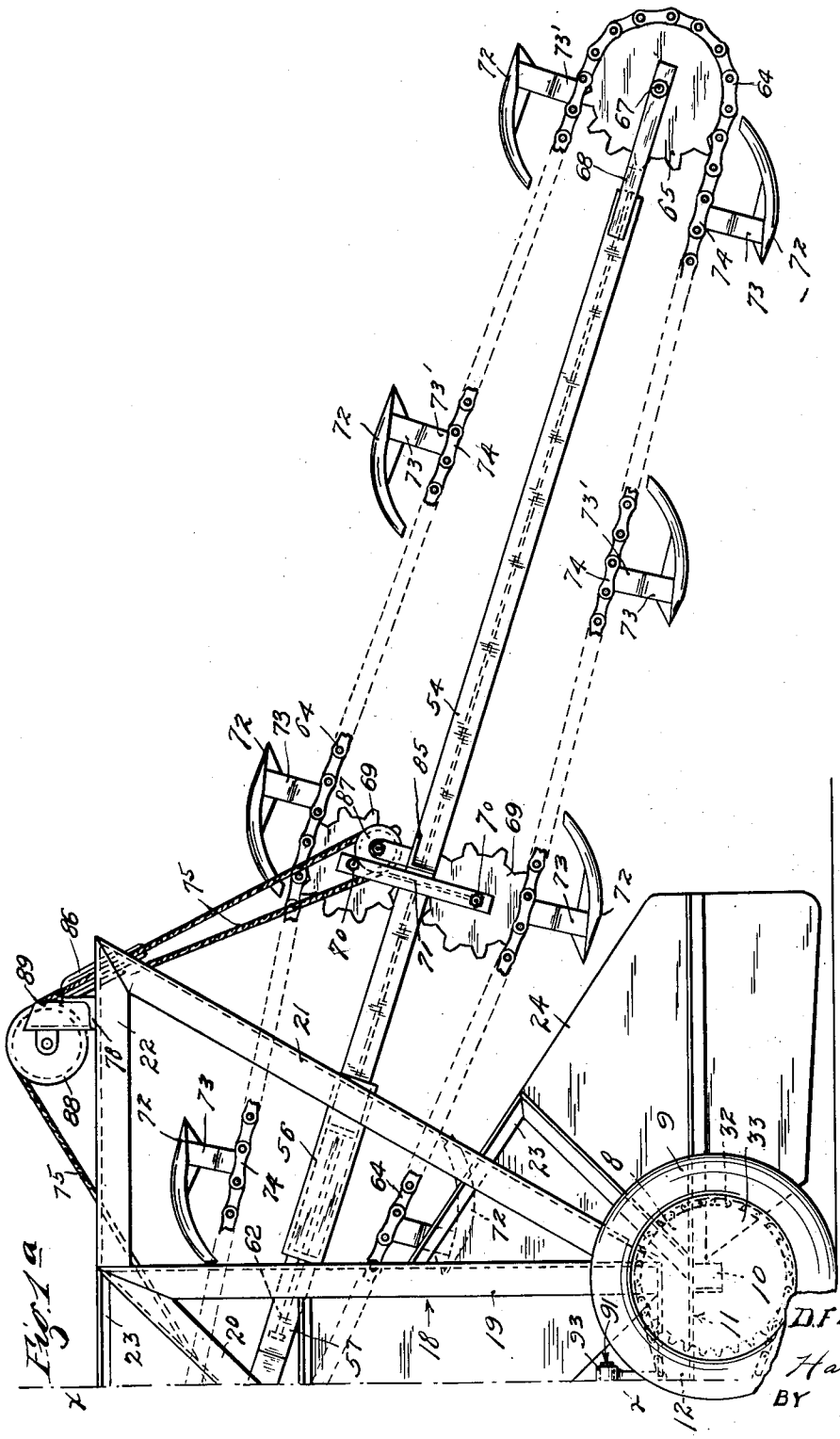


Fig. 1a

