

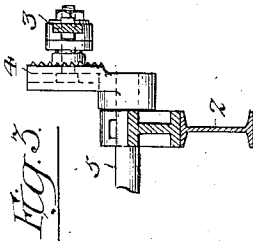
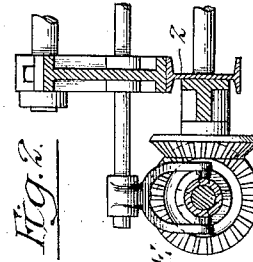
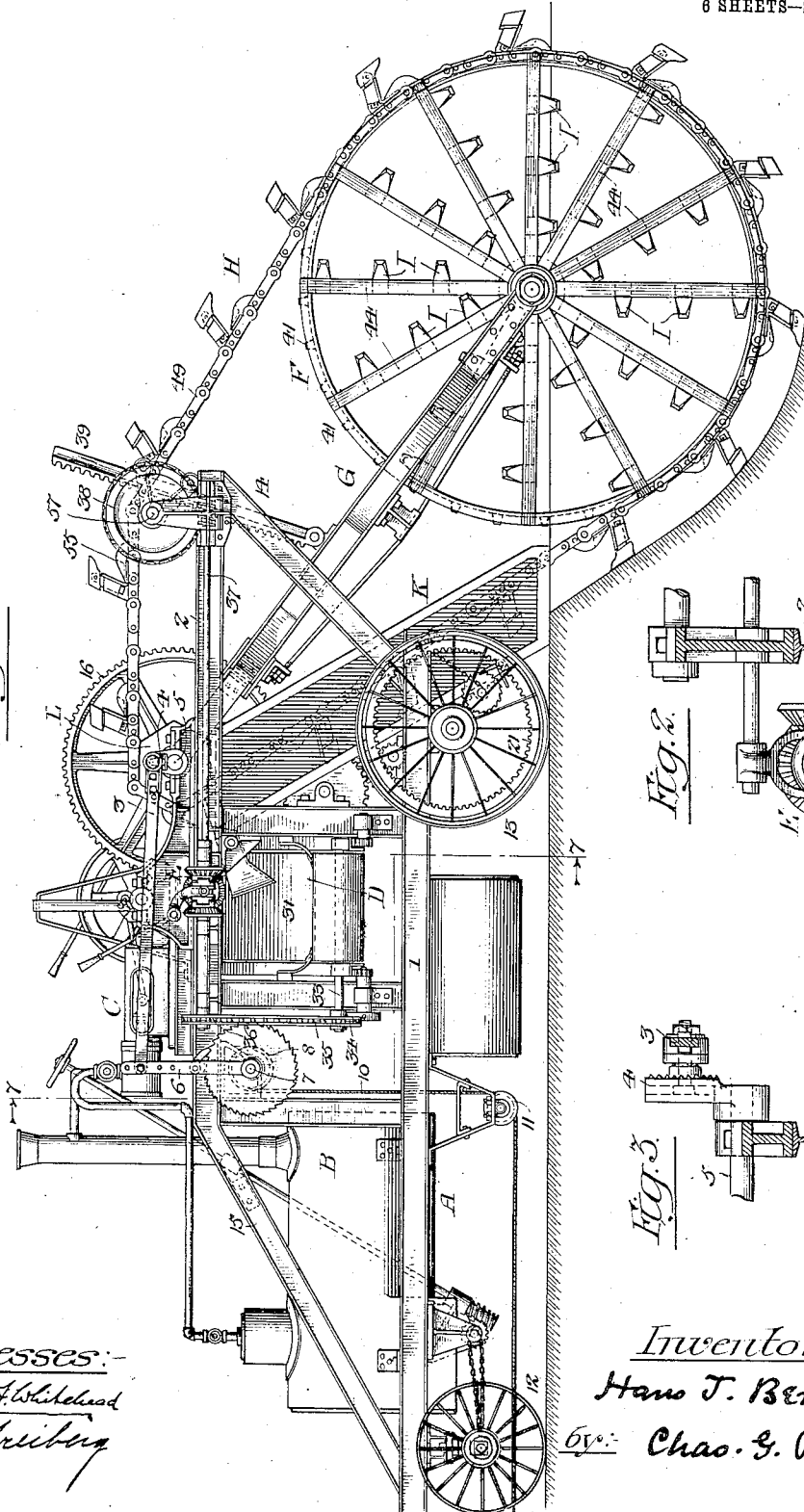
No. 824,839.

PATENTED JULY 3, 1906.

H. J. BENTSON.
TRENCHING MACHINE.
APPLICATION FILED NOV. 7, 1905.

6 SHEETS—SHEET 1.

Fig. 1.



