Aug. 28, 1923. 1,466,568

C. E. STAHL ET AL

EXCAVATOR

Filed July 22, 1918 5 Sheets-Sheet 1

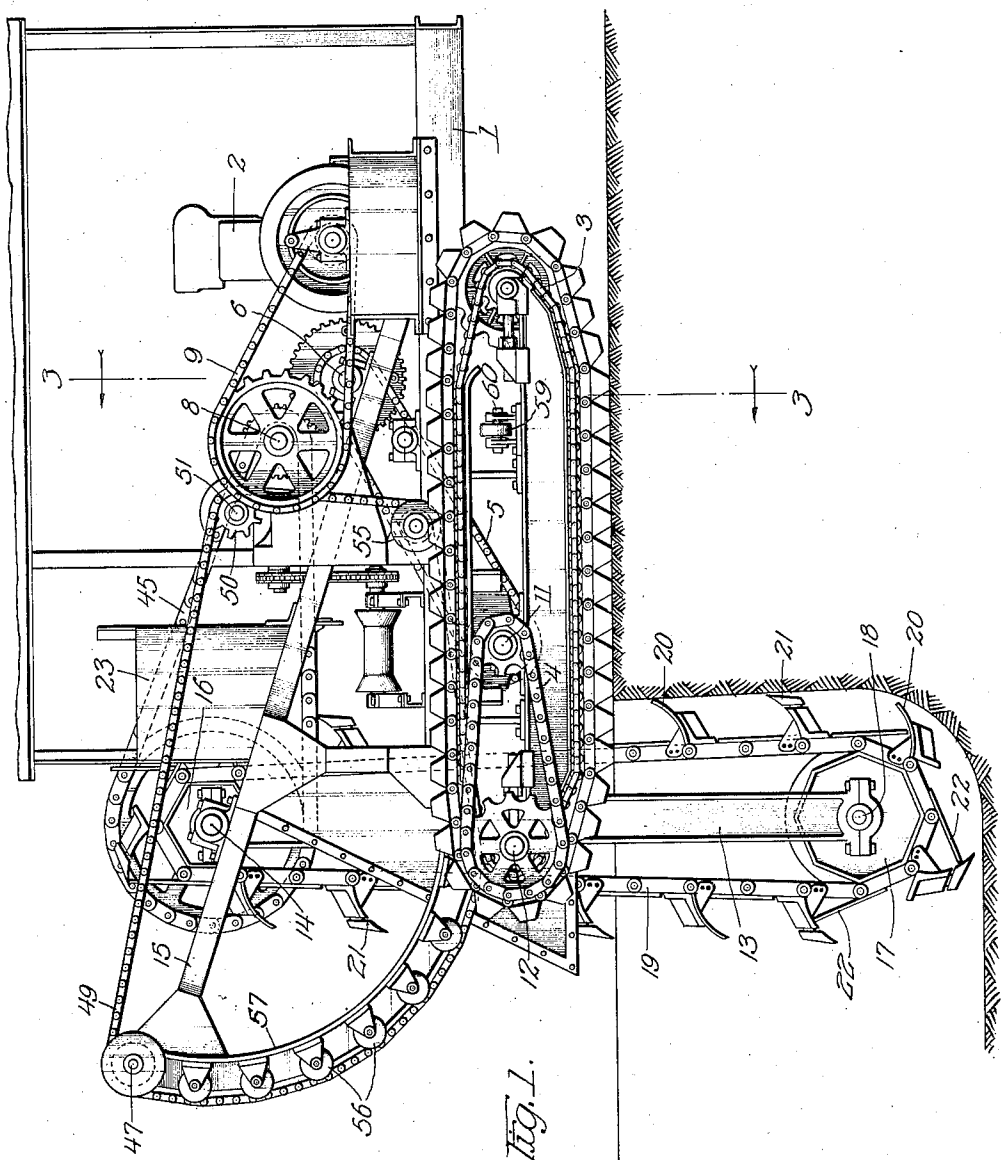


Fig. 1.

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Hans J. Bentson
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Aug. 28, 1923.