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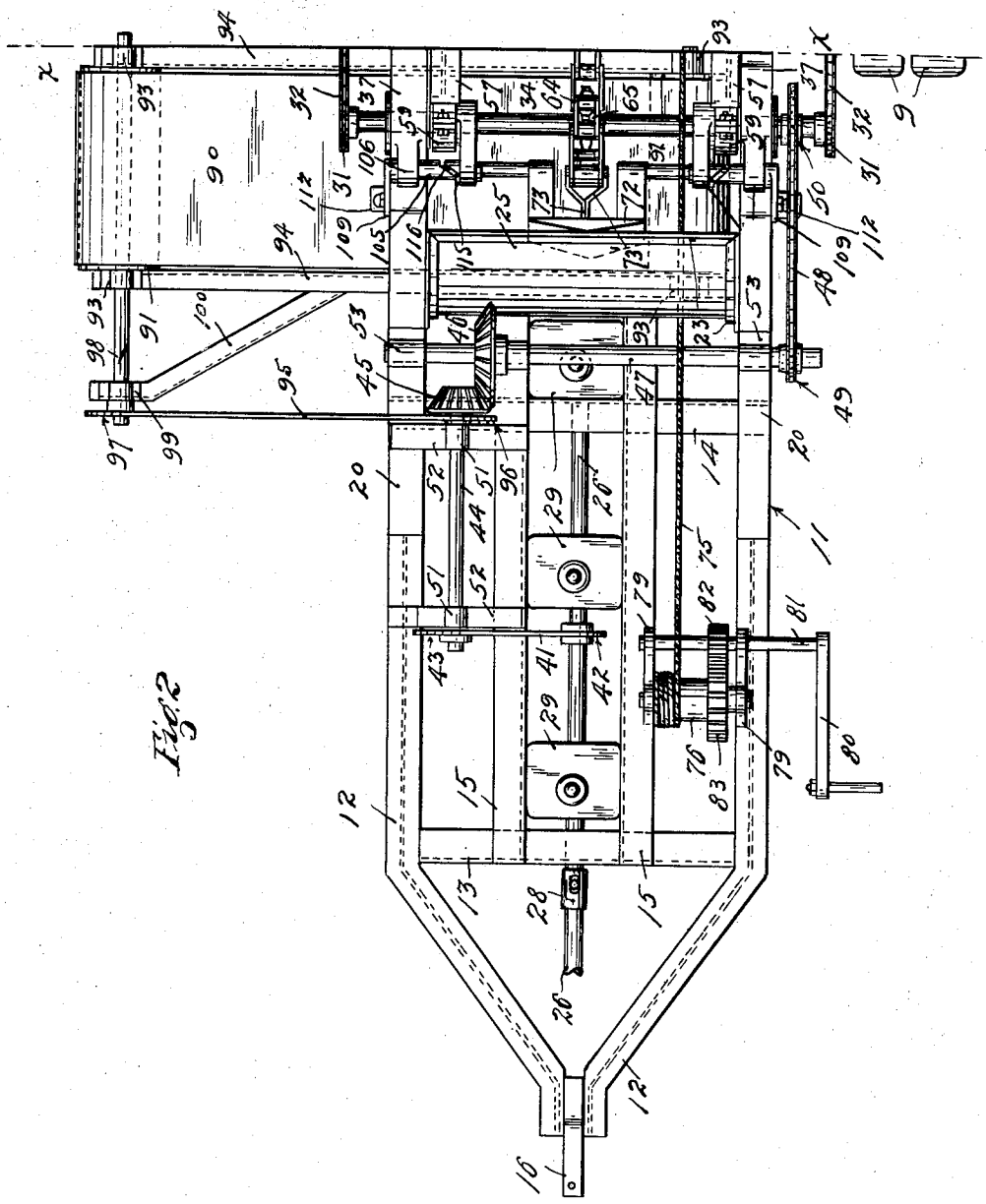


