April 26, 1932. P. SHANNON 1,855,998

MECHANICAL EXCAVATING MACHINE

Filed May 29, 1929 4 Sheets-Sheet 1

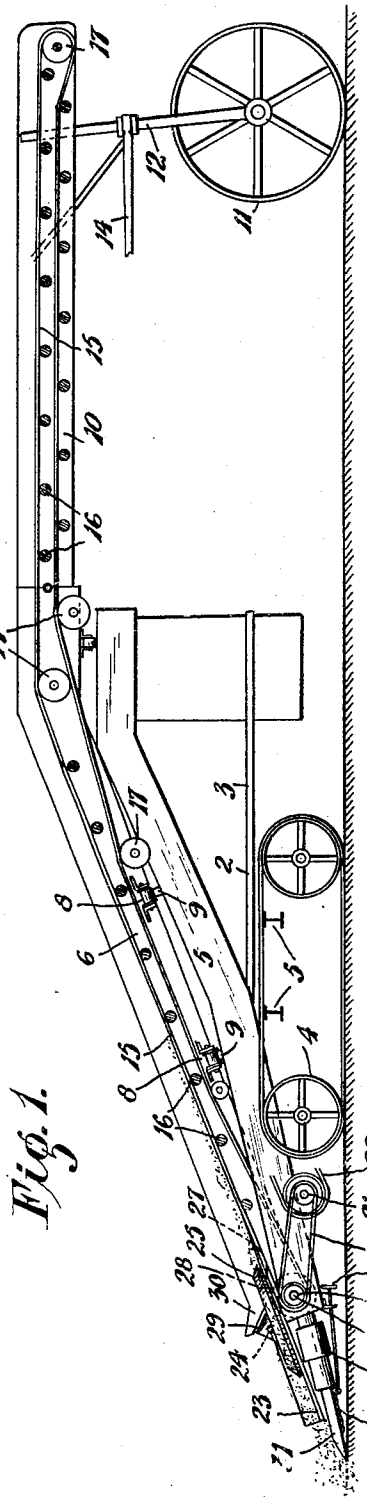


Fig. 1.

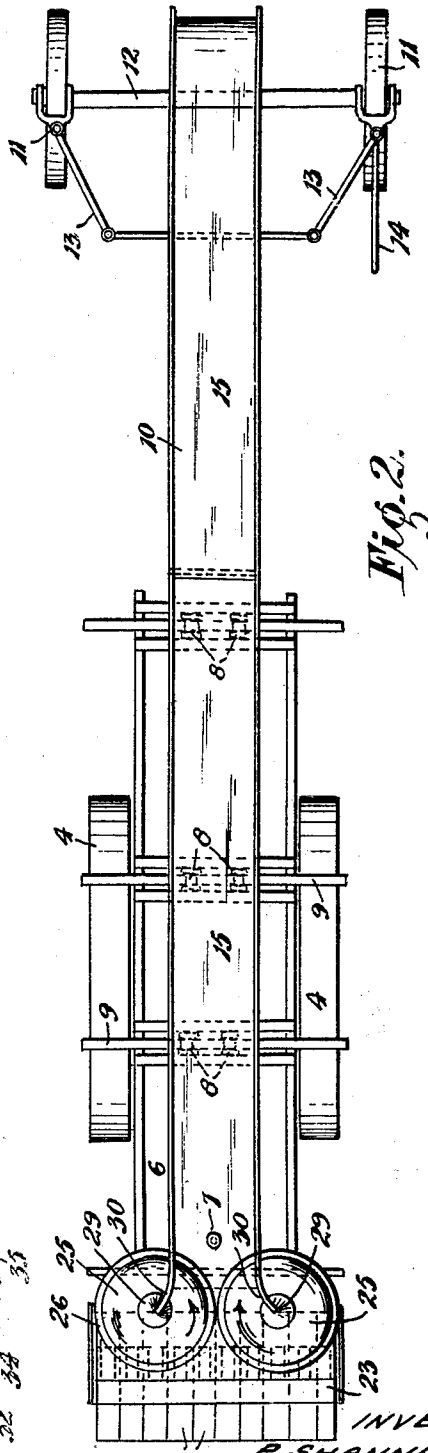


Fig. 2.