1,466,568

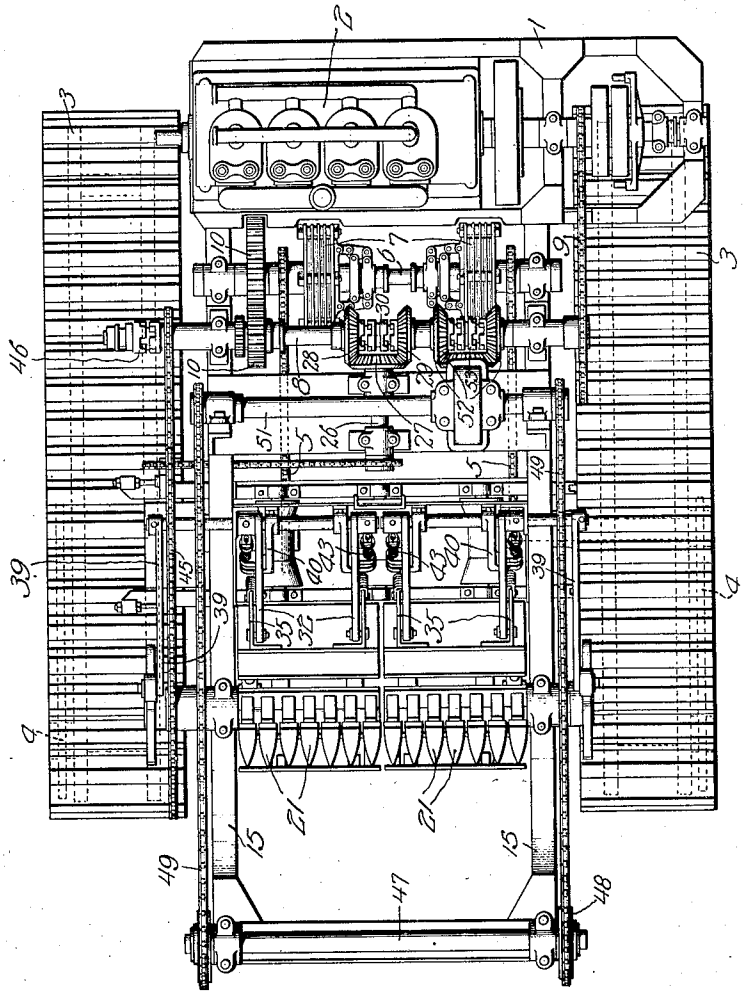
C. E. STAHL ET AL

EXCAVATOR

Filed July 22, 1918

5 Sheets-Sheet 2

Fig. 2.