Fig. 2

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TRENCH EXCAVATOR

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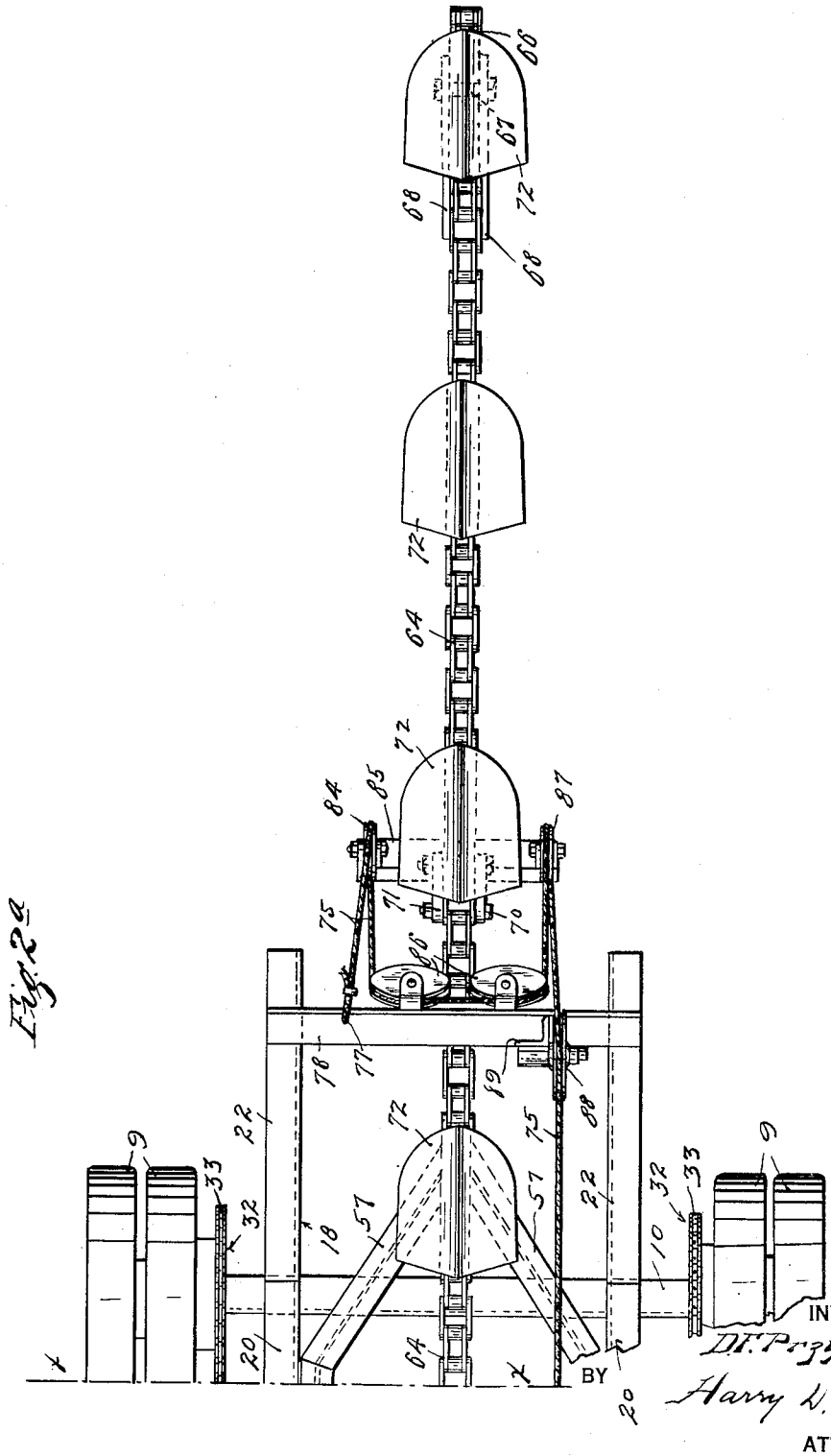