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MECHANICAL EXCAVATING MACHINE

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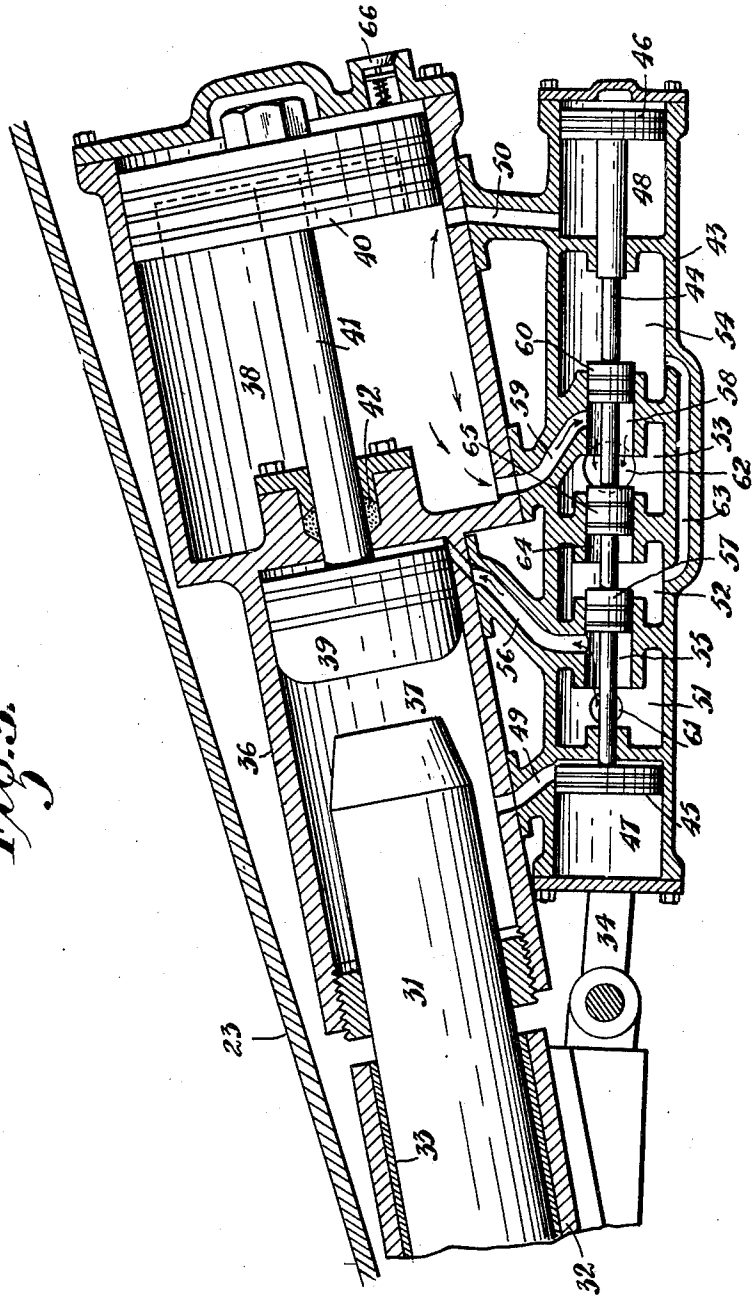


Fig. 3.

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MECHANICAL EXCAVATING MACHINE