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EXCAVATOR

Filed July 22, 1918 5 Sheets-Sheet 3

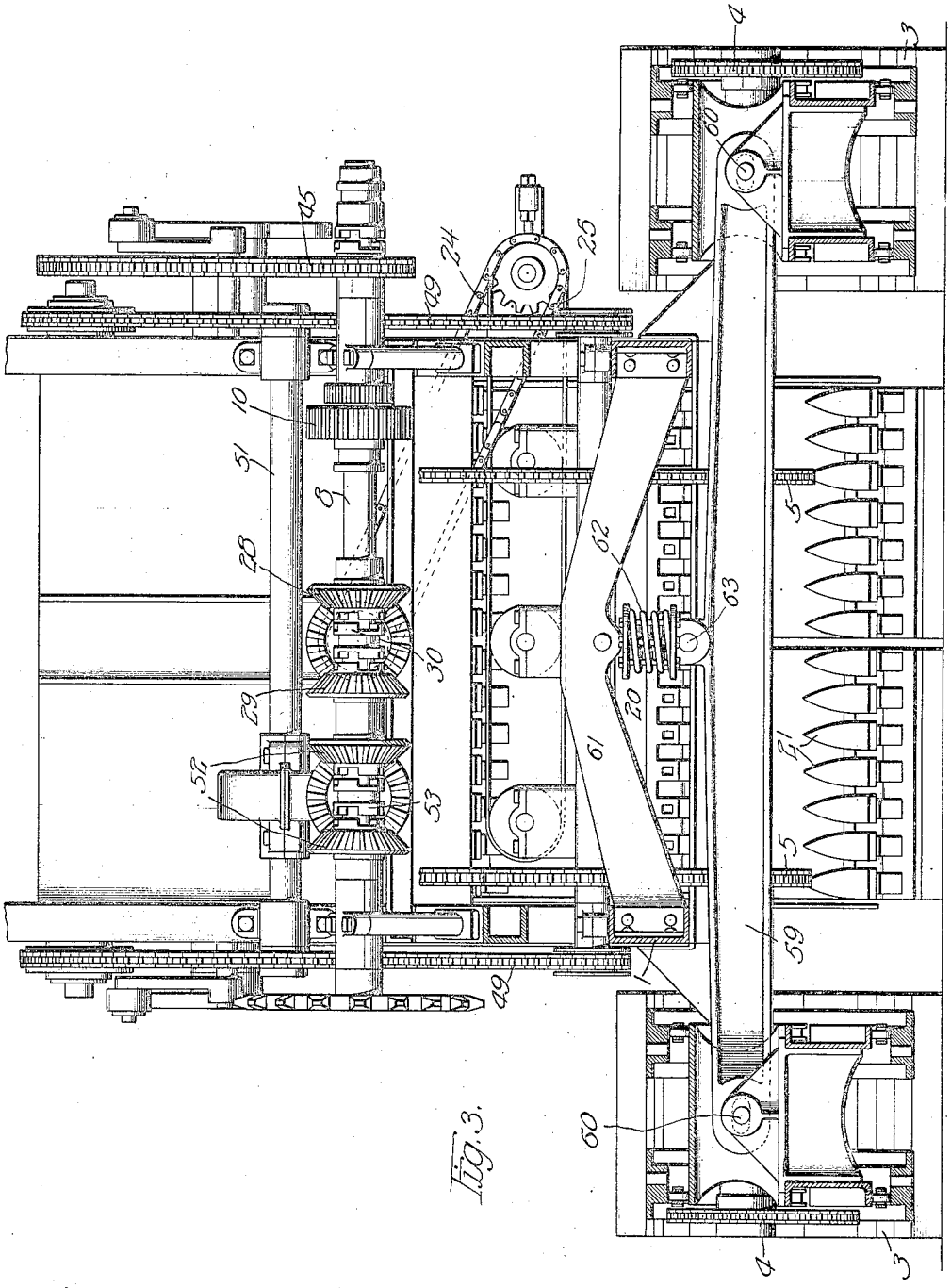


Fig. 3.

Witnesses
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Aug. 28, 1923. 1,466,568