Fig. 2a

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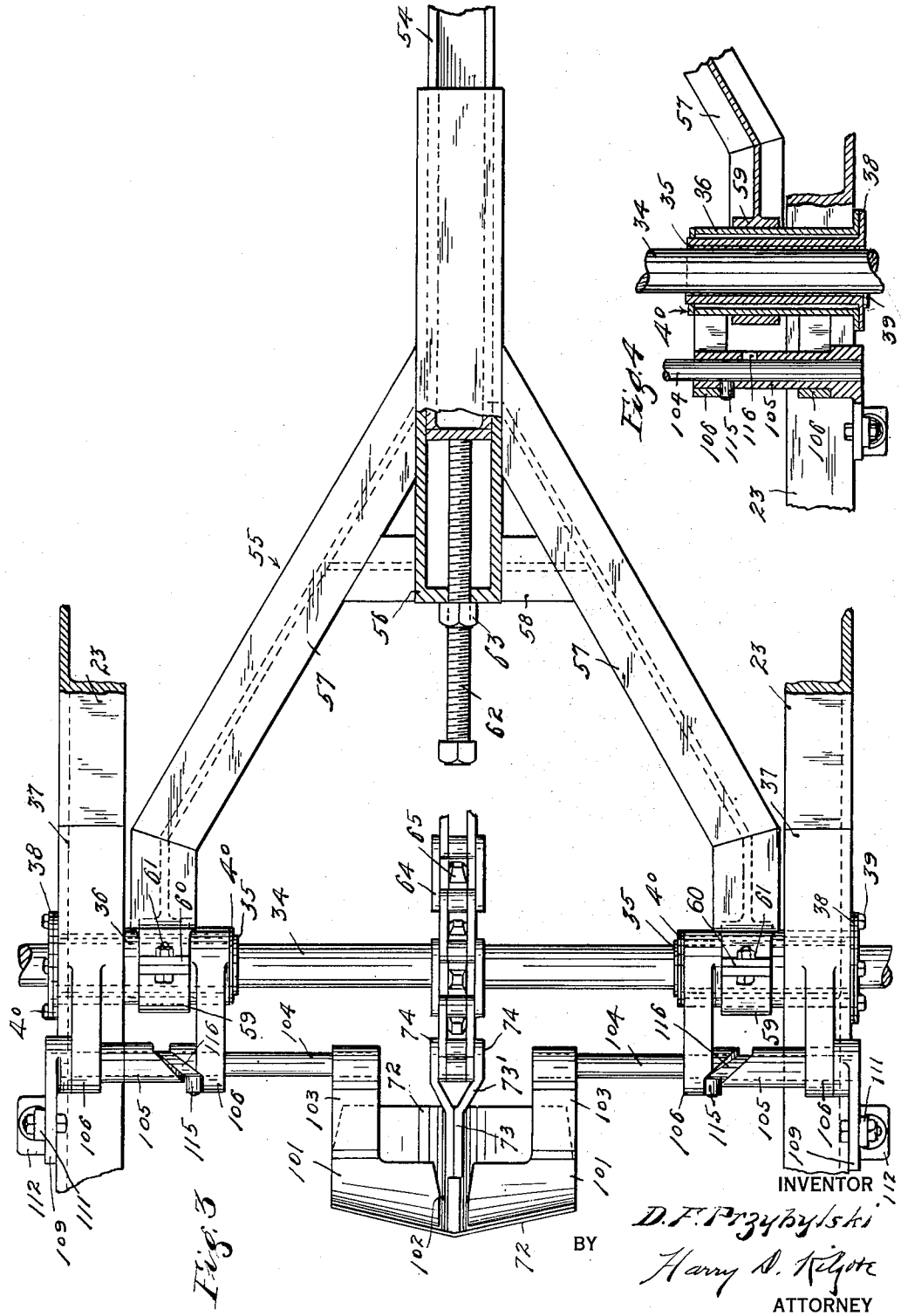


Fig. 3

Fig. 4

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UNITED STATES PATENT OFFICE

2,599,778

TRENCH EXCAVATOR

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Application November 23, 1945, Serial No. 630,310

1 Claim. (Cl. 37—90)

1

My invention relates to improvements in trench excavators, and more particularly, to an excavator suitable for digging a trench of the desired depth and width for laying tile.

