

June 8, 1943.

A. R. ASKUE

2,321,352

TRENCHING MACHINE

Filed Aug. 9, 1941

2 Sheets-Sheet 1

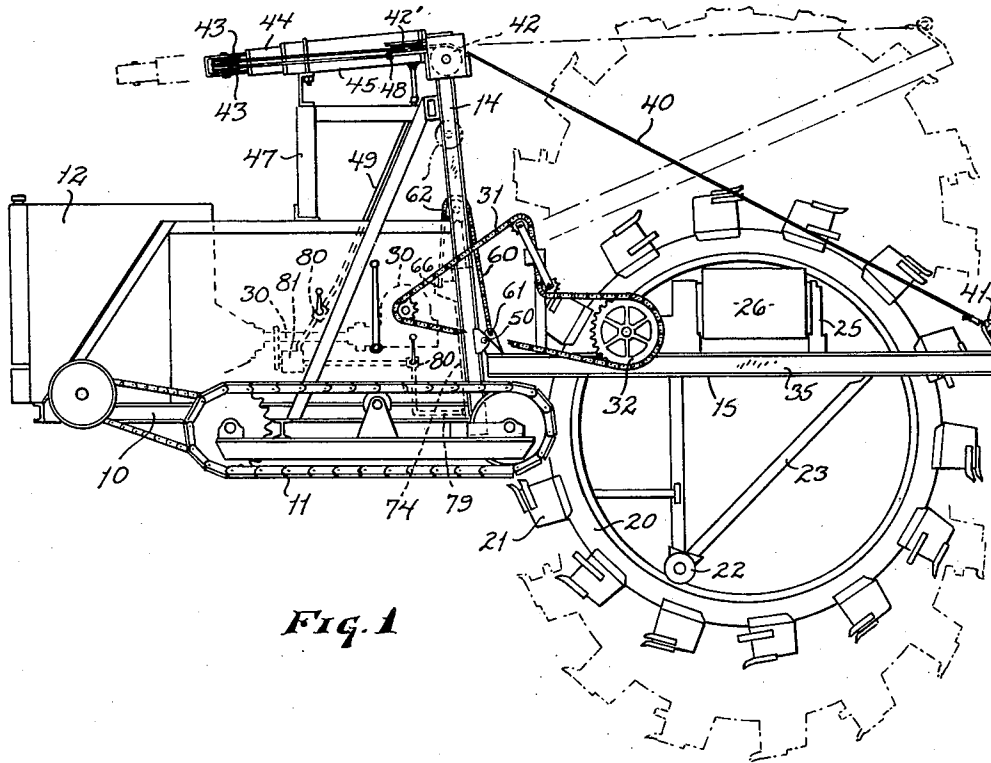


Fig. 1

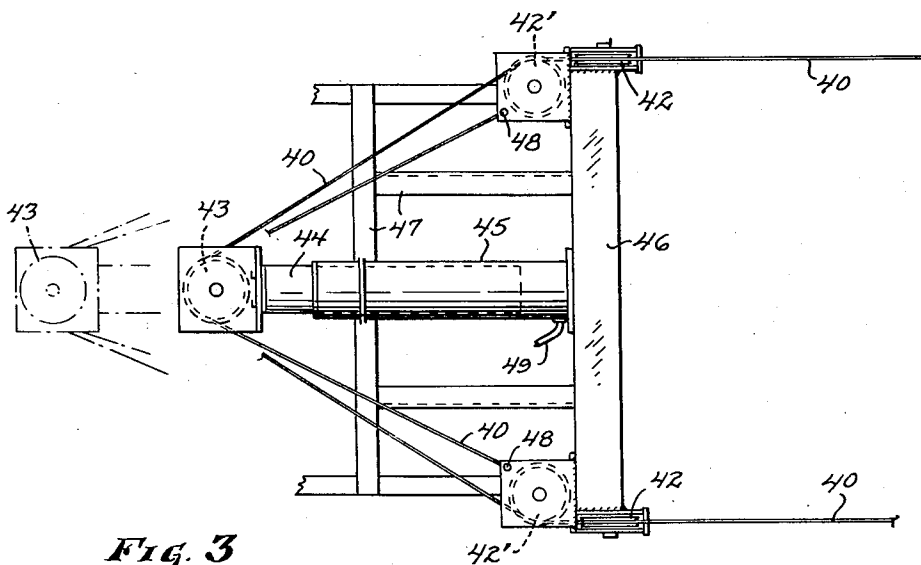


Fig. 3

INVENTOR.