C. E. STAHL ET AL

EXCAVATOR

Filed July 22, 1918 5 Sheets-Sheet 4

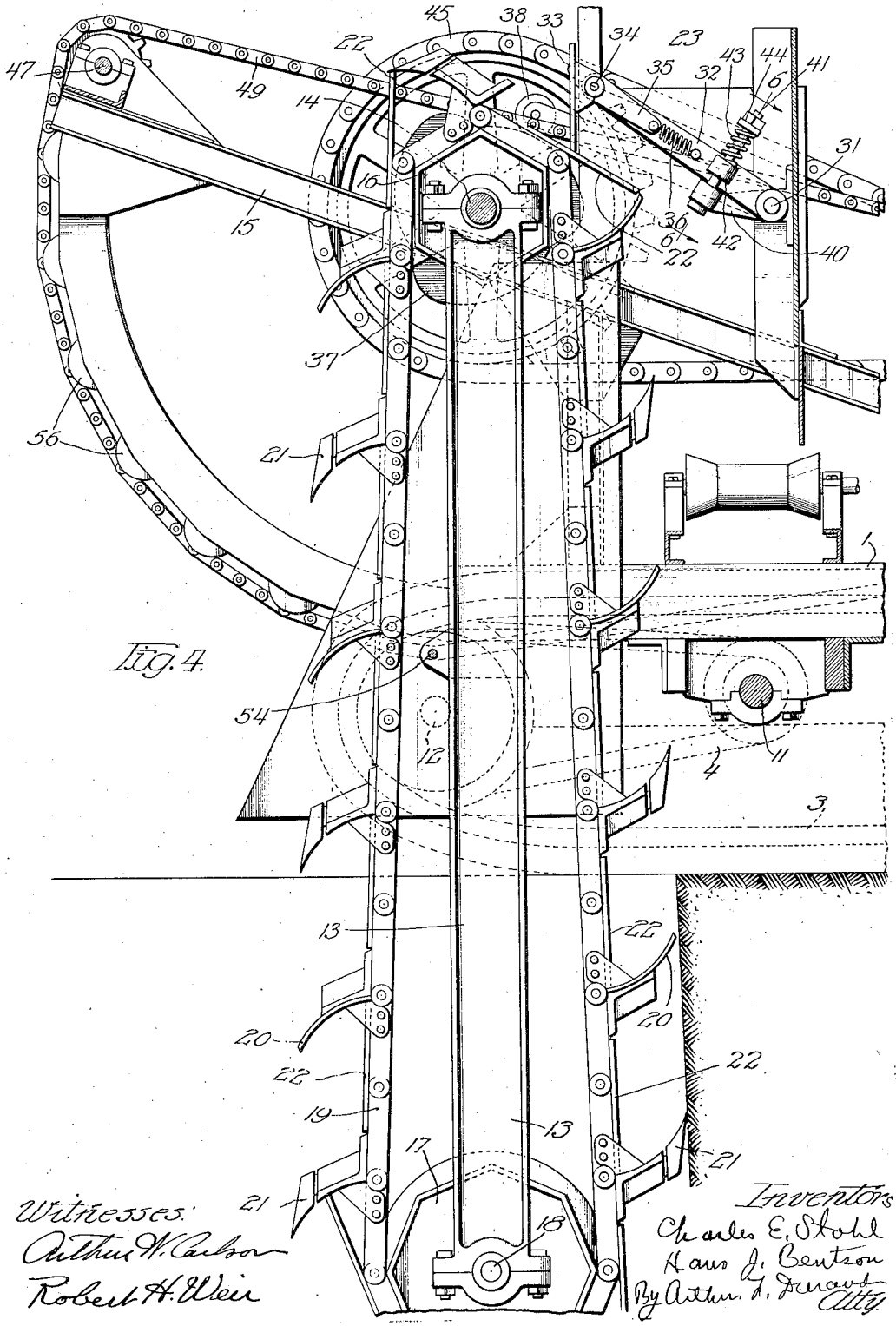


Fig. 4.

Witnesses:
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Aug. 28, 1923. **1,466,568**

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EXCAVATOR

Filed July 22, 1918 5 Sheets-Sheet 5

Fig. 5

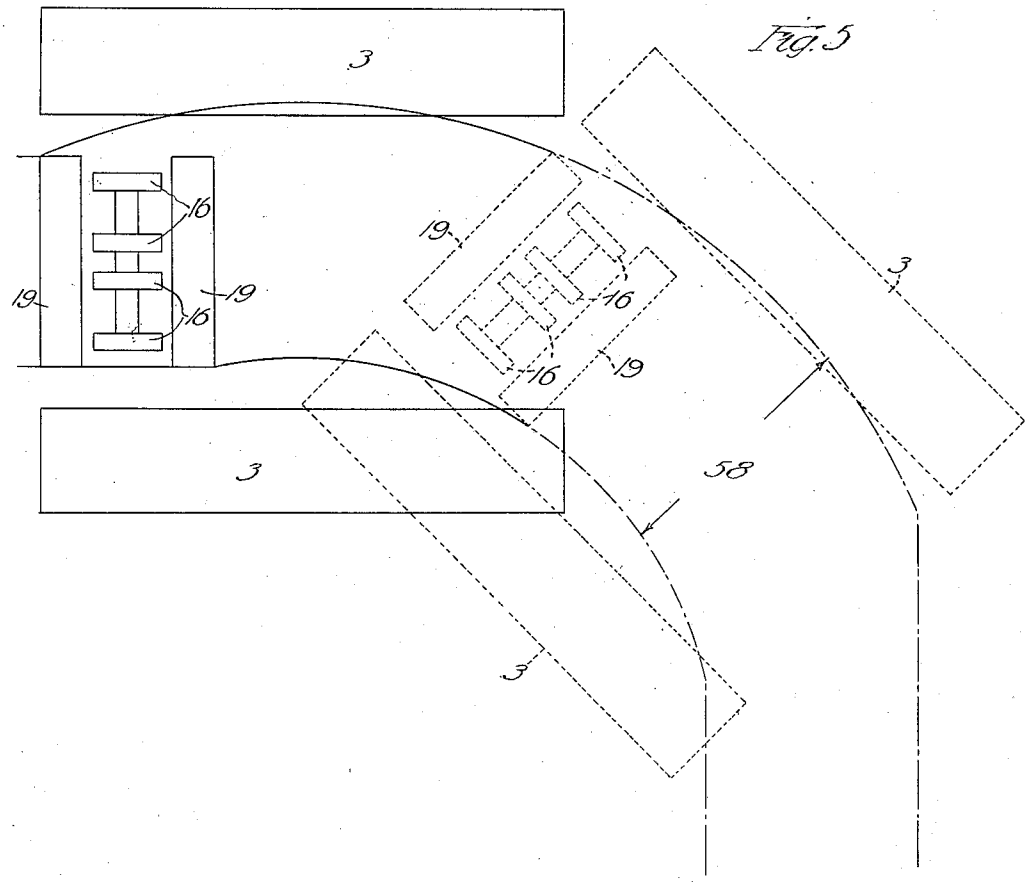
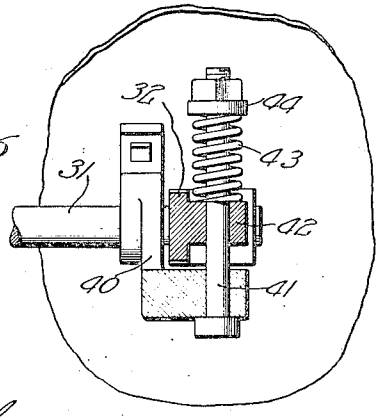