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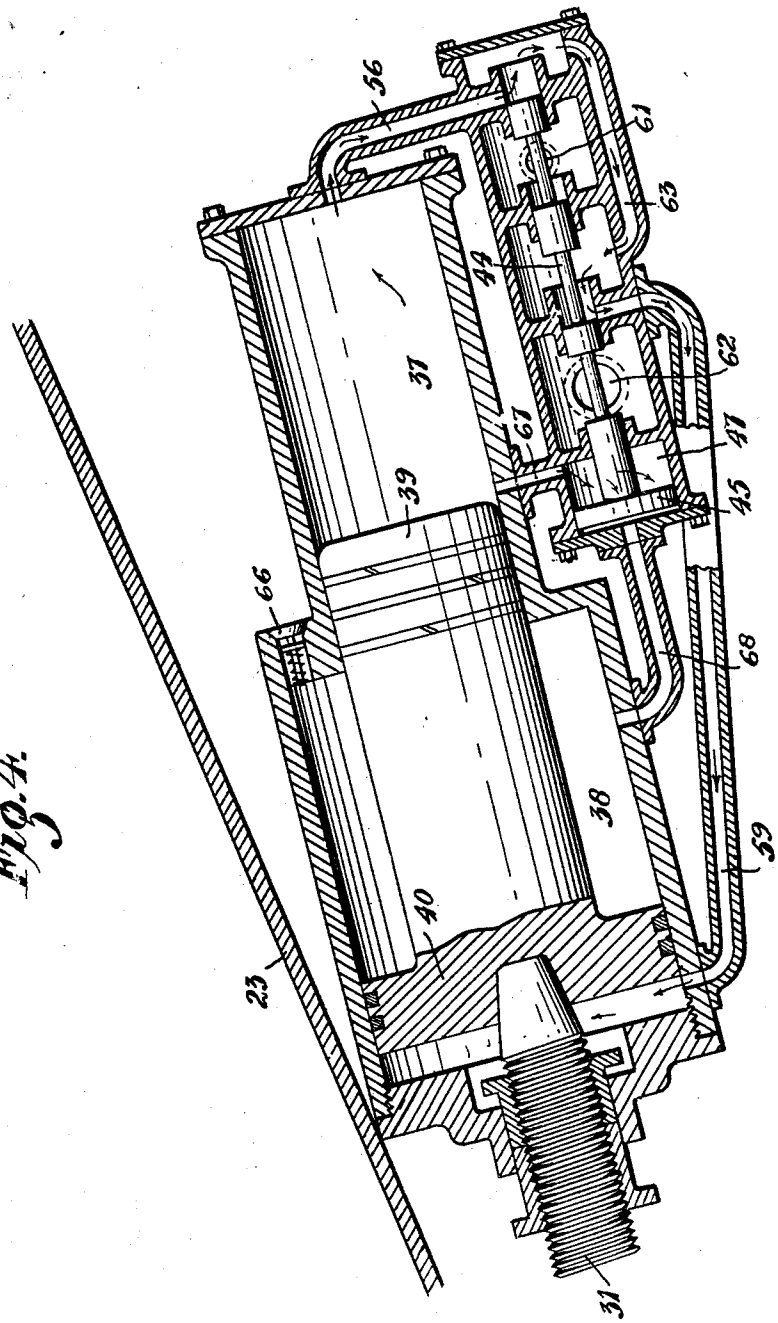


Fig. 4.

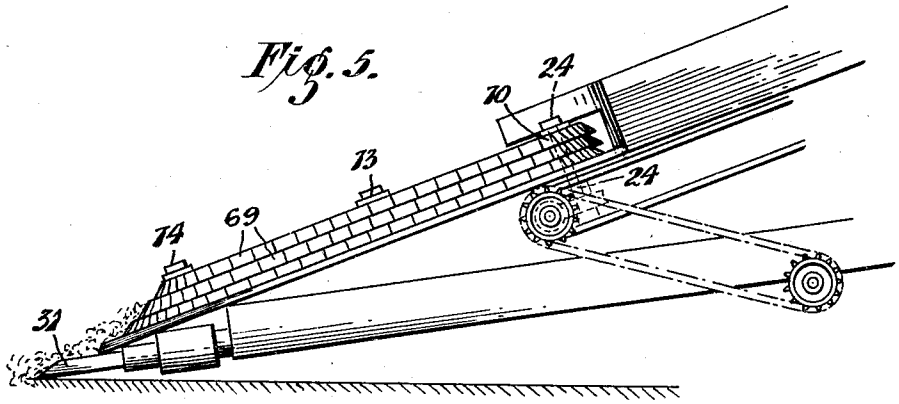
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MECHANICAL EXCAVATING MACHINE

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Fig. 5.



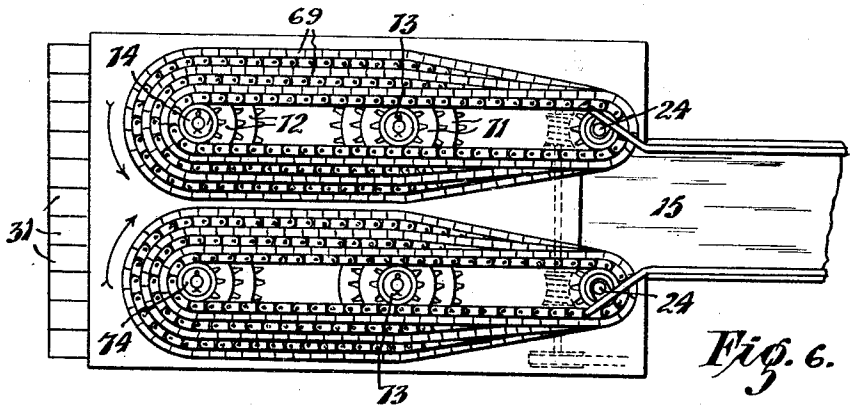


Fig. 6.