ALBERT R. ASKUE

BY

Bates, Teare, & McBean
ATTORNEYS

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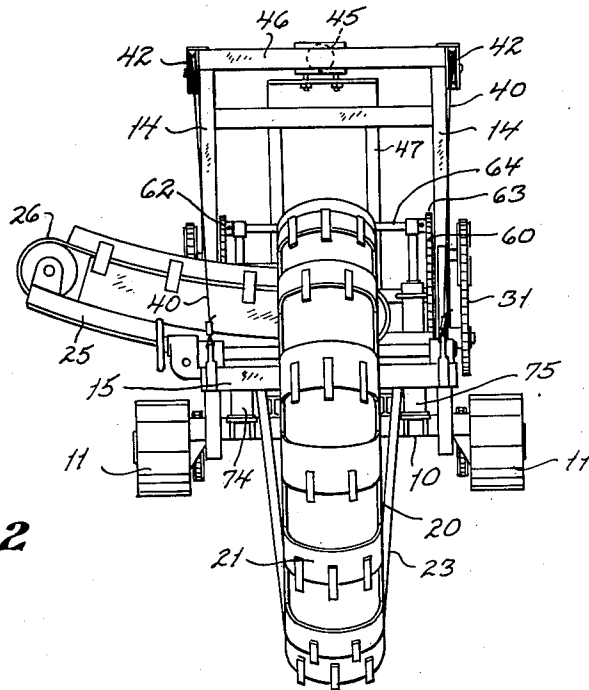


Fig. 2

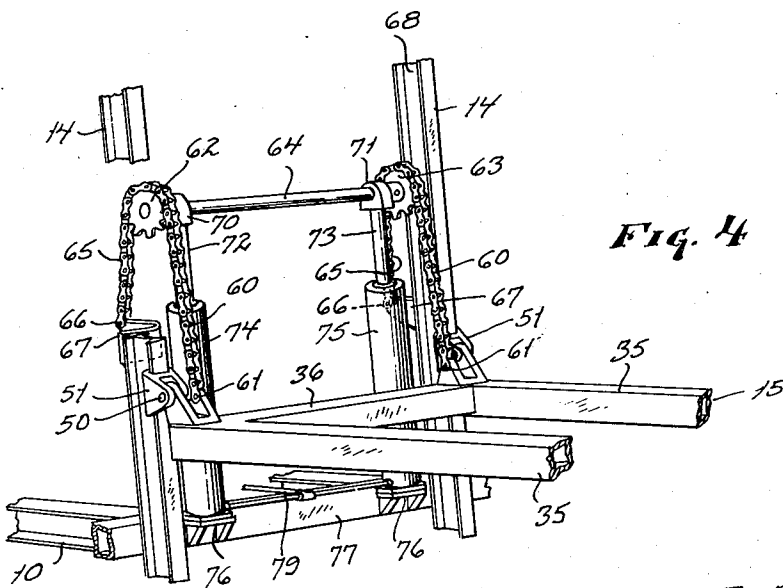


Fig. 4

INVENTOR.