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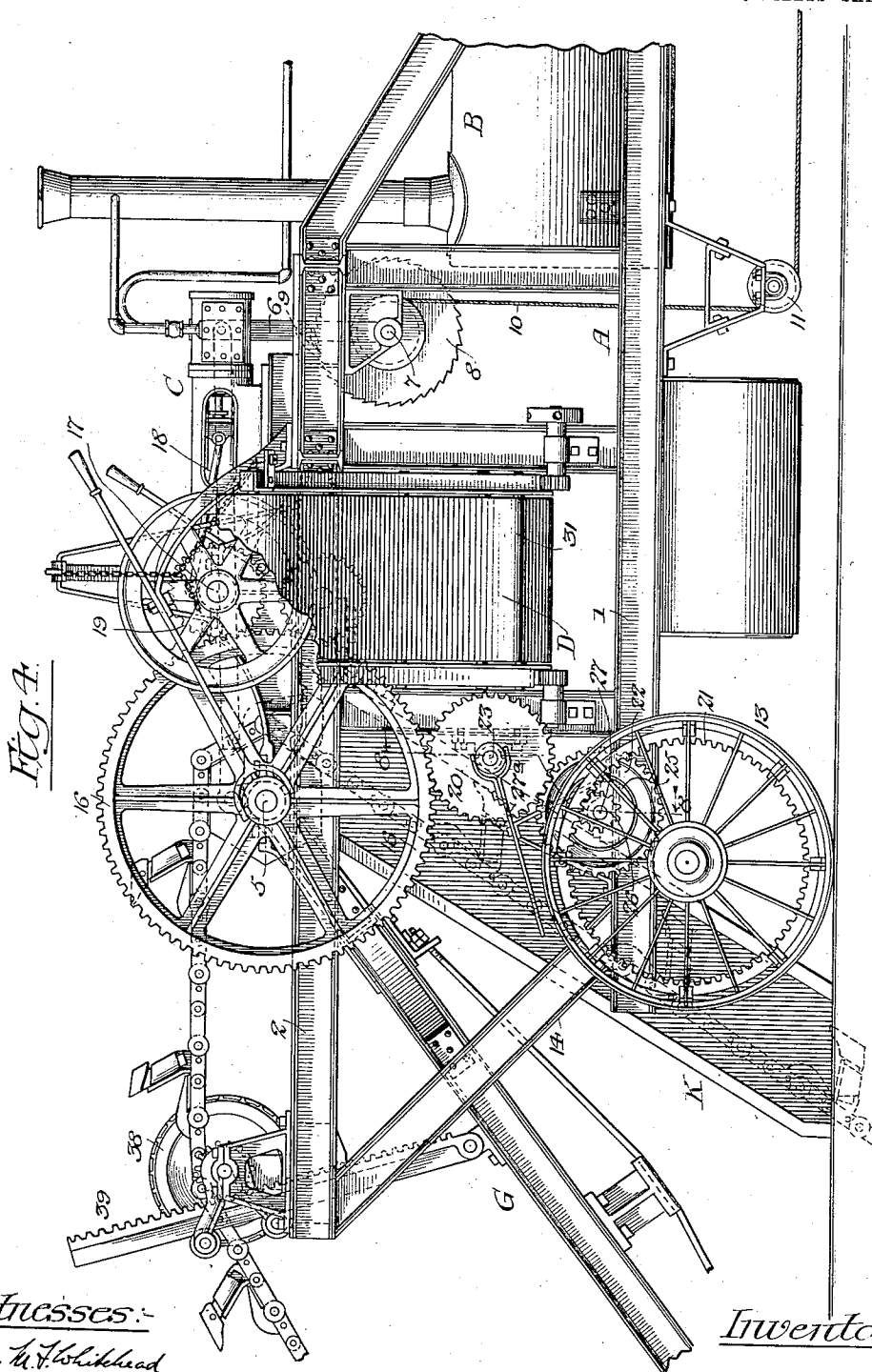
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6 SHEETS—SHEET 2.



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6 SHEETS—SHEET 3.

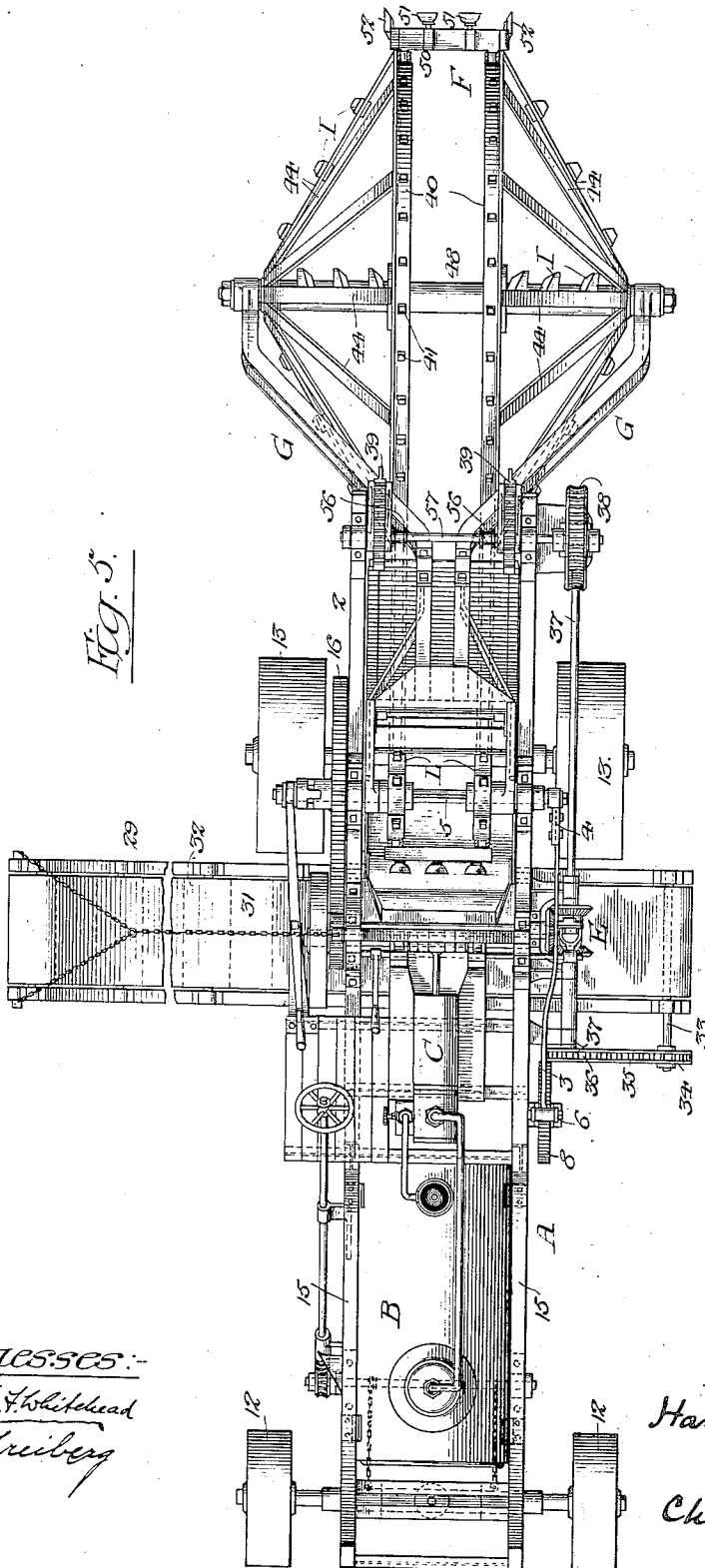


Fig. 5.

