No. 832,609. PATENTED OCT. 9, 1906.

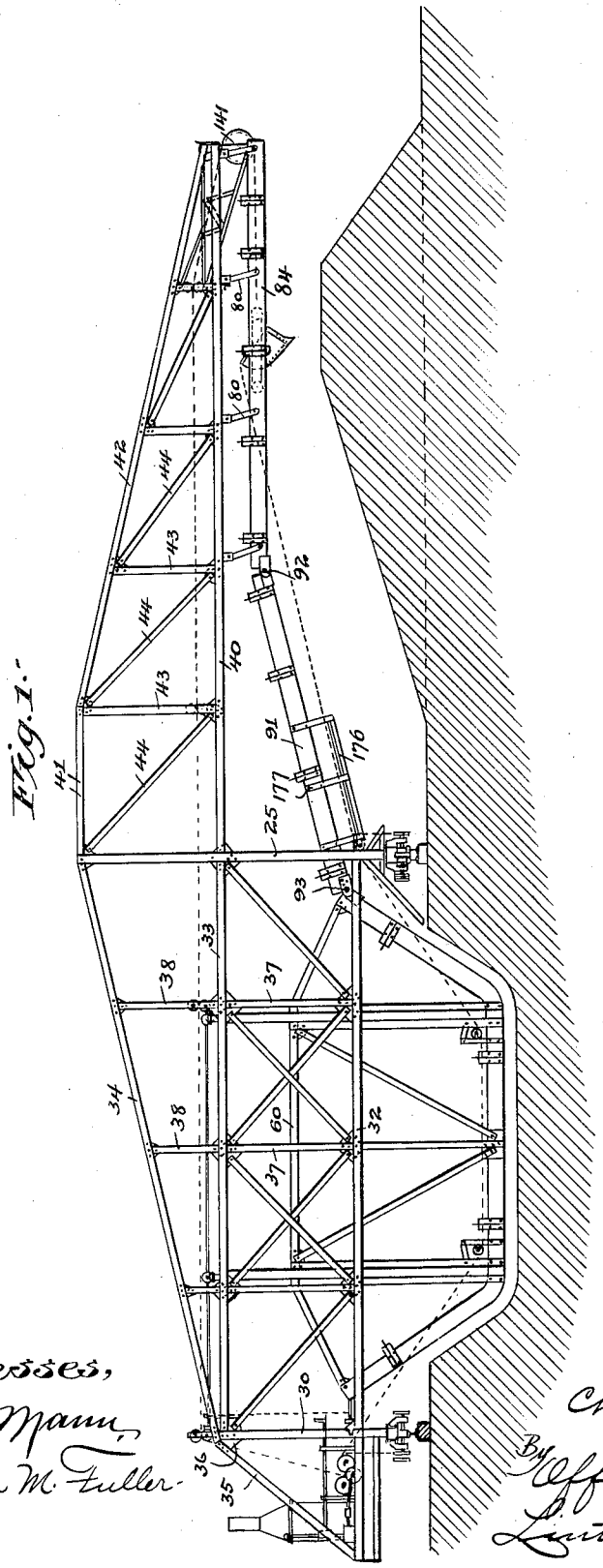
C. C. JACOBS.

EXCAVATING MACHINE.

APPLICATION FILED JAN. 12, 1906.

14 SHEETS—SHEET 1.

Fig. 1.



Witnesses,
F. D. Mann,
Walter M. Fuller.

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Charles C. Jacobs
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Attys.