ALBERT R. ASKUE

BY *Bates, Teare, + McBean*
ATTORNEYS

UNITED STATES PATENT OFFICE

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TRENCHING MACHINE

Albert R. Askue, Mentor, Ohio, assignor to The
Cleveland Trencher Company, Cleveland, Ohio,
a corporation of Ohio

Application August 9, 1941, Serial No. 406,158

5 Claims. (Cl. 37-97)

This invention relates to an improved trench digging machine and particularly to that type of machine utilizing a digging mechanism which is raised or lowered to determine the depth of trench dug or raised to move the mechanism entirely out of the ground to facilitate transportation of the machine from one job to another. The present invention is particularly concerned with an improved mechanism for positioning the digging unit. This, therefore, is the general object of this invention.

Another object of the present invention is to provide a trench digging machine with an improved mechanism to position the digging unit relative to the machine frame and at the same time maintain such unit in substantial vertical alignment despite any lack of balance in the weight of such unit.

A further object of this invention is to provide an improved mechanism for raising and lowering the digging unit of a trench digging machine, which mechanism will be highly efficient, easily controlled and economically manufactured.

Other objects of this invention will become more apparent from the following description, reference being had to the accompanying drawings in which there is illustrated a preferred embodiment of the invention. The novel and essential characteristics of the invention will be summarized in the claims.

In the drawings, Fig. 1 is a side elevation of a trench digging machine incorporating the present invention; Fig. 2 is a rear elevation of a machine illustrated in Fig. 1; Fig. 3 is a fragmentary plan view illustrating certain of the mechanism for positioning the digging unit, and Fig. 4 is a detail in perspective illustrating other mechanism used for raising and lowering the digging unit.

Referring now to the drawings, and particularly to Fig. 1, the present digging machine with which the invention has been illustrated comprises a frame 10 supported by a pair of spaced tractor belts 11. Mounted on the forward end of the machine frame is a motor 12 and mounted at the rear end of the frame is an upwardly extending, forwardly inclined guideway 14. A supplemental frame 15 extends rearwardly from the guideway 14 and supports a digging wheel or unit. This supplemental frame is mounted for movement lengthwise of the guideway to enable the raising and lowering of the digging unit. Suitable driving mechanism, not shown, but operatively connected with the motor 12, is provided to

actuate the tractor belts and propel the machine. In Fig. 1 the supplemental frame 15 which supports the digging unit is shown in full lines in a digging or lowered position and is indicated by dotted lines in an extreme lowered position and also by dotted lines in a position raised clear of the supporting surface of the machine to facilitate transportation of the machine from place to place.

The digging wheel comprises, as indicated, a pair of spaced rings 20 joined together by a plurality of digging buckets 21, spaced about the periphery thereof. This wheel is supported by a series of rollers, one of which is indicated at 22 as being carried by a frame 23 which is secured to the supplemental frame member 15. Extending transversely across the supplemental frame member 15 and passing through the digging wheel is a frame 25, which supports a belt conveyor 26, arranged to receive the material dug by buckets and discharge it to one side of the trench. The digging wheel is driven from the motor 12 by a driving mechanism, generally indicated at 29, which is coupled by a flexible drive chain 31 with a sprocket 32, carried by the supplemental frame 15. This sprocket is drivingly connected to the rings 20 of the digging wheel and is likewise connected to the belt conveyor 26.

The digging wheel or supplemental frame 15 comprises a pair of rearwardly extending frame members 35, secured together at their ends by suitable cross frame members, one of which is shown in Fig. 4 at 36. While the digging wheel is preferably mounted midway between the members 35 of the supplemental frame, to balance so far as possible the weight thereon, it will be noted that mechanism, such as the conveyor 26 extends to one side of this frame, thereby throwing the weight on the supplemental frame out of transverse balance. The side of the frame adjacent the projecting conveyor has a tendency to lag during the raising movement and it is one of the objects of this invention to overcome the tendency.