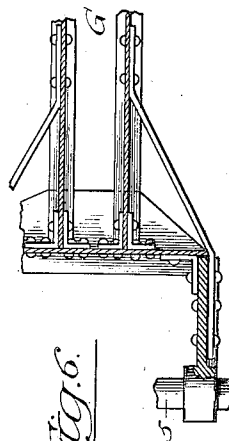


Fig. 6.

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6 SHEETS—SHEET 4.

Fig. 7.

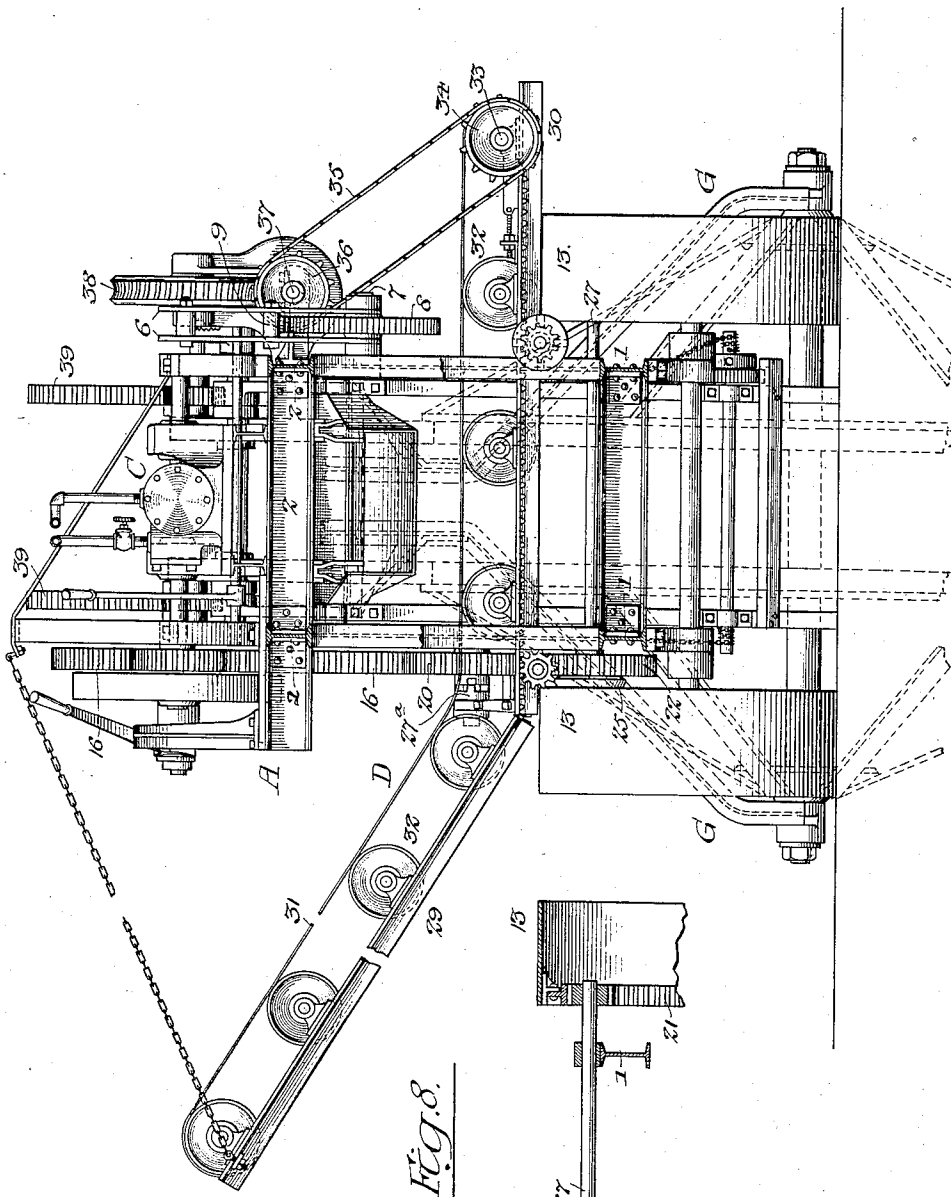
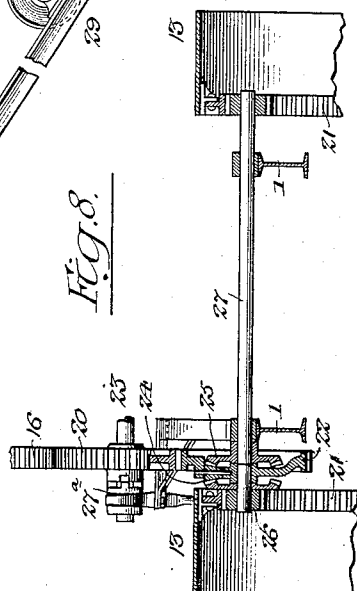


Fig. 8.