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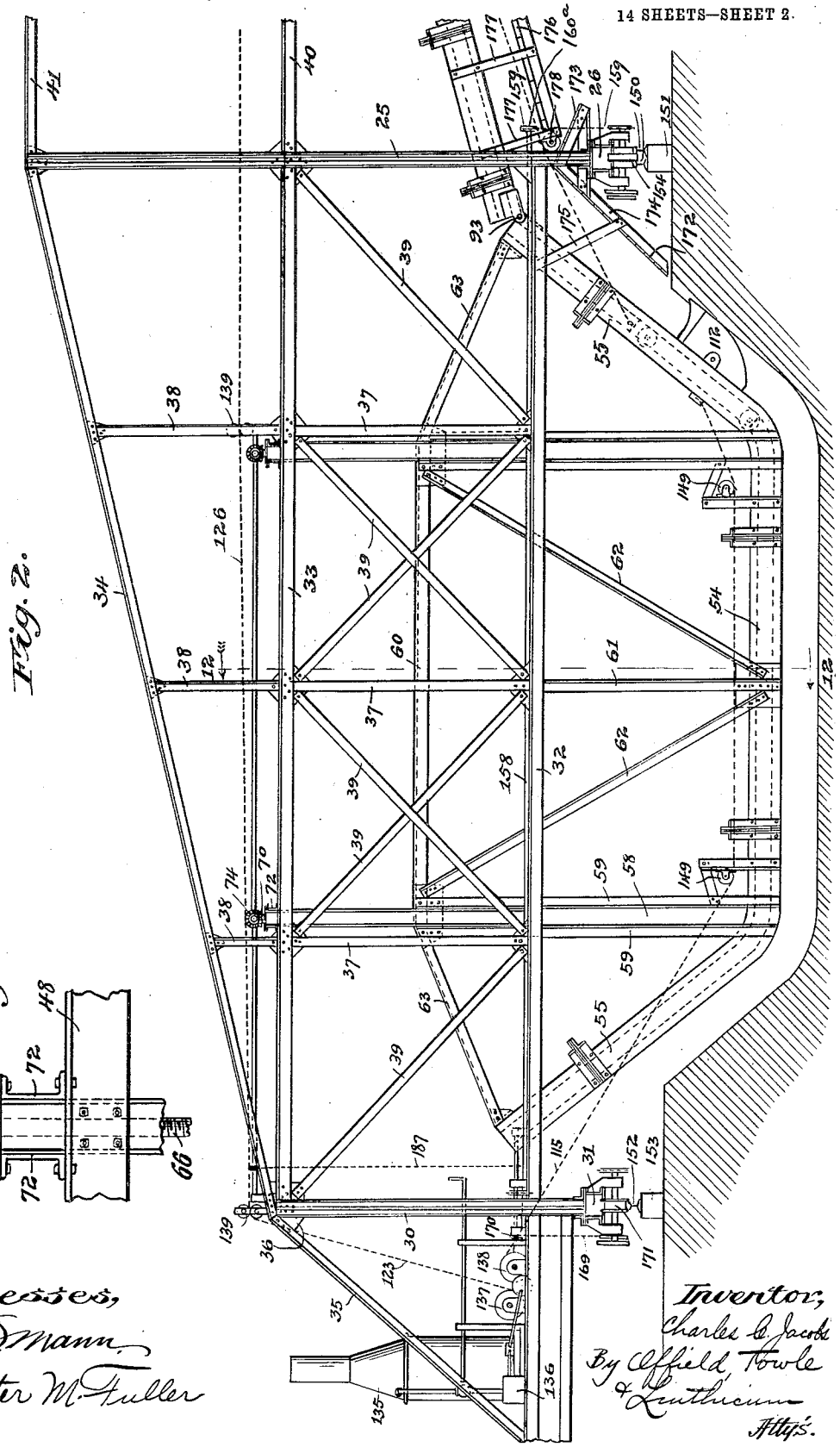

Fig. 2.

Fig. 3.

Witnesses,
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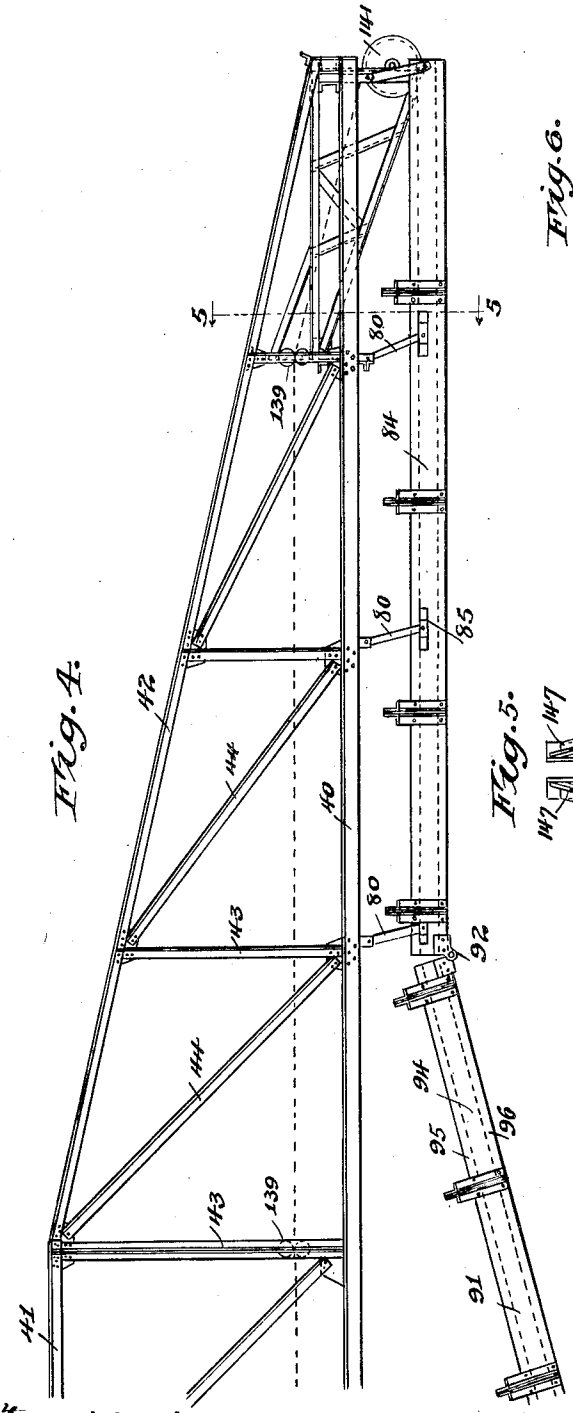

Fig. 4.

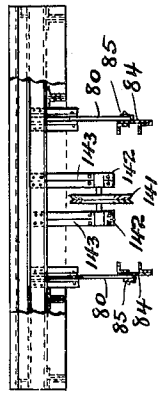

Fig. 6.