It is well known that tile is extensively laid on farms on level lands for drainage to improve the soil and therefore produce better crops in either wet or dry seasons. To date, this type of trench excavating has proved to be costly to the farmer, however, the improvement due to tiling the land is generally known to have paid for itself within a few years. At the present time, the majority of tiling of lands is done by hand with spades and shovels. This procedure is slow and costly.

There are machines manufactured which are capable of doing this work, but the number of these machines operating today are few. These machines are heavy, expensive and most of the digging is done by contractors. The majority of the farmers or groups of farmers are unable to pay the price of this type of machine and due to the limited number of such machines and contractors, they are inadequate to do the job.

The principal purpose of my invention is to provide a trench excavator which will save time and cost to the farmer in digging trenches suitable for laying tile, and which is compact, light and durable and can be manufactured at a price most farmers or groups of farmers can afford.

This trench excavator is a two-wheeled trailer that is drawn by a tractor of any type or make.

An object of this invention is to provide a trench excavator which is towed by a tractor, when moving on the road or to its destination of digging, and when in digging operation, is powered solely from the tractor by means of a power take-off and pushes the tractor.

Another object of this invention is to provide a trench excavator in which variations of speeds are flexible and regulated to synchronize the digging with the advancing of the machine, enabling the use of any type or make of tractor with a power take-off attachment, and enabling the power of the tractor to be fully utilized at all times when operating regardless of the size of the tractor, thus eliminating loss of surplus power when powered by a large tractor and accomplishing more and faster digging.

These and other objects of the invention will be apparent from the following description, reference being had to the drawings.

To the above end, generally stated, the invention consists of the novel devices and combination of devices hereinafter described and defined in the claim.

In the accompanying drawings, which illustrate the invention, like characters indicate like parts throughout the several views.

Referring to the drawings:

Figs. 1 and 1a are elevational views of the entire trench excavator separated on the line *x*—*x* and showing, respectvely, the front and rear portion thereof;

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Figs. 2 and 2a are plan views of the trench excavator as shown in Figs. 1 and 1a, respectively;

Fig. 3 is a fragmentary detail view in plan of the countershaft and associated parts; and

Fig. 4 is a fragmentary detail view principally in section taken on the line 4—4 of Fig. 1.

The numeral 5 indicates a fragment of a tractor having a rear platform 6 and a power take-off shaft 7.

As heretofore stated, the trench excavator is a two-wheeled trailer drawn by the tractor 5. The wheels of the trench excavator are indicated by the numeral 8 and equipped with dual tires 9. These wheels 8 are journaled on an axle 10. Mounted on the axle 10 and extending forwardly thereof is a skeleton bed 11 comprising a pair of longitudinal H side bars 12 and front and rear cross-tie bars 13 and 14, respectively. This bed 11 further includes a pair of intermediate longitudinal angle bars 15 on the cross-tie bars 13 and 14. The side bars 12, forwardly of the cross-tie bar 13, are in forwardly converging relation and downwardly inclined. Said side bars 12, at their extreme outer end portions, are parallel, rigidly connected and have therebetween a clevis 16 connected to the tractor platform 6 by a pivot pin 17.

Main side frames 18, made up of angle bars, are mounted on the bed 11 and each thereof includes an upright bar 19 directly over the axle 10, an oblique bar 20 forwardly of the bar 19 that extends from said bed to the top of the bar 19, a rear bar 21 that extends obliquely from the lower end of the bar 19, and a top horizontal bar 22 that connects the two bars 19 and 20 at their upper ends.

Secondary side frames 23 are mounted in part on the bed 11 and in part on the main side frames 18. These secondary side frames 23 are made up of relatively light angle bars and extend both forwardly and rearwardly of the axle 10. Sheet metal side plates 24 are secured to the two side frames 18 and 23. A front end plate 25 of sheet metal is secured to the secondary side frames 23.

The wheels 8 are independently driven from the power take-off shaft 7 by the following connections, to wit: a sectional drive shaft 26, a slip clutch 27, universal joints 28, three four-speed transmissions 29, a differential 30 having on each side thereof a small sprocket wheel 31 and sprocket chains 32 that run over the sprocket wheels 31 and large sprocket wheels 33 on the wheels 8.