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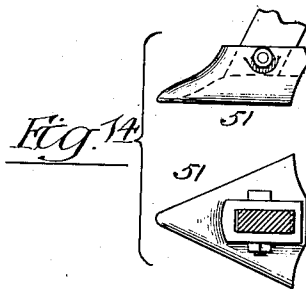
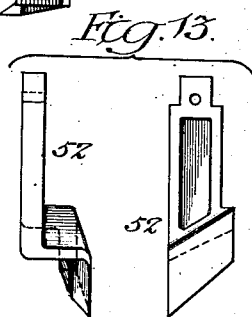
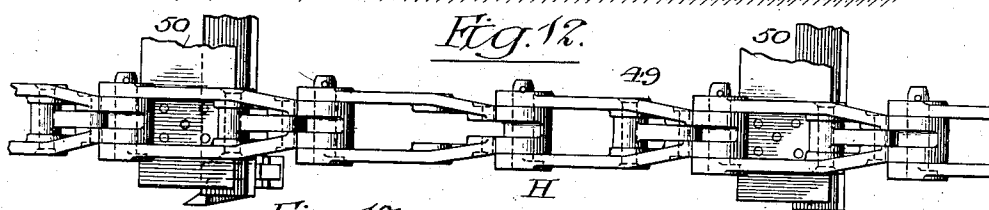
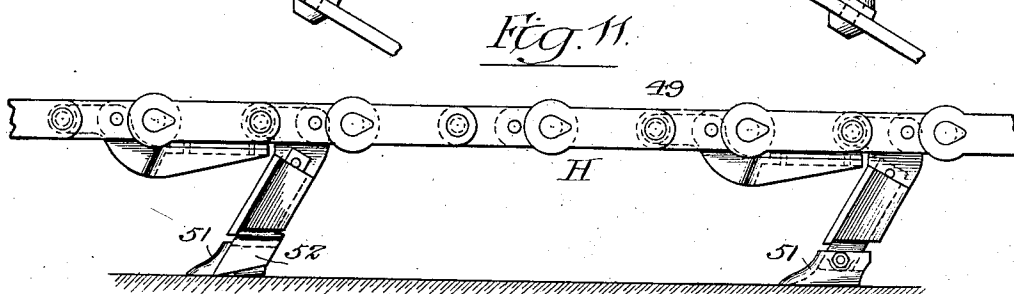
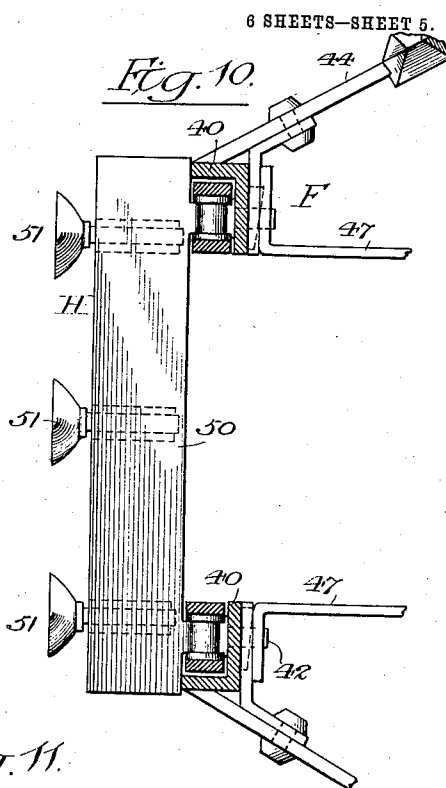
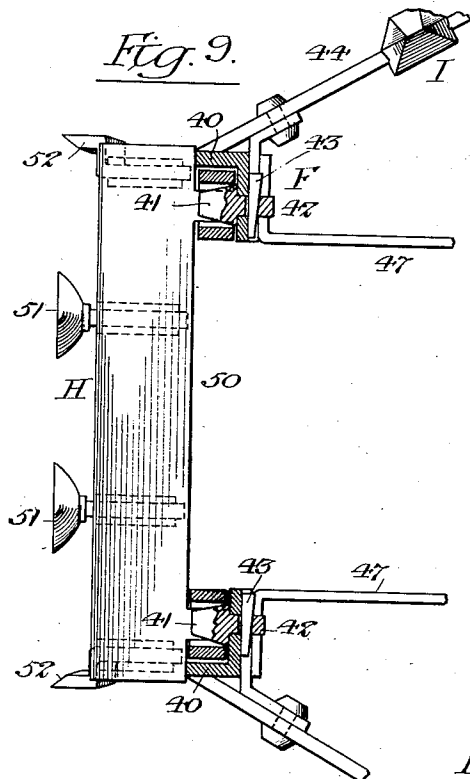
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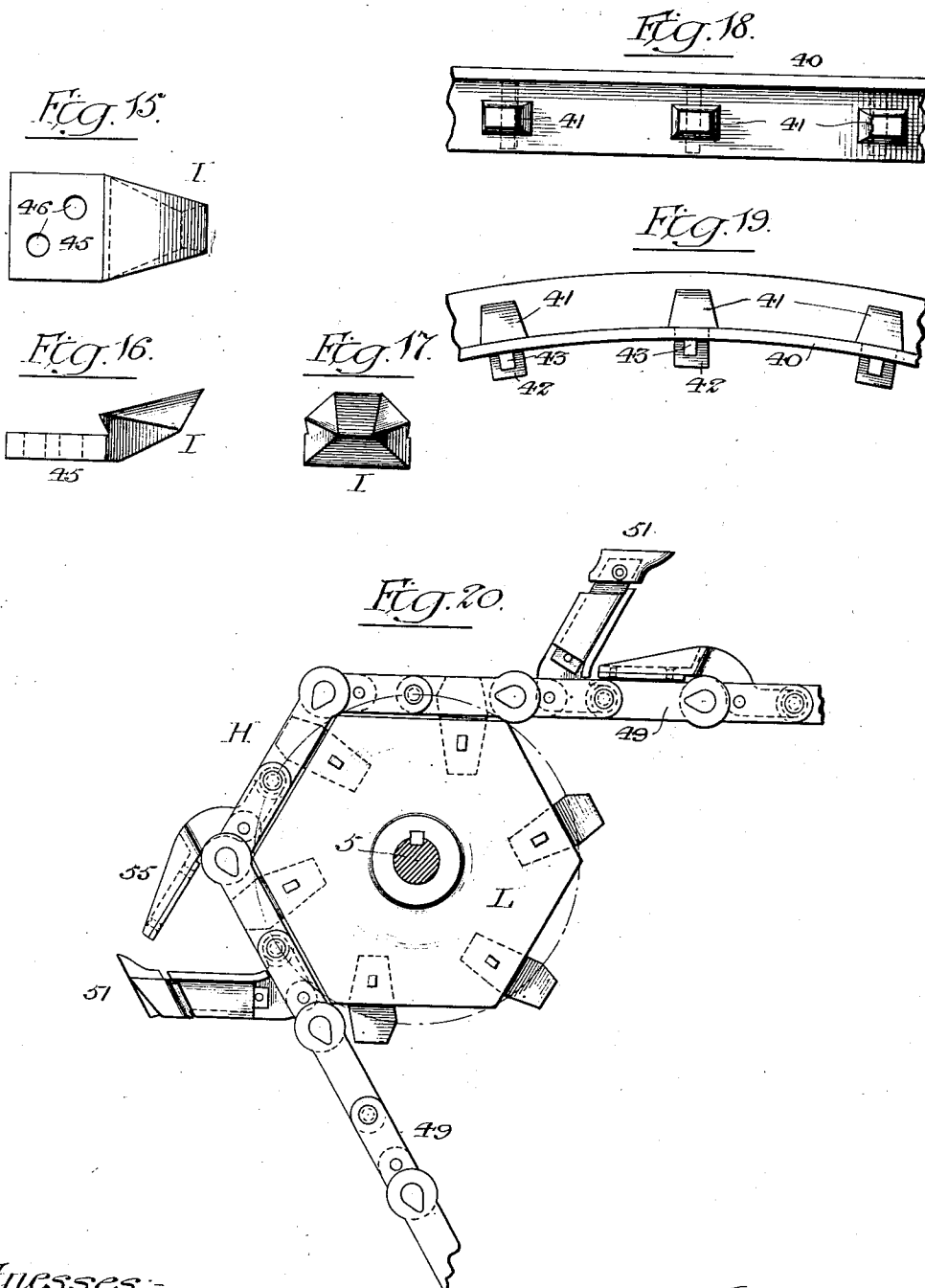
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APPLICATION FILED NOV. 7, 1905.