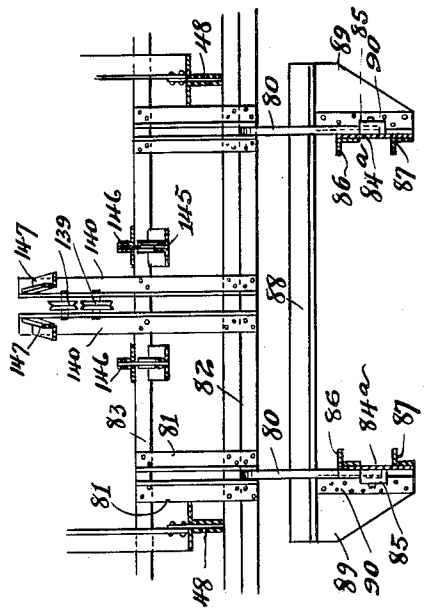

Fig. 5.

Witnesses,
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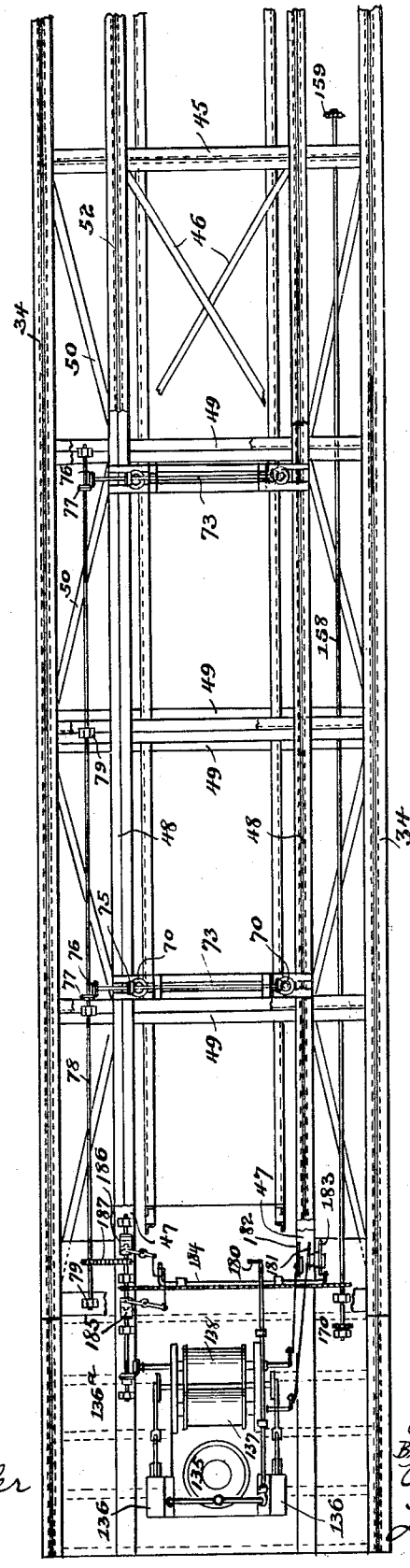

Fig. 7.

Witnesses,
S. S. Mann.
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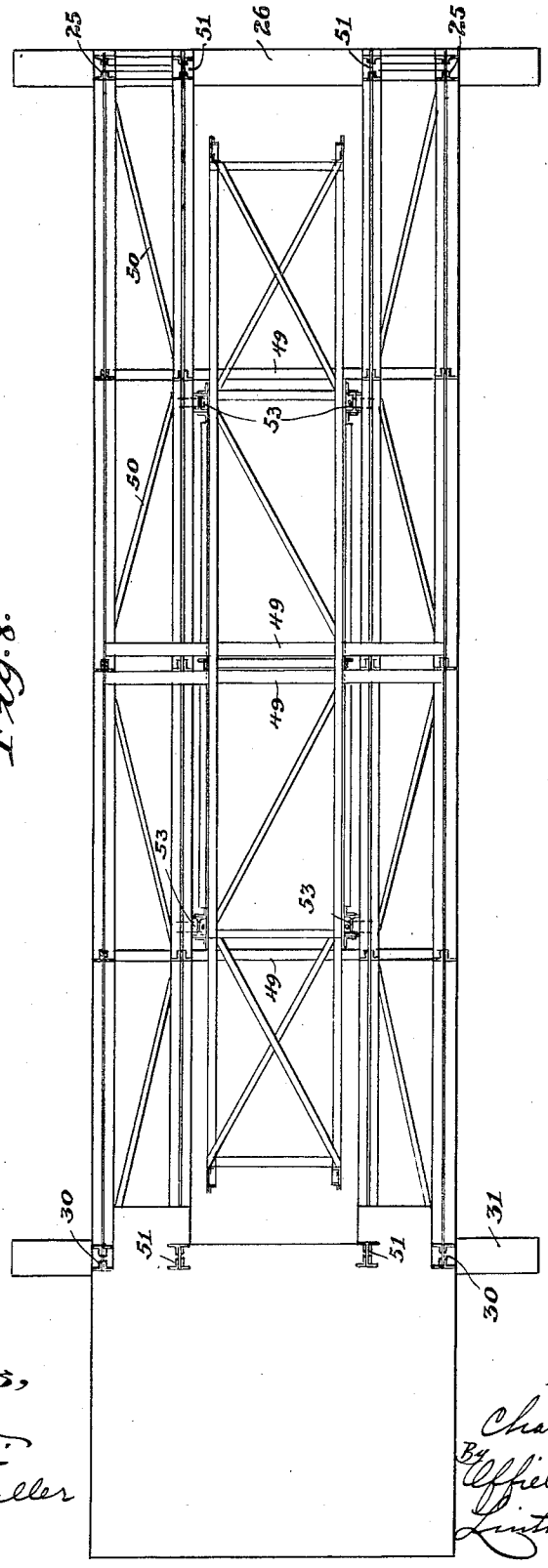

Fig. 8.