The slip clutch 27 connects the two shafts 7 and 26, one of the universal joints 28 is forward of the slip clutch 27 and the other is between said slip clutch and the first speed transmission 29 and the speed transmissions 29 and the differential 30 are mounted on the bars 15 of the bed 11.

A countershaft 34 is journaled in babbitted bearings 35 that are within and spaced from concentric sleeve bearings 36. These sleeve bearings 36 extend transversely over and rest on the oblique frame bars 20 and are welded thereto.

Said sleeve bearings 36 are further secured to the frame bars 20 by wide metal straps 37 that are folded thereover with their ends resting on said bars and welded thereto. These straps 37 are also welded to the sleeve bearings 36.

The bearings 35 are secured to the sleeve bearing 36, at their outer ends, by overlapping flanges 38 on the respective ends of said bearings and said flanges are connected by nut-equipped bolts 39. On the inner ends of the bearings 36 are collars 40 through which the bearings 35 at their inner end portions extend and are supported thereby.

The countershaft 34 is driven from the drive shaft 26 by the following connections, to wit: a sprocket chain 41 runs over a small sprocket wheel 42 on the drive shaft 26 and a large sprocket wheel 43 on the shaft 44 having a bevel pinion 45 that meshes with a bevel gear 46 on a shaft 47 and a sprocket chain 48 runs over a small sprocket wheel 49 on the shaft 47 and a large sprocket wheel 50 on the countershaft 34. The shaft 44 is journaled in bearings 51 on short transverse angle bars 52 on the left-hand side bar 12 and adjacent bar 15. The shaft 47 is journaled in bearings 53 on the oblique frame bar 20.

A rearwardly projecting boom 54 is attached to the countershaft 34 for swinging movement in a vertical plane. This boom 54 is, as shown, a long H-bar having on its inner end an adjustable head 55. This head 55 includes a long sleeve 56 that is square in cross-section and mounted on the respective end of the boom 54 for endwise sliding movement. A pair of diverging arms 57 are rigidly secured to the sides of the sleeve 56 slightly forwardly of the longitudinal centers of said sides. A cross-tie H-bar 58 connects the sleeve 56 and the two arms 57. The outer end portions of the arms 57 are parallel and one of the members of a pair of two-part bearings 59 are rigidly secured to the ends of said arms. The members of the bearings 59 have outturned lugs 60 connected by nut-equipped bolts 61. These bearings 59 are journaled on the sleeve bearings 36 and support the boom 54 for swinging movement in a vertical plane about the axis of the countershaft 34.

The boom head 55 is adjusted relative to the boom 54 by a long screw bolt 62 having threaded engagement with the closed inner end of the sleeve 56 and impinges the closed inner end of the boom 54. A lock nut 63 on the bolt 62 impinges the closed end of the sleeve 56. The purpose of adjusting the head 55 on the boom 54 is to vary the operative length of said head and boom to act as a chain tightener, as will hereinafter appear.

A heavy endless conveyor sprocket chain 64 runs over a large sprocket wheel 65 on the countershaft 34 midway between the arms 57 and a like idle sprocket wheel 66 journaled on a short shaft 67 on a pair of parallel bars 68 on the outer end of the boom 54 and from an extension thereof. This sprocket chain 64 also runs over upper and lower guide sprocket wheels 69 journaled in a short shaft 70 on a pair of upright bars 71 secured to the boom 54 on the sides thereof.

By manipulating the screw bolt 62, the boom 54 may be endwise adjusted relative to its head 55 and thereby vary the distance between the sprocket wheels 65 and 66 to suit the conveyor chain 64.

A plurality of shovels 72 are secured to the conveyor chain 64 at longitudinally spaced points. Each shovel 72 has an upstanding post 73 provided at its upper end with a pair of diverging arms 73' on the outer ends of which are plates 74 that form one of the links of the conveyor chain 64 and attach the shovel 72 thereto.