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UNITED STATES PATENT OFFICE.

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TRENCHING-MACHINE.

No. 824,839.

Specification of Letters Patent.

Patented July 3, 1906.

Application filed November 7, 1905. Serial No. 286,216.

To all whom it may concern:

Be it known that I, HANS J. BENTSON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Trenching-Machines, of which the following is a specification.

My invention relates to trenching-machines in which a suitable truck or body-frame is provided with rearwardly-arranged excavating means and advanced by suitable propelling means proportionally to the progress of the work.

A prominent and particular object of my invention is to provide simple and efficient means for forming a trench or ditch with sloping side walls.

Further objects are to avoid clogging, to conveniently and effectively carry off the loose soil, to provide a compact and durable construction of excavating means, to provide for a suitably wide range of adjustment on the part of the excavating means, to permit the excavating means to be enlarged with reference to the formation of a comparatively wide trench without necessitating the construction of an undesirably large and heavy body-frame and machinery thereon, and to provide certain further improved features of construction, combination, and detail serving to increase the general efficiency and desirability of means for digging ditches.

In the accompanying drawings, Figure 1 is a side elevation of a trenching-machine embodying the principles of my invention. Fig. 2 is a detail section mainly illustrating a clutch device, which is shown in side elevation in Fig. 1 and employed for connecting and disconnecting certain devices hereinafter mentioned with and from the motor or driving power. Fig. 3 is a sectional detail mainly illustrating the pitman and crank connection for operating a sprocket-shaft having sprockets for the endless excavating-conveyer. Fig. 4 is a side elevation, on a larger scale, of a portion of the machine, the side illustrated being opposite the one shown in Fig. 1. Fig. 5 is a top plan view of the machine. Fig. 6 is a sectional detail illustrating a portion of the swinging frame which supports the excavating-wheel. Fig. 7 is a section on line 7 7 in Fig. 1. Fig. 8 is a detail, partly in section and partly in elevation,

mainly illustrating certain driving-gear for one of the supporting-wheels of the machine, the section being on line 8 8 in Fig. 4. Fig. 9 is a detail view, partly in section, illustrating a portion of the excavating-wheel and a portion of the endless excavating-conveyer, the section being transversely through the frame portion of the wheel. Fig. 10 is a like view with the section taken through the wheel at another point. Fig. 11 illustrates a portion of the endless excavating-conveyer and may be termed an "edge" view of the same. Fig. 12 is a top plan view of Fig. 11. Fig. 13 comprises two views of one of the edge or outside cutters or blades of the endless excavating-conveyer. Fig. 14 comprises two views of one of the middle or inner plow-blades of the endless excavating-conveyer. Figs. 15, 16, and 17 are views from different sides of one of the knives or paring-blades which are in certain other figures shown secured to the spokes of the excavating-wheel. Fig. 18 is a plan, and Fig. 19 is a side elevation, of a part of one of the angle-rim portions of the excavating-wheel. These views also show the removable teeth and keys or wedges whereby said teeth are locked upon the wheel-rim portions. Fig. 20 is a detail illustrating one of the rear sprockets for the endless conveyer-belt and includes a portion of the latter trained upon said sprocket.

The operating members of the machine are shown supported upon a wheeled carriage A, having a suitable motor or engine and driving mechanism, whereby it can be propelled from place to place, it being understood that during the operation of digging a trench the machine can be advanced by said propelling means or that it can be warped ahead in a common and well-known way. The engine or motor can be of any suitable type.