Witnesses,
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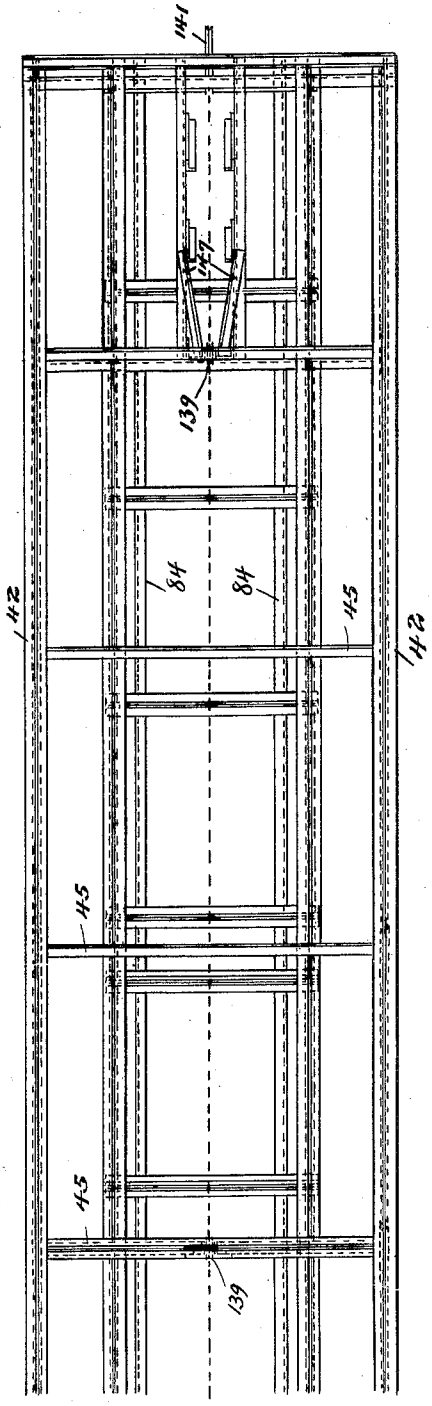

Fig. 9.

Witnesses,
L. S. Mann
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14 SHEETS—SHEET 7.

Fig. 10.

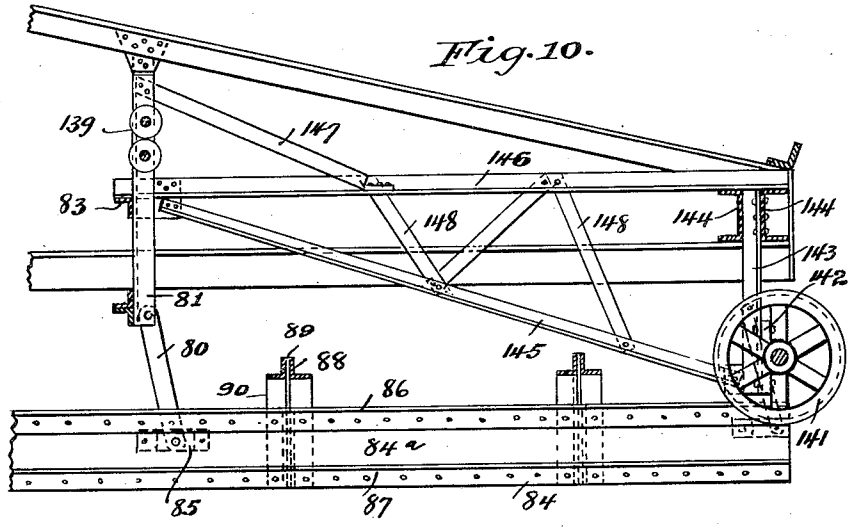
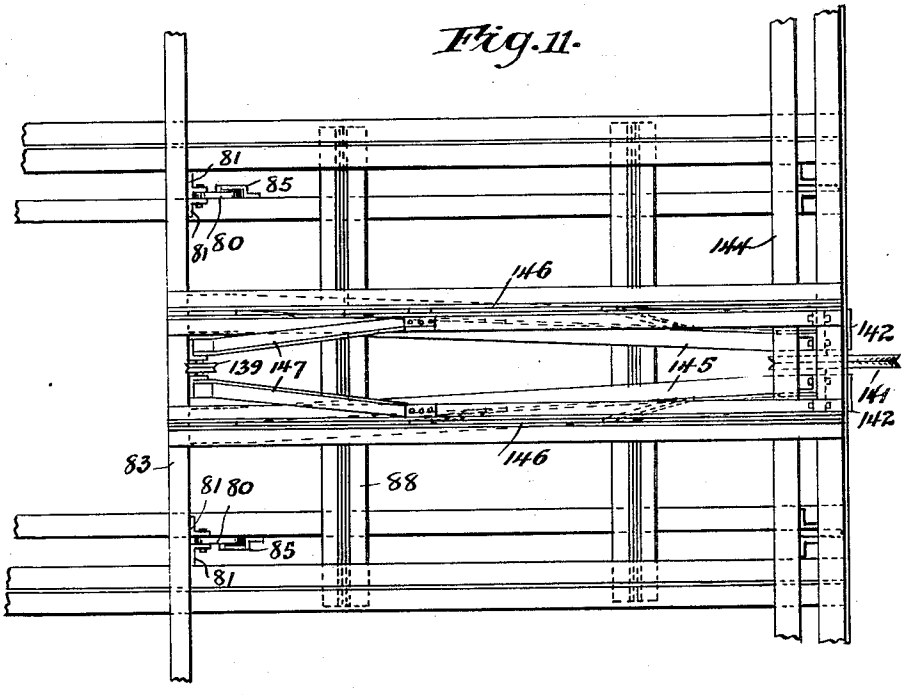