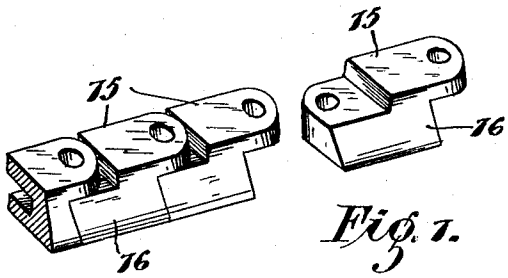


Fig. 7.

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UNITED STATES PATENT OFFICE

PHILIP SHANNON, OF GWABEGAR, NEW SOUTH WALES, AUSTRALIA

MECHANICAL EXCAVATING MACHINE

Application filed May 29, 1929, Serial No. 367,043, and in Australia October 3, 1928.

This invention relates to an improved mechanical excavating machine of the type having cutters or digging tools at the forward end to loosen the earth or material, and an elevating conveyor for delivering the spoil to a truck or dray at the rear end of the machine.

The improved machine is mounted or built upon a tractor, and is characterized chiefly by having a series of digging tools which are operated by steam or fluid pressure rams to loosen the earth or material. Other features of the invention are an improved general construction, the provision of inwardly rotating discs to feed the spoil onto the elevating conveyor, improved means for supporting the elevating conveyor, the construction of the fluid pressure rams and the steam control means therefor, and means for utilizing the expansion of the steam for automatically returning the rams to initial position after each forward action. Features of construction and combination are also included and are hereinafter fully described aided by reference to the accompanying drawings wherein:—

Figure 1 is a sectional side view of the improved excavating machine.

Figure 2 is a view in plan of Figure 1.

Figure 3 is a sectional view illustrating one of the fluid pressure rams for actuating the digging tools and the steam control means therefor.

Figure 4 is a sectional view showing a modified form of the mechanism shown in Figure 3.

Figure 5 is a side view showing modified means for feeding the loosened earth from the digging tools onto the conveyor.

Figure 6 is a plan view of Figure 5.

Figure 7 is a detail view of one of the chains or belts of the modified feed means.

The improved excavating machine in the form illustrated in Figures 1 to 4 embodies a steam tractor 2 of any suitable type, the frame 3 of which is supported by caterpillar traction wheels 4. Mounted upon the frame of the tractor is an inclined structure 5, which supports a conveyor framework 6. The forward end of said conveyor framework is pivotally connected to the inclined structure at 7, while its rear portion is adjustably supported by anti-friction rollers 8 engaging transverse rails 9 mounted on said inclined structure 5. The pivot 7 and the rails 9 enable the conveyor framework to be angularly adjusted relatively to the tractor 2, as may be found necessary during the working of the machine.

Hingedly attached to the rear end of the conveyor framework 6 is an extension framework 10 supported at its rear end by a pair of trailer wheels 11. These wheels are mounted in a light steering framework 12 having arms 13 actuated by means of a handle 14 whereby the trailer wheels can be swivelly moved for steering the machine.

The main framework 6 and the extension framework 10 support an endless conveyor belt 15 which passes over a series of guide rollers 16 and 17. This conveyor belt is driven by a pulley wheel 18 mounted on a transverse shaft 19 which is driven by chain and sprocket gearing 20 from a countershaft 21. Said countershaft, in turn, is driven by chain and sprocket gearing 22 from the crankshaft of the tractor engine or any suitable power take-off shaft (not shown).

Mounted at the forward end of the machine is an inclined plate 23 supported by extension bearers from the conveyor framework 6. This plate is inclined at the same angle as the conveyor belt 15, and its rear end overlaps the forward portion of said conveyor belt so that the earth or material loosened by the digging tools is positively delivered by said plate onto said travelling conveyor belt.

Mounted in bearings provided on the inclined plate 23 are short spindles 24 supporting two large feed discs 25, which are rotated in a direction inwardly towards each other, as shown in Figure 2, to feed the earth and material inwardly onto the travelling conveyor belt 15. These discs are located close to and parallel with the surface of the inclined plate 23 and each preferably has its marginal portion bevelled as indicated by 26. The feed discs 25 may be driven by any suitable means. In Figure 1 of the drawings I have shown drive means consisting of bevel

gears 27 formed on the underside of the discs and meshing with bevel wheels 28 on the shaft 19. Fitted centrally on each feed disc 25 is a conical member 29 against which a scraper 30 operates. This scraper is preferably formed as an extension of the conveyor framework 6 and it ensures that the earth and material picked up by the feed discs is delivered onto the conveyor belt 15.