As herein illustrated, the boiler B is arranged upon the rear part of the lower frame portion 1, and the motor or engine C is supported upon the upper frame portion 2 of the body-frame A. By this arrangement the engine is brought within convenient range of the various operative parts of the machine. A pitman 3, Figs. 1 and 3, connects at one end with a crank 4 on the sprocket-shaft 5, said pitman connecting at its opposite end with a vibratory arm 6, arranged to vibrate about the axis 7 of a spur-wheel 8 and pro-

vided with a pawl 9, which engages the spur or ratchet wheel 8, as shown in Fig. 1. The pitman is operated by the sprocket-shaft, the object of this arrangement being to produce a step-by-step movement, whereby any suitable warping means connected with the wheel 8 can be operated—as, for example the axle of the wheel 8 is provided with a winding-drum, as shown in dotted lines, and a cable 10 extends downwardly from this winding-drum to and under a guide-pulley 11 below the main frame and thence forwardly, as illustrated, it being understood that during operation this cable can be attached to a stake or post driven into the ground at a suitable point ahead of the machine.

The body-frame A is constructed with a lower frame portion 1, which is mounted upon front wheels 12 and rear wheels 13. Said body-frame is also constructed with an upper frame portion 2, which extends back of the lower frame portion 1, so as to overhang a trench in which the excavating portion of the machine is operating, as in Fig. 1, this upper elevated portion 2 of the body-frame being supported at its rear end by the rear inclined frame portion 14 and at its forward end by the inclined frame portion 15, it being particularly observed that the rear frame portion 14 inclines upwardly and rearwardly from the rear end of the lower frame portion 1, thereby leaving ample space for the excavating-wheel hereinafter particularly described. The sprocket-shaft 5 is provided at one end with a crank 4, hereinbefore mentioned, and provided at its opposite end with a comparatively large gear 16, which latter is operated from the engine by suitable power-transmitting connection, such as a pitman and suitable gearing. For example, rotary shaft 17 (best shown in Fig. 4) is operated by the engine-pitman 18 and provided with a gear or pinion 19, which engages the large gear 16, and, as shown in said figure, the gear 16 engages a gear 20, which in turn may connect with an annular gear 21 on one of the front wheels by means of any suitable arrangement of connecting-gear—as, for example, the gear 20, as shown in Figs. 4 and 8, engages a gear 22 on an axle 23, and the gear 22 engages a gear 24, which in turn connects with the wheel-gear 21 by a compensating gear 25, Fig. 8, and a pinion 26, arranged upon an axle 27. The gear 20 can be thrown out of mesh with gear 16 by any suitable clutch device 28, it being observed that this portion of the machine is for applying power to one of the wheels, so that when the machine is not at work it can be propelled as an automobile.

D indicates a transversely-arranged conveyer for receiving the loose soil and discharging the same at one side of the machine, it being observed that this conveyer is ele-

vated and arranged above the lower frame portion 1 of the machine and that, as illustrated, it comprises suitable frame portions 29 and 30 and an endless conveyer-belt 31, arranged upon rolls 32 on the frame portions 29 and 30. The belt 31 is operated by a suitable driven belt-roll on a rotary shaft 33, Fig. 7, said shaft being provided at one end with a sprocket 34, upon which is trained a short endless driving-belt 35. This driving-belt 35 is operated by a driven sprocket 36, fixed upon a horizontal shaft 37, and said shaft 37 can be connected with and disconnected from a worm-wheel 38 on the sprocket-shaft 5 by means of a clutch device E, (illustrated in Figs. 1, 2, and 5,) it being observed that as this particular device for operating the transverse conveyer-belt is shown and described in a prior patent it need not be herein further referred to in detail, it being regarded as only necessary to state that in this machine I prefer to provide a transversely-arranged delivery-conveyer and to carry the loose soil from the trench up to said transversely-arranged delivery belt or conveyer. Also I may here note that the excavating means hereinafter more particularly described are peculiarly and especially adapted to entirely clear the trench of loose dirt and to carry the soil as it is loosened upwardly and out of the trench, and then forwardly of the end of the trench, so as to entirely clear the latter and avoid the spilling of loose dirt into the newly-formed excavation.

The excavating means comprise an endless excavating conveyer-belt adapted for digging a trench of suitable depth and an excavating-wheel upon which the endless excavating conveyer-belt is trained, the excavating-wheel being provided with spokes which at opposite sides thereof spread or incline outwardly from the peripheral portion of the wheel, said spokes being provided with blades rigid thereon and adapted for cutting the side walls of the trench, so as to produce a trench having sloping side walls which converge downwardly from the ground-line. The inclined arrangement of spokes and the blades secured thereon will give to the side walls of the trench a defined inclination or slope in conformity with the degree of inclination of the spokes and the arrangement of blades thereon. During operation the soil pared from the side walls of the trench by the blades on the spokes falls to the bottom of the trench, where it is taken by the endless excavating conveyer-belt and by such belt carried along with other loose dirt upwardly and out of the trench to a point where the soil is discharged onto the transversely-arranged delivery-belt.

The width of the bottom of the trench is determined by the width of the endless excavating conveyer-belt, so that the knives on the sides of the wheel are left to shape the side walls of the ditch and give to the same

an incline which extends downwardly and terminates along the bottom portion formed by the endless excavating-conveyer.