Fig. 11.



Witnesses,
S. S. Mann.
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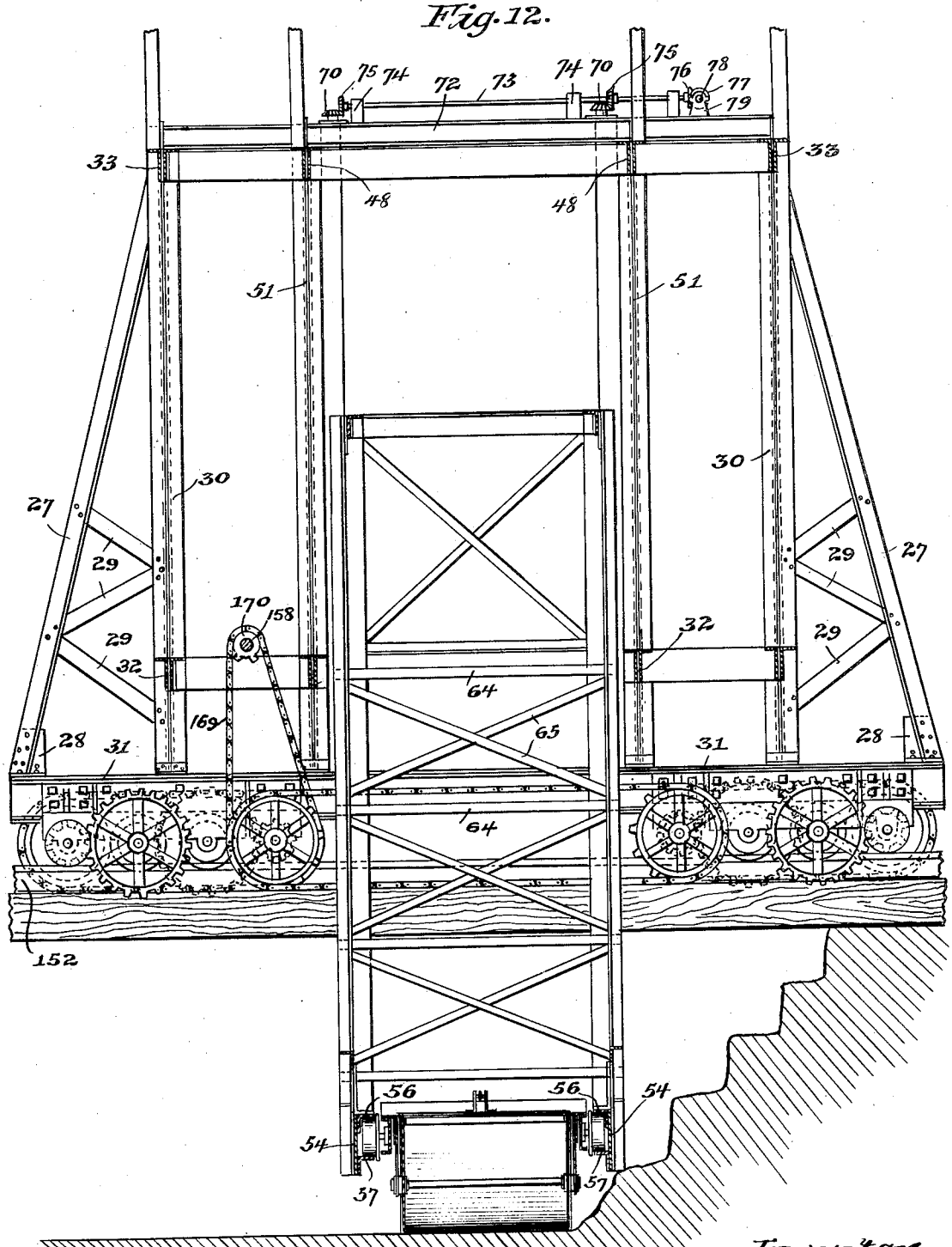
14 SHEETS—SHEET 8.