Fig. 6



Witnesses:
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Patented Aug. 28, 1923. 1,466,568

UNITED STATES PATENT OFFICE.

CHARLES E. STAHL AND HANS J. BENTSON, OF WINTHROP HARBOR, ILLINOIS, ASSIGNORS, BY MESNE ASSIGNMENTS, TO F. C. AUSTIN MACHINERY COMPANY, A CORPORATION OF ILLINOIS.

EXCAVATOR.

Application filed July 22, 1918. Serial No. 246,009.

To all whom it may concern:

Be it known that we, CHARLES E. STAHL and HANS J. BENTSON, citizens of the United States of America, and residents of Winthrop Harbor, Illinois, have invented a certain new and useful Improvement in Excavators, of which the following is a specification.

This invention relates to excavators of that kind in which a trench cutter is arranged at the rear end of the machine, so that a trench of the desired depth will be cut as the machine travels forward over the surface of the ground, and in which means are provided for raising and lowering the trench cutter by swinging movement thereof about a transverse axis disposed a distance above the top of the trench.

Generally stated, the object of the invention is to provide a novel and improved excavator of the foregoing general character, adapted to operate more satisfactorily under certain conditions, as will hereinafter more fully appear, than machines heretofore employed for doing this kind of work.

It is also an object to provide certain details and features of construction and combinations tending to increase the general efficiency and desirability of an excavator of this particular character.

To these and other useful ends the invention consists in matters hereinafter set forth and claimed and shown in the accompanying drawings, in which—

Fig. 1 is a side elevation of an excavator embodying the principles of the invention.

Fig. 2 is a plan of said machine.

Fig. 3 is an enlarged vertical transverse section on line 3—3 in Fig. 1.

Fig. 4 is an enlarged side elevation of the trench cutter and adjacent parts, showing certain portions of the construction in vertical section.

Fig. 5 is a diagram showing the movements of the excavator in making a short turn, the machine being especially adapted for this purpose.

Fig. 6 is a detail sectional view of a portion of the scraper mechanism by which the cleaners of the buckets or digging devices are scraped as they pass the point of discharge.