F indicates the excavating-wheel arranged in rear of the machine and revolubly mounted upon a swinging support G. The support G is at one end fulcrumed to swing about the axis of the transversely-arranged sprocket-shaft 5, the excavating-wheel being mounted upon the opposite end of said support. The support G can be of any suitable construction, and it can be raised and lowered by any suitable raising and lowering device, the means herein shown being a rack 39, which is hinged to the support and understood to be in engagement with a suitable operating-gear. The excavating-wheel F is constructed with two annular rim portions 40, which are made angular in cross-section, as illustrated in Figs. 9, 10, and 18. These rim portions 40 are spaced or set apart to an extent proportional to the width of the endless excavating conveyer-belt H, as best illustrated in Figs. 9 and 10. Each rim portion 40 is provided with a series of teeth 41, having shank portions 42, which are inserted through openings in the rim portions 40 and locked in place by keys 43, wedged into openings which are formed in the shank portions 42 at points to permit the wedges when thus inserted to bear against the inner periphery of the rim portions 40, as shown in Figs. 9, 18, and 19. By such arrangement a broken tooth can be readily removed and a new tooth substituted therefor. These teeth 41 engage suitable portions of the endless excavating conveyer-belt, whereby when said belt is driven it will operate the excavating-wheel. Each rim portion of the wheel is provided with a set of spokes 44, which incline outwardly from the rim portion, whereby each side of the wheel has a conical conformation, the cone being of course made up of spokes. These inclined spokes are provided with cutters I, which are rigidly secured upon the spokes and adapted for paring down the side walls of the trench. These cutters can be secured to the spokes in any suitable way, a simple arrangement being to provide each cutter with a shank portion 45, Figs. 15 and 16, having bolt-holes 46 for bolts which can be inserted through said holes, so as to rigidly bolt the cutters to the spokes. The holes 46 are preferably in a line oblique to the length of the cutter, as in Fig. 15, whereby the cutters can be set so as to effect a shear cut. An effective form of cutter is illustrated in Figs. 15, 16, and 17, although I do not confine myself to the specific form of cutter thus shown. If desired, the wheel may also be braced and strengthened by spokes 47, it being understood that all of these spokes are at their inner ends secured to a suitable hub—such, for example, as a hub 48. (Illustrated in Fig. 5.) The endless excavating-

conveyer herein illustrated comprises as a matter of general construction a pair of marginal chains 49, composed of suitably-connected links, and a series of cross bars or plates 50, connecting together at intervals the two endless chains 49, the said bars or plates 50 being provided with suitable cutters and plows for excavating purposes. In the drawings each cross bar or plate 50 of the endless excavating-conveyer is provided with plow-blades 51, some of these cross bars or plates being also provided with end cutters 52, it being observed that the plow-blades 51 of one cross bar or plate are staggered with reference to the plow-blades of the next adjacent cross bar or plate, as illustrated by comparing Fig. 9 with Fig. 10, it being seen that in Fig. 9 the plow-blades are opposite the spaces between the plow-blades in Fig. 10. By this arrangement of plates or cross-bars and plow-blades the soil which is dug up by the plow-blades 51 and the cutters 52 is carried upwardly and out of the trench during operation, and this arrangement also serves to carry up and out of the trench such soil as may be pared from the side walls of the trench by the blades I, it being understood that during operation the rotary action of the excavating-wheel will cause the soil thus loosened by the blades I to drop within the range of action of the plows, whereby it will be carried up along with the soil which the plows themselves have loosened. In order to permit this endless excavating-conveyer H to further carry the soil from the ground-line up to a point where it will discharge upon the delivery-conveyer D, the machine is provided with an inclined trough, chute, or guideway K, arranged at the rear of the machine and providing a surface along which the plows can carry up loose dirt.

The endless excavating-belt H is trained over the excavating-wheel F in rear of the machine, and it is also trained over sprockets L, secured upon the sprocket-shaft 5 at a point forward of the rear end of the body-frame of the machine, said sprockets L being in position to permit automatic wipers 55 on the endless excavating conveyer-belt to free the plows and plates thereon from the elevated soil at a point proper for discharging the latter onto the transversely-arranged delivery-conveyer D. The endless excavating conveyer-belt passes from the sprockets L downwardly to and under the wheel F, and from the upper portion of said excavating-wheel F the belt H passes over one or more elevated idlers 56, arranged upon shaft 57, and from thence said belt passes forwardly to the sprockets L. The idlers 56, which may consist of one or more rolls or wheels on the axle 57, are mounted upon the highest rear portion of the machine, whereby I am enabled to provide a large excavating-wheel suitable for digging trenches of considerable

depth, and by such arrangement I am also enabled to raise and lower the wheel without cramping or binding the elevating conveyer-belt, it being observed that when the wheel
 5 is raised and lowered the lower portion of the belt swings about the sprockets L and that the upper swinging portion of the said belt swings about the shaft 57.

With further reference to the guide or
 10 apron K it will be seen that the same is practically tangential to the lower peripheral portion of the excavating-wheel when the latter is lowered and at work within a trench, as in Fig. 1, and that the endless excavating conveyer-belt carries the soil up to the ground-
 15 line and thence upwardly along the guide portion of the inclined apron.

Although the excavating-wheel is shown with its periphery composed of the two
 20 spaced rim portions, it is broadly considered a wheel having a periphery equal or substantially equal in width to the width of the bottom of the trench. The wheel, however, is practically completed by the endless exca-
 25 vating conveyer-belt, which is equal or substantially equal in width to the periphery of the wheel and which when trained thereon may be said to form the tread of the wheel, which latter has its sides inclined outwardly
 30 from the margins of the endless belt and provided with knives for making the side walls of the trench inclined.

What I claim as my invention is—

1. In a trenching-machine, an excavating-
 35 wheel constructed with spokes inclined from the periphery of the wheel outwardly toward opposite sides of the latter and having blades secured thereon and arranged for making the side walls of the trench inclined;
 40 an endless excavating conveyer-belt provided with plows and trained upon the excavating-wheel for digging the trench and carry up the loosened soil; means for operating the endless excavating conveyer-belt; and means
 45 for raising and lowering the excavating-wheel.