The digging tools 31 of the machine are mounted beneath the inclined plate 23 and are slidably supported between guide plates 32 which may be fitted with renewable wearing liners 33. The guide plates 32 are slidably adjustable by means of a screw-threaded rod 34 passed through a tapped lug 35 on the conveyor framework 6, see Figure 1. A handle is provided on the end of rod 34 whereby said rod can be conveniently rotated to effect longitudinal adjustment of the guide plates 32 relatively to the digging tools.

Each digging tool has steam ram actuating mechanism as illustrated in Figure 3. This mechanism comprises a casing 36 constructed to form two steam cylinders 37 and 38 of different sizes,—one of which forms a high pressure steam cylinder and the other a low pressure steam cylinder. Slidably mounted in said cylinders are two pistons 39 and 40 connected together by a piston rod 41, which is passed slidably through a gland 42 in the wall between the two cylinders. The two pistons are of different sizes corresponding to their respective cylinders, and the forward or smaller piston 39 is so shaped as to function as a hammer or ram to engage the rear end of the digging tool 31, which slidably projects into the smaller cylinder 37.

Located beneath the casing 36 is a valve casing 43 of cylindrical shape wherein is slidably fitted a longitudinal valve actuating rod 44. At the opposite ends of said rod there are mounted two control pistons 45 and 46 slidably movable in chambers 47 and 48 provided at opposite ends of the valve casing. The forward chamber 47 is connected to the high pressure steam cylinder 37 by a passage 49, and the rear chamber 48 is connected to the low pressure steam chamber 38 by a passage 50.

The central portion of the valve casing is divided to form four chambers 51, 52, 53 and 54. The chambers 51 and 52 are connected by an opening 55 to a passage 56 leading to the rear end of the high pressure steam chamber 37. A piston valve 57 fitted on the rod 44 is slidable in said opening 55 and is adapted to control opening of the passage 56 to either of the chambers 51 and 52.

The other two chambers 53 and 54 are connected by an opening 58 to a passage 59 leading to the forward end of the low pressure steam cylinder 38. A piston valve 60 also fitted on the rod 44 is slidable in the opening 58 and is adapted to control the opening of the passage 59 to either of the chambers 53 and 54. The chamber 51 forms the steam inlet chamber and it is connected by the port 61 to a supply of high pressure steam. The chamber 53 is connected by a port 62 to the steam exhaust pipe. The other two chambers 52 and 54 are interconnected by a transfer passage 63. Between the chambers 52 and 53 there is an opening 64 wherein a piston gland 65 is slidably mounted. This gland is rigidly fitted on the rod 44 and it functions solely as a guide member for the slidable movement of said rod 44.

The operation of the steam ram mechanism for actuating the digging tools is as follows:—

The parts being normally in the position shown in Figure 3, high pressure steam is admitted through the inlet port 61 and passes via the opening 55 and the passage 56 into the rear end of the steam cylinder 37. The action of the admitted steam forces the piston head 39 forwardly within the cylinder 37 and causes said piston to engage the end of the digging tool 31, thus actuating said tool to cause it to dig into the soil.

Towards the completion of its forward strokes the piston 39 uncovers the end of the passage 49, allowing some steam from the cylinder 37 to pass into the chamber 47 through said passage 49. This admitted steam acts on the control piston 45 causing the rod 44 to be slidably moved forwardly, thus reversing the position of the valve gear so that the piston valves 57 and 60 are slidably moved to the opposite sides of the passages 56 and 59, respectively. This action closes the chamber 51 from the passage 56 thereby shutting off admission of steam to the cylinder 37, but simultaneously the passage 56 is opened to the chamber 52. The expanded steam in the high pressure cylinder 37 now flows through said passage 56 to the chamber 52, and thence by the transfer passage 63 to the chamber 54. From said chamber the steam passes through the opening 58 and passage 59 into the low pressure steam cylinder 38, causing the large piston 40 to be forced rearwardly therein by steam expansion. This action returns the ram piston 39 to starting position in readiness for further ramming movement.