As thus illustrated, the invention comprises a body 1 which forms a platform or support for the engine 2 and various other parts or elements which are necessary for the operation of the excavator. Said body is supported by a pair of multi-pedal traction belts 3, of any suitable, known or approved construction, one at each side of the body. Sprocket chains 4 and 5 connect the rear ends of these traction belts with the transverse shaft 6 on the body, this shaft having clutches 7, of any suitable character, for controlling the transmission of power from this shaft to the two traction belts, and whereby either belt can be driven independently of the other, friction clutches being preferably employed for this purpose. The transverse shaft 8 is driven from the engine through the medium of a sprocket chain 9, and power from this shaft is communicated through the spur gearing 10 to the shaft 6, whereby the latter is adapted to drive the two traction belts. Each belt rocks in a vertical plane about a transverse axis provided by the shaft or axle 11, it being observed that this shaft or axle 11 is provided with two sprocket wheels for engaging the chains 4 and 5, and that the sprocket chain 4 drives the shaft 12 at the rear end of each belt, thereby to operate the traction belts in the well-known manner to propel the excavator. Any suitable means can be employed for manually controlling the clutches 7, so that the two traction belts will be driven at the same or at different speeds, or whereby one belt may remain stationary while the other is driven to cause the excavator to make a short turn to the right or the left, or to turn clear around.

The trench cutter comprises a swinging ladder frame 13 mounted on the transverse shaft 14 at its upper end, this shaft being suitably supported by the frame 15 which overhangs the rear end of the body of the excavator. Sprockets or rotary members 16 are mounted on the shaft 14, and similar sprockets or rotary members 17 are mounted on the shaft 18 at the bottom or lower end of the ladder frame 13, the parallel and endless sprocket chains 19 being carried on these sprockets or rotary members. The digging devices comprise the alternate buckets 20, and the intermediate tooth-shaped cutters 21, the latter being arranged in transverse rows extending from one chain to the other. With this arrangement the

alternate digging devices are scraper-shaped buckets, and the intermediate digging devices are rows of tooth-shaped cutters, both the buckets and the cutters being concave or curved when viewed from the side. These digging devices are rigidly secured to the alternate links of the chains 19, and the intermediate links are provided with cleaners 22 consisting of plates rigidly secured to these links. With this arrangement, when the digging devices travel upward and pass over the sprockets or rotary members 16, the pivotal action between the links of the sprocket chains causes each cleaner plate 22 to scrape the concave inner surface of the bucket or set of cutters immediately in rear thereof, so that the rear edge of each cleaner plate serves automatically to discharge the contents or load from the bucket or digging device when the point of discharge is reached at the upper end of the trench cutter.

It will be observed that the trench cutter is of a length to extend downward from its axis 14 to a point some distance below the surface of the ground, and that the front buckets or digging devices travel upward while the rear ones travel downward, thus cutting the trench as the traction belts 3 are operated to slowly move the excavator forward. A hopper 23 catches the discharge from the buckets and digging devices, and the excavated dirt is discharged from this hopper onto the transverse conveyer 24, which latter is adjustable, in any suitable manner, to project at either side of the machine. A sprocket chain 25 connects one end of this belt conveyer 24 with a short longitudinal shaft 26, suitably mounted in bearings on the frame of the excavator, and this shaft 26 is provided with a bevel gear 27 which engages the bevel pinions 28 and 29 on the previously mentioned shaft 8, clutch mechanism 30 being provided to control the rotation of the bevel pinions 28 and 29, whereby the shaft 26 can be rotated in either direction to discharge the excavated dirt from either end of the conveyer 24 at either side of the excavator. A transverse rock-shaft 31 is mounted inside of the hopper 23, and provided with arms 32 that carry the pivoted plate 33, the latter being disposed in position to scrape the outer surface of the cleaner plates 22, one after the other, during the operation of the trench cutter. The plate 33 is preferably pivoted on the arms 32 at 34, and provided with an arm 35 which is connected by a spring 36 to one of the arms 32, so that the plate 33 may oscillate about the transverse axis provided by the pivots 34, relatively to the arms 32, and whereby this oscillation of the plate 33 is yieldingly opposed by the spring 36, in a manner that will be readily understood. As shown, the plate 33 is provided with an arm 35 at each end thereof, so that there are two of these arms 35 and two springs 36, and it will be understood that one or more springs can be employed for this purpose, if necessary or desirable. It will also be seen that the construction, as shown and described, involves four sprocket chains 19, so that the digging devices are arranged in two endless parallel series, side by side, at the rear of the excavator. With this construction there are four of the arms 32 and two scraper plates 33 (see Fig. 2), and two transverse rock-shafts 31, there being one of these rock-shafts for each separate set of buckets or digging devices. With this construction, cams 37 are mounted on the ends of the shaft 14 to engage the rollers 38 on the arms 39, these arms being rigidly mounted on the rock-shafts 31, so that the rotation of said cams will move the scraper plates 33 up and down during the operation of the trench cutter. For this purpose, it will be seen that the cams 37 are so shaped that they raise the rollers 38, and therefore the scraper plates 33, each time a pair of cleaner plates 22, one for each set of buckets, passes under said scraper plates. Bracket arms 40 are provided with bolts 41 that extend through lugs 42 on the arms 32, and these bolts are provided with springs 43 which are compressed between the lugs 42 and the nuts 44 on the outer ends of these bolts when the cams 37 raise the scraper plates 33, and with this arrangement the springs 43 serve to yieldingly hold or present the scraper plates 33 in position to properly scrape the cleaner plates 22, in a manner that will be readily understood. The cleaner plates 22, however, are not required to lift the plates 33 against the pressure of the springs 43, or at least not entirely, inasmuch as the cams 37 lift the rollers 38 and thereby rock the shafts 31 to slightly raise the scraper plates 33 when the cleaner plates 22 pass under, (see Fig. 4), and in this way the load is first swept out of the bucket or digging device by the cleaner plate 22, and then swept or scraped off from the latter by the plate 33, so that the excavated dirt falls within the hopper 23 and onto the transversely arranged conveyer 24 previously described. The shaft 14 is driven by a sprocket chain 45 from the shaft 8, and this transmission of power is controlled by a clutch mechanism 46 of any suitable, known or approved character, so that the trench cutters can be started and stopped at will.