The boom 54 is raised and lowered by a cable 75 and a windlass drum 76. One end of the cable 75 is attached at 77 to a cross-tie angle bar 78 on the main frame bars 22 and its other end portion is wound on the windlass drum 76. The windlass drum 76 is journaled in bearings 79 on the left-hand bar 12 of the bed 11 and the adjacent bar 15 and operated by a hand crank 80 on a shaft 81 journaled in said bearings and having a spur pinion 82 that meshes with a spur gear 83 on the windlass drum 76. The cable 75 from its attachment at 77 to the angle bar 78 runs over a sheave 84 on a transverse angle bar 85 on the boom 54, over a pair of directional sheaves 86 on the cross-tie bar 78, over a sheave 87 on the angle bar 85 at the opposite side of the boom 54 from the sheave 84 and over a guide sheave 88 on a post 89 on the angle bar 78 to the windlass drum 76.

After digging a load of soil, the shovels 72 are moved by the conveyor chain 64 upwardly under the boom 54 and as they pass around the sprocket wheel 65, the loads therein are dumped therefrom and precipitated onto a cross conveyor belt 90. The cross conveyor belt 90 runs over outer and inner rolls 91 and 92, respectively. These rolls 91 and 92 are journaled in bearings 93 on a pair of angle bars 94 secured to the bed side bars 12. The outer roll 91 is driven from the shaft 44 by a sprocket chain 95 that runs over a sprocket wheel 96 on said shaft and a sprocket wheel 97 on the shaft 98 of said outer roll. The end portion of the shaft 98 having the sprocket wheel 96 extends materially outwardly of the cross conveyor belt 90 and is journaled in a third bearing 99 on an angle bar arm 100 on the adjacent angle bar 94.

Soil precipitated onto the cross conveyor belt 90 is carried thereby to one side of the trench being dug and discharged onto the ground. In actual construction, the cross conveyor belt 90 will be removably mounted so that it may be positioned to discharge on either side of the trench. In the left-hand side plate 24 is an aperture for the cross conveyor belt 90 and an apron 90' is hung in this aperture to prevent soil precipitated onto said conveyor belt from being discharged through this aperture.

The shovels 72 as they are carried upwardly around the sprocket 65 successively move past a scraper blade 101. This scraper blade 101 comprises two sections that are spaced apart to leave a passageway 102 therebetween for the posts 73 of the shovels 72. Each section of the scraper blade 101 has on its outer end portion an arm 103 rigidly secured to the inner end portion of a rock shaft 104. The rock shafts 104 are axially aligned and journaled in long sleeve bearings 105 held in brackets 106 on the metal straps 37 and the sleeve bearing 36. The scraper blade 101 and its arms 103 are on the arc of a circle having its center below said scraper blade and arms. Each section of the scraper blade 101 is yieldingly held by a pair of opposing relatively weak and strong springs 107 and 108, respectively. On the outer end of each rock shaft 104 is a crank arm 109 to which a long depending screw rod 110 is attached by a link 111 pivoted to said arm. This rod 110 extends axially through the springs 107 and 108 and a spring base 112 on the adjacent oblique bar 20. The springs 107

and 108 are compressed between the spring base 112 and spring frames 113 on the rod 110. These spring followers 113 are adjustably held where positioned on the rod 110 by pairs of nuts 114.

In case an object or substance on one of the shovels 72 is not precipitated therefrom when said shovel is in dumping position, the scraper blade 101 is engaged thereby and said scraper blade moved with the respective shovel. As the scraper blade 101 is moved with one of the shovels 72, the tension of the springs 108 is progressively increased and thereby exerts a greater force on the scraper blade 101 to remove the obstruction. During this movement of the scraper blade 101 with the shovel 72, the sprocket wheel 65 and the conveyor chain 64 passing therearound are in the path of movement of said scraper blade. To cause the sections of the scraper blade 101 to pass the sprocket wheel 65 and the conveyor chain 64, said sections are further separated to increase the width of the passageway 102 therebetween by moving the rock shaft 104 axially. This axial movement of the rock shaft 104 is accomplished by roller-equipped cam studs 115 on said shafts and cam slots in the bearings 105 in which said cam studs work.