2. In a trenching-machine, an excavating-wheel constructed with spokes inclined from the periphery of the wheel outwardly toward
 50 opposite sides of the latter and having blades secured thereon and arranged for making the side walls of the trench inclined; an endless excavating conveyer-belt trained on the excavating-wheel for digging the trench and
 55 carrying up the loosened soil; means for operating the endless excavating conveyer-belt; a transversely-arranged conveyer positioned upon the machine to receive loose soil carried up by and discharged from the endless conveyer-belt; and means for raising and lower-
 60 ing the excavating-wheel.

3. In a trenching-machine, a body-frame; a swinging member hinged upon the body-frame and extending rearwardly therefrom;
 65 an excavating-wheel mounted upon the rear

portion of said swinging member and constructed with spokes inclined from the periphery of the wheel outwardly toward opposite sides thereof and having blades secured
 70 thereon and arranged for making the side walls of the trench inclined; an endless excavating conveyer-belt trained upon the excavating-wheel for digging the trench and carrying up the loosened soil; means for operating the endless excavating conveyer-belt; and
 75 means for raising and lowering the swinging member upon which the excavating-wheel is supported.

4. In a trenching-machine, a body-frame having a rearwardly - projecting portion
 80 adapted to overhang an end portion of the trench during operation; a swinging member hinged upon the body-frame forward of the rear terminal thereof and extending back of such rear terminal of the frame; an excavat-
 85 ing-wheel mounted upon the rear portion of the swinging member and constructed with spokes inclined from the periphery of the wheel outwardly toward opposite sides thereof and having blades secured thereon and arranged for making the side walls of the trench
 90 inclined; an endless excavating conveyer-belt trained upon the excavating-wheel for digging the trench and carrying up the loosened soil; means for operating the endless excavating conveyer-belt; and means for
 95 raising and lowering the swinging member upon which the excavating-wheel is mounted.

5. In a trenching-machine, an excavating-wheel constructed with spokes inclined from
 100 its periphery outwardly toward opposite sides thereof and having blades secured thereto and arranged for making the side walls of the trench inclined; a support for the excavating-wheel arranged for up-and-down
 105 movement; an endless excavating - belt trained upon the excavating-wheel for digging the trench and carrying loosened soil forwardly and upwardly; means for operating the endless excavating conveyer-belt;
 110 and a guide or apron over which a portion of the endless excavating conveyer-belt moving upwardly above the ground-line passes.

6. In a trenching-machine, a body-frame; a delivery-conveyer arranged upon the body-
 115 frame; an excavating-wheel upon which the endless excavating conveyer-belt is trained; means for operating said belt; and means for supporting and raising and lowering said wheel; the endless excavating conveyer-belt
 120 being provided with plows and of a width to dig the trench, and the excavating-wheel being adapted to make the walls thereof inclined.

7. In a trenching-machine, a body-frame;
 125 a member supported upon the body-frame for up-and-down movement and extending rearwardly therefrom to an extent to overhang an end portion of the trench when the machine is at work forming the latter; an ex- 130

cavating-wheel supported upon said member and constructed with sides which incline outwardly from the periphery of the wheel and have blades secured to them and arranged
 5 for forming the trench with sloping side walls; an engine upon the body-frame; means for operating the excavating-wheel from the engine; and means for raising and lowering the member upon which the excavating-
 10 wheel is supported.

8. In a trenching-machine, an excavating-wheel constructed with a pair of spaced rims angular in cross-section and provided with teeth; spokes attached to the rims and in-
 15 clining outwardly therefrom and having blades rigidly secured thereto and arranged for making the side walls of the trench inclined; an endless excavating conveyer-belt constructed with a pair of spaced endless
 20 chains connected together by cross-pieces having plows, said chains being trained upon the toothed rims of the wheel; means for operating the endless excavating conveyer-belt, and means for raising and lowering the
 25 excavating-wheel.

9. In a trenching-machine, a body-frame having an upper portion extending back of its lower portion and adapted to overhang an end portion of the trench while the lower
 30 frame portion is ahead of such end of the trench; an excavating-wheel supported in rear of the body-frame and constructed with spokes inclined from the wheel-rim outwardly toward opposite sides of the wheel, and hav-
 35 ing blades secured thereon and arranged for making the side walls of the trench inclined; an endless excavating conveyer-belt trained on the excavating-wheel and adapted for digging a trench; means for operating the
 40 endless excavating conveyer-belt; and means for raising and lowering the excavating-wheel.

10. In a trenching-machine, a body-frame; an excavating-wheel provided with side
 45 blades, and a member supported upon the body-frame for up-and-down movement and

in turn supporting the excavating-wheel at its rear portion back of the body-frame; an endless excavating-belt trained upon the excavating-wheel and also trained upon a
 50 sprocket mounted on the main frame; the upper leaf of the excavating-belt which extends from said sprocket to the upper portion of the excavating-wheel being carried over a roll or sprocket which is mounted upon the
 55 rear portion of the main frame at a point between the excavating-wheel and the sprocket first mentioned.

11. In an excavating-machine, a body-frame; a sprocket mounted thereon; a swing-
 60 ing member hung to swing about the axis of the sprocket; an excavating-wheel provided with inclined sides and side cutters and mounted upon the swinging member; an endless excavating-belt trained upon both the
 65 sprocket and the excavating-wheel; an idler upholding the upper leaf of the excavating-belt at a point between the excavating-wheel and the sprocket; means for operating the sprocket; and means for raising and lowering
 70 the swinging member.

12. In a trenching-machine, an excavating-wheel having a periphery equal or substantially equal in width to the width of the bottom of the trench; an endless excavating con-
 75 veyer-belt trained upon the excavating-wheel and equal or substantially equal in width to the periphery of the excavating-wheel; a body-frame; means upon the body-frame for supporting and operating the end-
 80 less excavating-belt, and means for raising and lowering the excavating-wheel, said excavating-wheel being constructed with sides inclined outwardly from the margins of the endless excavating-belt and having blades
 85 secured thereon to make the side walls of the trench inclined.

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