The mechanism for raising and lowering the trench cutter by swinging it up and down about its axis 14 is as follows: The overhanging frame 15 is provided at its rear end with a transverse shaft 47, upon the ends of which are mounted the idlers 48 for engaging the sprocket chains 49,

which latter are driven by sprocket wheels 50 on the transverse shaft 51 suitably mounted in bearings on the body frame. This shaft 51 has a reversible power-transmitting connection with the shaft 8, through the medium of the beveled gears 52 and the clutch 53, which may be of any suitable character, so that the direction of travel of the endless sprocket chains 49 may be reversed at will by simply reversing the direction of rotation of the shaft 51, the latter being disposed over the longitudinal shaft 26 previously described. The sprocket chains 49 are fastened to the two ladder frames at 54, in any suitable or desired manner, and are arranged to travel around the idlers 55 on the body frame, and upon the idlers 56 disposed in curved rows on the curved supports 57 at the rear of the excavator. It will be seen that these curved supports 57 have their upper ends supported by the frame 15, and have their lower ends supported on the body, so that the portions of the chains which are in engagement with the idlers 56 travel on curves struck from the axis 14, these curved paths of travel of the sprocket chains being disposed a substantial distance from said axis. In this way, a powerful leverage is obtained for both the raising and the lowering of the trench cutter by swinging the ladder frames 13 about the axis 14, and this raising and lowering of the trench cutter is also accomplished quickly and easily.

It will be seen that the trench cutter is disposed between the rear end portions of the two traction belts 3, and quite close to the imaginary vertical axis about which the excavator turns to the right or to the left, or about which it turns clear around, so that a short turn can be made when desired. In Fig. 5 the position of the traction belts 3 is shown in full lines, as is also the position of the trench cutter. The subsequent positions of the traction belts are shown in dotted lines, as well as the position of the trench cutter, and it will be seen that the curves 58 in the trench are comparatively short, and that the machine is thus capable of making a turn suddenly to the right or to the left, or turning clear around. In this diagram it is assumed that the right hand traction belt has traveled at a slower rate of speed than the left hand traction belt, being at the inner side of the curve or turn in the trench. However, an even sharper or shorter turn can be made by stopping one traction belt, so that the machine as a whole will then turn or swing around about an imaginary axis located substantially at the center of the traction belt which has been stopped. This is done while the trench cutter is in operation, when it is desired to change the direction of the trench, but when the trench cutter is raised out of the ground, the machine is then adapted to travel over the surface of the ground and to be steered to the right or to the left like an ordinary tractor. Of course, a reversing gear can be applied in any suitable or desired manner, in the transmission of power from the engine to the traction belts, for the purpose of reversing the direction of travel of the excavator at will, or whenever such is necessary or desirable. For example, the spur gearing 10 may be constructed, in any suitable, known or approved or ordinary manner, to reverse the direction of rotation of the shaft 6, thereby to reverse the direction of travel of the traction belts.