The supplemental frame 15 is supported at its outer end by a pair of cables 40. These cables are affixed as at 41 to the outer end of the frame at opposite sides thereof. Each cable 40 extends from a point 41 upwardly and forwardly to a sheave 42 carried at the upper end of one guideway member 14. From the sheave 42 each cable extends forwardly over a sheave 42 to a sheave 43 and thence rearwardly to a point 43 adjacent the other guideway member 14. The result is

that a forward movement of the sheaves 43 will cause an equal pull in the two cables 40.

The cables 40 are moved forwardly by a hydraulic mechanism to raise the outer end of the digging unit. As illustrated, the sheaves 43 are carried on the outer end of a piston 44 which operates in a substantially horizontally extending cylinder 45. The base of the cylinder 45 is secured to a frame member 46 extending across the upper ends of the guideway members 14. The outer end of the cylinder is braced by frame members 47. Thus, fluid pressure applied to the cylinder 45 will raise the outer end of the supplemental frame by an equal pull at its opposite sides, swinging such frame evenly and without distortion around pivots 50 carried by independent slide blocks 51 which are secured to opposite frame members 35 of the supplemental frame and slidingly coact with the respective guideway members 14.

The inner end of the supplemental frame or digging unit is supported by a pair of chains 60 each of which is secured, as at 61, to the inner end of a respective supplemental frame member 35. From the points 61, each chain 60 passes upward to its respective sprocket 62 or 63, which are secured to opposite ends of a shaft 64 supported as will hereinafter be more fully described. From the sprockets 62 and 63, each chain extends downward as at 65, and is fastened as at 66 to a rigid frame member, such as a bracket 67 carried by the respective guideway 14.

The shaft 64 to the ends of which the sprocket 62 and 63 are drivingly secured extends substantially from one guideway member to another and if desired may be provided with rollers, (not shown), but which may engage the channel surfaces 68 of the respective guideways 14 to guide the shaft in its upward movement. The shaft 64 is supported adjacent its opposite ends by a pair of bearing members 70 and 71, which are carried by respective pistons 72 and 73. These pistons are operatively mounted in hydraulic cylinders 74 and 75, respectively, which are mounted in a substantially vertical position between and closely adjacent their respective guideways. As illustrated in Fig. 4, the cylinders 74 and 75 are supported at their lower ends by brackets 76 which are secured to a transverse frame member 77 of the machine frame.

The arrangement of the mechanism supporting the inner ends of the supplemental frame is such that skewing of this frame due to unequal load distribution is eliminated. Assuming that an unequal load has a tendency to cause, say the cylinder 74 to lag behind the cylinder 75 when fluid pressure is applied to raise the supplemental frame, the tendency of the other cylinder 75 would be to raise its respective side of the supplemental frame at a faster rate of speed, but this cannot take place because the sprocket 63 cannot rotate faster than the sprocket 62, and the retarding load on the latter thus acts as a brake, holding back the action of cylinder 75 until the pressure has built up in cylinder 74. The action is therefore equalized and the frame is raised evenly and without skewing irrespective of local concentration of load. This arrangement, and the equalization of the support for the outer end of the supplemental frame already noted, insures the entire frame rising without skewing notwithstanding unequal loading.

The arrangement of the hydraulic cylinders and supporting mechanism above described adds a considerable factor of safety to the operating

mechanism, in that it permits the use of two cylinders and, because of the equalization of forces, eliminates any need for selected matching of the cylinders. In other words, even though one cylinder be more efficient than the other, successful operation of the raising mechanism is assured.

The cylinders 45, 74 and 75 are connected by conduits 49 and 79 to a suitable control valve generally indicated at 80 as being conveniently located relative to the operator's position. This valve is connected with a hydraulic pump 81 of the usual type which may be operated from the motor 12 in the usual manner.

From the foregoing description it will be seen that I have provided an efficient mechanism for raising and lowering the digging unit of a trenching machine, which, even though the weight on such unit be out of balance transversely of the machine, the unit will be raised in substantially vertical alignment with the machine, and that this mechanism is so arranged that it may be economically manufactured and assembled without necessitating undue precision in the machining or selection of the parts to be used.