It will be noted that the shovels 72 move about the axis of the countershaft 34 and that the scraper blade 101 moves about the axes of the rock shafts 104 which are eccentric to the axis of said countershaft. Due to this eccentricity, the scraper blade 104 progressively moves away from the shovel 72 by which it is being moved by an obstruction thereon. In case an obstruction on a shovel 72 is not removed by the scraper blade 101, said scraper blade by the time it reaches its extreme raised position, will have been moved out of contact with the obstruction and returned to normal position by the compressed springs 108. During the return of the scraper blade 101, the springs 107 act as cushions for said scraper blade and associated parts. It is evident that in some instances only one of the sections of the scraper blade 101 will be moved with a shovel 72; or if both, they may be released from the obstruction at different times and returned to normal position.

The shovels 72 and the scraper blade 101 are more fully shown and described and broadly claimed in application No. 630,311 filed November 23, 1945, now Patent 2,472,758 issued on June 7, 1949, and entitled "Trench Excavator Shovel and Scraper."

From the above description, it is evident that by raising or lowering the boom 54, the depth to which a trench is to be cut may be varied at will. In case one of the shovels 72 engages a large rock, root or other obstruction, the clutch 27 will slip and thereby prevent undue strain on the excavator.

As heretofore stated, the variation of speeds is flexible and can be regulated to enable any type or make of tractor with a power take-off attachment, regardless of size, to power it. When moving the trench excavator on the road or to its destination of digging, it is towed by the tractor. When in operation, the trench excavator pushes the tractor but is powered solely by the tractor by means of the power take-off. Only one man is necessary to operate the trench excavator and the tractor.

The variation of speeds of the trench excavator is regulated by means of the transmissions 29, the digging synchronized with the advance enabling the power of the tractor to be fully utilized at all times when operating, regardless of the size of the tractor, thus eliminating loss of surplus power when powered by a large tractor and accomplishing more and faster digging. It will, of course, be understood that when the trench excavator is being towed by the tractor, the several transmissions 29 will be in neutral positions and when the trench excavator is being powered from the tractor and is pushing said tractor, the tractor's speed transmission will be in neutral position.

The drawings illustrate a commercial form of the trench excavator, but it will be understood that the same is capable of modification as to details of construction, arrangement and combination of parts within the scope of the invention herein disclosed.

What I claim is:

In combination with a tractor having a power take-off, a trench excavator including an elongated substantially rectangular frame, dual wheels mounted beneath one end of the frame supporting the frame, a speed transmission mounted on forward end of the frame, a drive shaft coupled between the power take-off and the speed transmission including therein a slip clutch, a secondary speed transmission mounted on the frame in rearwardly spaced relationship to the first named transmission, a drive connection between the two transmissions, a differential mounted beneath the frame and having drive connection with the secondary transmission, each of said ground engaging wheels having chain-drive engagement with the differential, a driven shaft rotatably mounted above and transversely of the frame, an elongated boom disposed longitudinally of the frame and mounted to swing about the axis of the driven shaft, an endless bucket digger movably mounted longitudinally of and on the boom and having operable connection with the driven shaft, a bucket scraper yieldably mounted adjacent the driven shaft and aligned with the travel line of said buckets, an endless discharge conveyor mounted transversely of the frame beneath the bucket scraper and overhanging one side thereof, said driven shaft and said conveyor having a common operable drive connection with that drive shaft interconnecting the two speed transmissions, and a hand operable windlass on said frame for raising and lowering the boom about the axis of the driven shaft.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
577,167	Mayback	Feb. 16, 1897
1,038,915	Lyback	Sept. 17, 1912
1,630,231	Vaughn	May 24, 1927
1,722,585	Manley	July 30, 1929
1,832,787	Penote	Nov. 17, 1931
1,852,344	Coultas et al.	Apr. 5, 1932
1,959,768	Seyferth et al.	May 22, 1934
1,987,928	Eckert	Jan. 15, 1935
2,169,518	Brady et al.	Aug. 15, 1939
2,252,837	Dicke	Aug. 19, 1941
2,259,659	Penote et al.	Oct. 21, 1941