Preferably the two traction belts 3 are connected together, at the front of the shaft or axle 11, by an equalizer or transverse bar 59 which has a pivotal connection 60 with the frame of each traction belt, so that this bar or equalizer may tilt upward at either end, when either caterpillar tilts upward at its forward end. This arrangement can be constructed in any suitable manner, and as shown the body frame 1 of the excavator has a cross member 61, the middle portion of which is provided with a compression spring device 62 having its lower end pivoted at 63 to the center of the said bar or equalizer 59, whereby the weight of the excavator is communicated through this spring to the middle portion of said bar or equalizer. In this way the weight of the excavator is carried partly by the shaft or axle 11 and partly by the bar or equalizer 59, but at the same time each traction belt is adapted to oscillate or tilt up and down more or less independently of the other, when the machine travels over rough or uneven ground.

What we claim as our invention is:—

1. In a trenching machine, the combination of a supporting frame, a digging conveyer frame pivoted in the supporting frame, a flexible member for swinging said digging conveyer frame up out of the trench, and a guide for said member, said guide being fixed upon the supporting frame and curved about the pivot of the digging conveyer frame.

2. In a trenching machine, the combination of a supporting frame, a digging conveyer frame pivoted in the supporting frame, a flexible member for swinging said conveyer frame up out of the trench, and a guide for said member, said guide being fixed upon the supporting frame and curved on the arc of a circle having a center at the center of movement of the digging conveyer frame.

3. A digging conveyer having blades cutting successively over the breast of the trench, a digging conveyer frame pivoted above the ground, a flexible member movable in one direction to pull said digger conveyer frame to hold said blades against

work and in the other to lift the digging conveyer frame up out of the ground, and fixed guides located on opposite sides of said pivoted conveyer frame and about which said flexible member is movable.

4. In an excavator, a trench cutter having a series of digging devices, a cleaner for each digging device, a scraper for engaging said cleaners, and cam mechanism for controlling said scraper.

5. A structure as specified in claim 4, and springs to yieldingly present the scraper to said cleaners.

6. A structure as specified in claim 4, said mechanism including a rotary cam, an arm provided with means to engage said cam, and means to provide a horizontal axis about which said arm and scraper are moved up and down by said cam.

7. In an excavator, a trench cutter comprising an endless series of digging devices, the alternate digging devices being adapted to serve as buckets to carry the excavated dirt upward from the trench, the intermediate digging devices comprising transverse rows of cutting teeth, an automatic cleaner for each digging device, each cleaner having a transverse axis of pivotal motion relatively to its allotted digging device, said digging devices being curved about the axes of their cleaners, and means to clean said cleaners.

8. In an excavator, a body mounted on independently driven traction belts so that a short turn can be made, a trench cutter mounted in vertical working position and operable during such turning of said body, means to provide a transverse axis for tilting movement for said traction belts, and an equalizer connecting said body with said traction belt, said axis being disposed between said equalizer and said trench cutter.

9. In a trenching machine, the combination of a body frame, a trench cutter mounted therein, means to support said trench cutter for swinging about a transverse axis at the upper end thereof, a front connection to pull said trench cutter to working position, and a rear connection to pull said trench cutter out of the trench, said connections extending respectively from opposite sides of the trench cutter and exerting direct pull thereon in the direction of movement.

10. In a trenching machine, the combination of a body frame, a trench cutter mounted therein, means to support said trench cutter for swinging about a transverse axis at the upper end thereof, a front connection to pull said trench cutter to working position, and a rear connection to pull said trench cutter out of the trench, said front and rear connections extending in opposite directions from the trench cutter and comprising a sprocket chain, and guiding means therefor.

Signed by us at Chicago, Illinois, this 29th day of June, 1918.

CHARLES E. STAHL.
HANS J. BENTSON.