Towards the termination of the rearward movement of the piston 40, the end of the passage 50 is uncovered allowing some steam from the cylinder 38 to be admitted into the chamber 48. This admitted steam forces the control piston 46 rearwardly, thus again reversing the valve gear so that the piston valves 57 and 60 are returned to the positions shown in Figure 3. The steam in the cylinder 38 is thus exhausted through the passage 59 and opening 58 to the exhaust port 62, and simultaneously therewith high pressure steam from the inlet 61 is again admitted

to the cylinder 37 to drive the ram piston 39 forwardly. These actions are repeated during each forward movement imparted to the digging tool, the ram piston 39 being driven forwardly by the action of high pressure steam and retracted by the action of the expanding steam.

To provide for displacement of air from behind the piston 40, a spring controlled valve as 66 may be fitted in the rear end of the cylinder 38.

During the reciprocating action of the digging tools, the machine is moved forward by the tractor 2 and the earth and material loosened by said digging tools is gathered on the inclined plate 23. From said inclined plate the spoil is delivered by the rotating discs 25 onto the travelling conveyor belt 15 and carried thereby to the rear trailer end of the machine where it is discharged into suitable trucks or wagons positioned between the trailer wheels 11.

The forward movement of the tractor causes the digging tools to be forced rearwardly after they have been driven into the earth or rock, thus assisting the rearward movement of the fluid actuated rams, and positively ensuring operation of the valve gear to admit the expanding steam to the low pressure cylinder 38.

The high pressure steam admitted into the cylinder 37 acts as a cushion during the impact of the digging tool against the earth and rock and holds it against the work during the forward movement of the tractor until the valve gear is reversed as previously described to allow the expanding steam to pass through the passage 63 to the chamber 38. The pressure on the digging tool then ensures positive retraction of the ram and the tool before the next ramming action takes place.

Figure 4 shows a modified construction of steam ram mechanism for actuating the digging tools. This mechanism functions similarly to that previously described, but the arrangement of the parts is modified so as to simplify construction. The high pressure steam cylinder 37 in this construction is positioned rearwardly of the low pressure cylinder 38, and a compound type of piston is used for actuating the digging tool. Only one chamber 47 and control piston 45 are provided in the valve gear, and passages 67 and 68 connect said chamber 47 to the cylinders 37 and 38, respectively.

High pressure steam is admitted to the cylinder 37 from the inlet port 61 through the pipe 56 and forces the compound piston forwardly to actuate the digging tool. After the valve gear has been reversed by the admission of some steam into the chamber 47, the expanded steam in the cylinder 37 flows via the passage 56, transfer passage 63 and passage 59 to the low pressure cylinder 38 to act on the piston 40 and return the ram to starting position in similar manner to that previously described.

In the modified construction shown in Figures 5 to 7 the two rotating feed discs 25 are dispensed with and two sets of endless feed belts or chains 69 are used in lieu thereof. These chains 69 are passed around driving sprocket wheels 70 secured to the spindles 24 and also around other sprocket wheels 71 and 72 which are loosely mounted on spindles 73 and 74 arranged in advance of the spindles 24.

The driving sprocket wheels 70 are of equal diameter, but the loose sprocket wheels 71 and 72 are of varying diameters having the smallest wheel uppermost, thus causing the feed belts to assume a stepped formation at the forward end of the machine. This stepped formation provides between the two sets of belts, a narrow feed trough or channel, along which the loosened earth and material is conveyed to the conveyor 15.

Each of the feed belts or chains 69 consists of a series of pivotally connected links 75 as shown in Figure 7 and each link preferably has a bevelled side face 76 as shown to facilitate the feeding of the loose earth.

What I do claim is:—

1. An improved excavating machine, comprising a wheeled frame provided at its forward end with an inclined plate, a series of digging tools mounted under the inclined plate in alignment transverse the forward end of the plate, tool operating mechanism for each individual tool, said mechanism comprising means for positively driving the tool to its work and reseating to permit pressure of the earth against the tool to return the latter to normal position, an endless conveyor extending rearwardly from under the plate to the rear of the frame, and means mounted on the plate intermediate the conveyor and digging tools and overlapping the plate and conveyor for directing the dirt from the digging tools and plate onto the conveyor.

2. An improved excavating machine, comprising a wheeled frame, an inclined plate at the forward end of the frame, a conveyor in rear of the plate, a series of digging tools mounted in alignment transverse the forward end of the plate, operating mechanism for each tool to positively drive the tool in one direction only, said mechanism being wholly disconnected from the tool whereby upon return to normal position of said mechanism the tool will be returned to its normal position by pressure of the earth with which it contacts.

In testimony whereof I affix my signature.

PHILIP SHANNON.