I claim:

1. In a trenching machine, a main frame, a mobile support for said frame, upwardly extending guideway members carried by said frame, a supplemental frame slidably mounted for up and down movement on said guideway members, a digging unit carried by said supplemental frame, means to raise and lower the said supplemental frame, said means comprising a pair of upwardly extending hydraulic cylinders spaced transversely of the main frame, pistons carried by the respective cylinders, a pair of transversely spaced sprocket wheels, means drivingly connecting said sprocket wheels whereby they must rotate as a unit and means interconnecting the sprocket wheels with said cylinders to raise and lower said wheels, flexible drive chains extending from respective sides of the supplemental frame adjacent the inner end thereof upwardly over respective sprocket wheels and thence downward to points of securement fixed relative to the main frame.

2. In a trenching machine, a main frame, a mobile support for said frame, a pair of substantially vertically extending guideways carried by said frame, a supplemental rectangular frame slidably mounted for up and down movement on said guideway members, means to raise and lower said supplemental frame, said last named means including a pair of hydraulic cylinders spaced transversely of the main frame and extending substantially vertically relative thereto, a piston carried by each cylinder, a shaft carried by and extending between the upper ends of said pistons and rotatively journaled therein, a pair of transversely spaced sprocket wheels drivingly carried by said shaft, a flexible drive chain extending from each side of the supplemental frame adjacent the inner end thereof upwardly over one of said sprocket wheels and thence downwardly to a point of securement fixed relative to the main frame.

3. In a trench digging machine, a main frame, a mobile support for said frame, a pair of spaced substantially vertically extending guideway members carried by said frame and at one end thereof, a substantially horizontally extending rectangular supplemental frame slidably mounted for up and down movement on said guideway members, a digging unit mounted in said frame, means to raise and lower said sup-

plemental frame, said means including a pair of vertically extensible members disposed adjacent respective guideway members, a rotatably journaled shaft extending between the upper ends of said extensible members, a sprocket wheel drivingly secured to opposite ends of said shaft, a pair of flexible drive chains extending from respective sides of the supplemental frame upwardly over respective sprocket wheels and thence downwardly to points of attachment fixed relative to the main frame, and means to raise and lower said extensible members.

4. In a trench digging machine, a main frame, a mobile support for said frame, a pair of spaced substantially vertically extending guideway members carried by said frame, at the rear end thereof, a substantially horizontally extending rectangular supplemental frame slidably mounted for up and down movement on said guideway members, a digging unit mounted in said frame, means to raise and lower the inner end of said supplemental frame, said last named means comprising a pair of vertically extensible members disposed adjacent respective guideway members, a rotatably journaled shaft carried by and extending between the upper ends of said vertically extensible members, sprocket wheels drivingly secured to opposite ends of said shaft, a pair of flexible drive chains, each of said chains extending from a respective side of the supple-

mental frame at a point adjacent the inner end thereof, upwardly around a respective sprocket wheel and thence downwardly to a point of attachment fixed relative to the main frame, and means to actuate said extensible members.

5. In a trench digging machine, a main frame, a mobile support for said frame, a pair of spaced substantially vertically extending guideway members carried by said frame at the rear end thereof, a substantially horizontally extending rectangular supplemental frame slidably mounted for up and down movement on said guideway members, a trench digging unit mounted in said supplemental frame, means to raise and lower said supplemental frame, said last named means including a pair of vertically extending spaced hydraulic cylinders disposed adjacent respective guideway members, a piston carried by respective cylinders, a rotatably journaled shaft carried by and extending between the upper ends of said pistons, sprocket wheels drivingly secured to opposite ends of said shaft, a pair of flexible drive chains, each of said chains extending from a respective side of the supplemental frame adjacent the inner end thereof upwardly over respective sprocket wheels and thence downwardly to points of attachment fixed relative to the main frame, and means to supply fluid pressure to said cylinders as desired.

ALBERT R. ASKUE.