Fig. 12.



Witnesses,
H. J. Mann.
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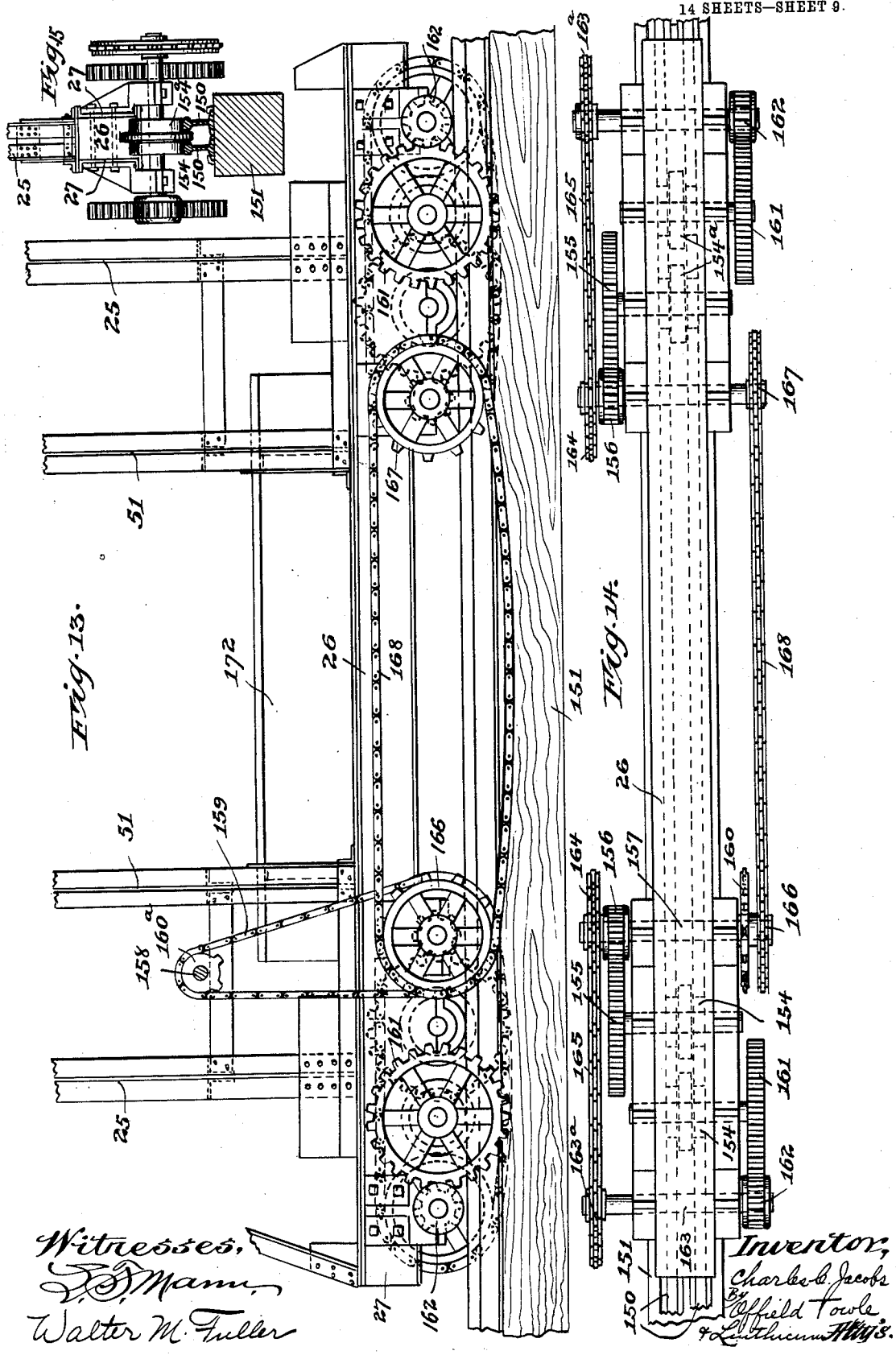
14 SHEETS—SHEET 9.



Witnesses,
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14 SHEETS—SHEET 10.

Fig. 16.

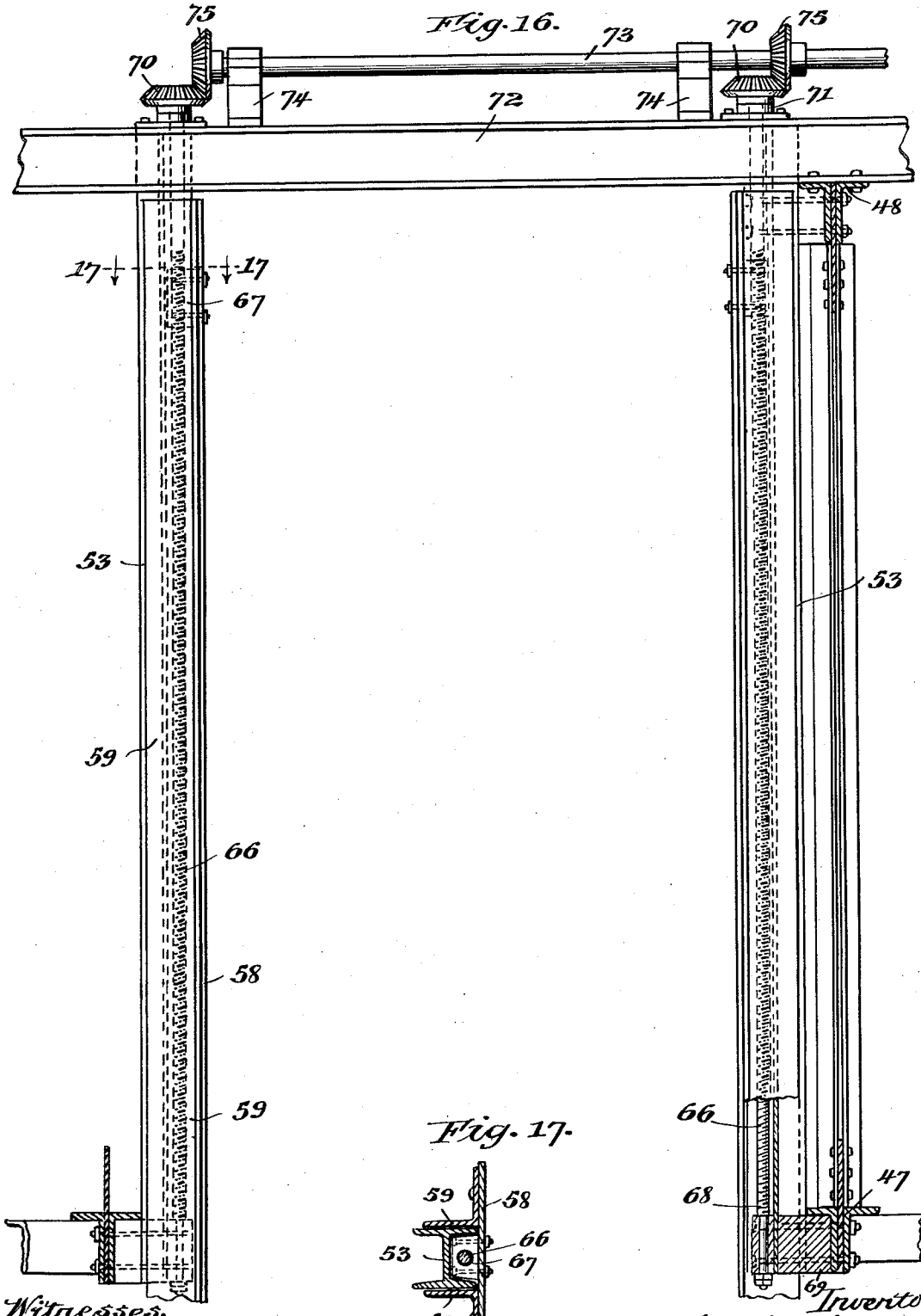

Fig. 17.

Witnesses,
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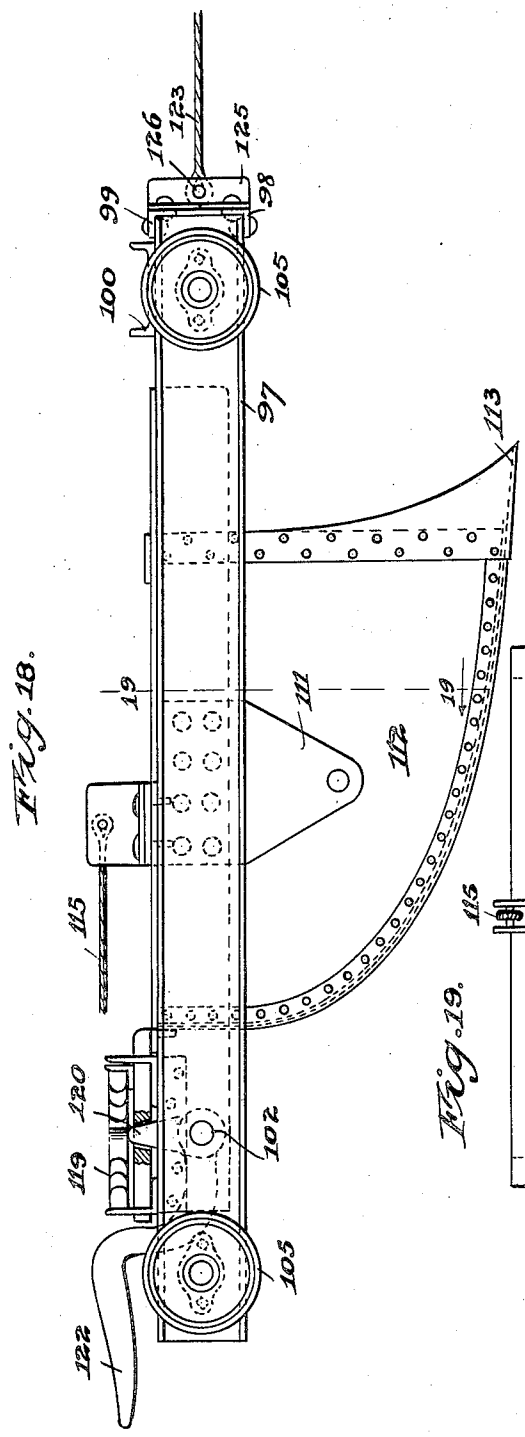

Fig. 18.

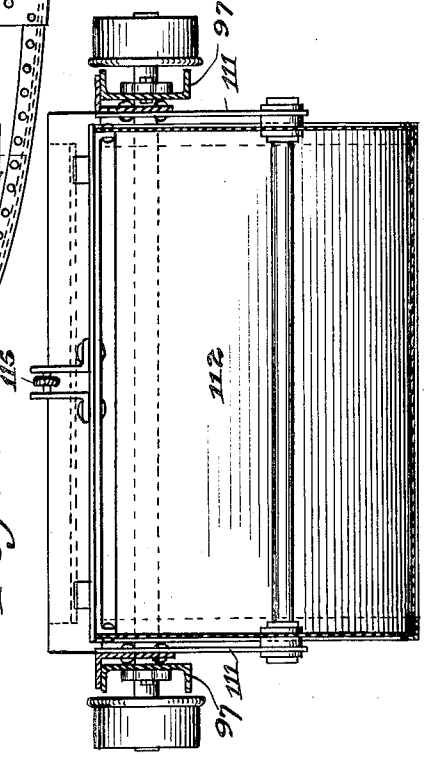

Fig. 19.

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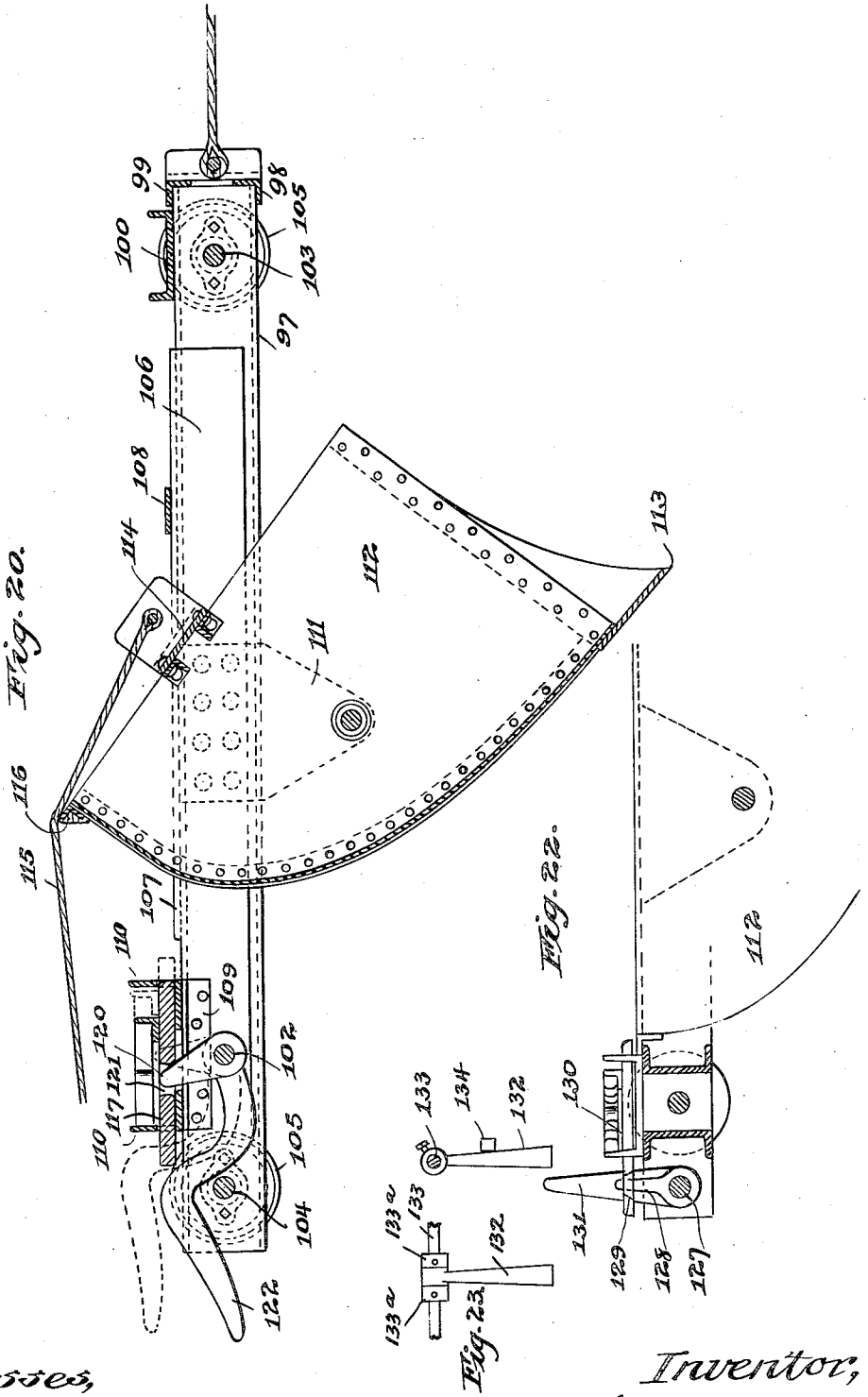

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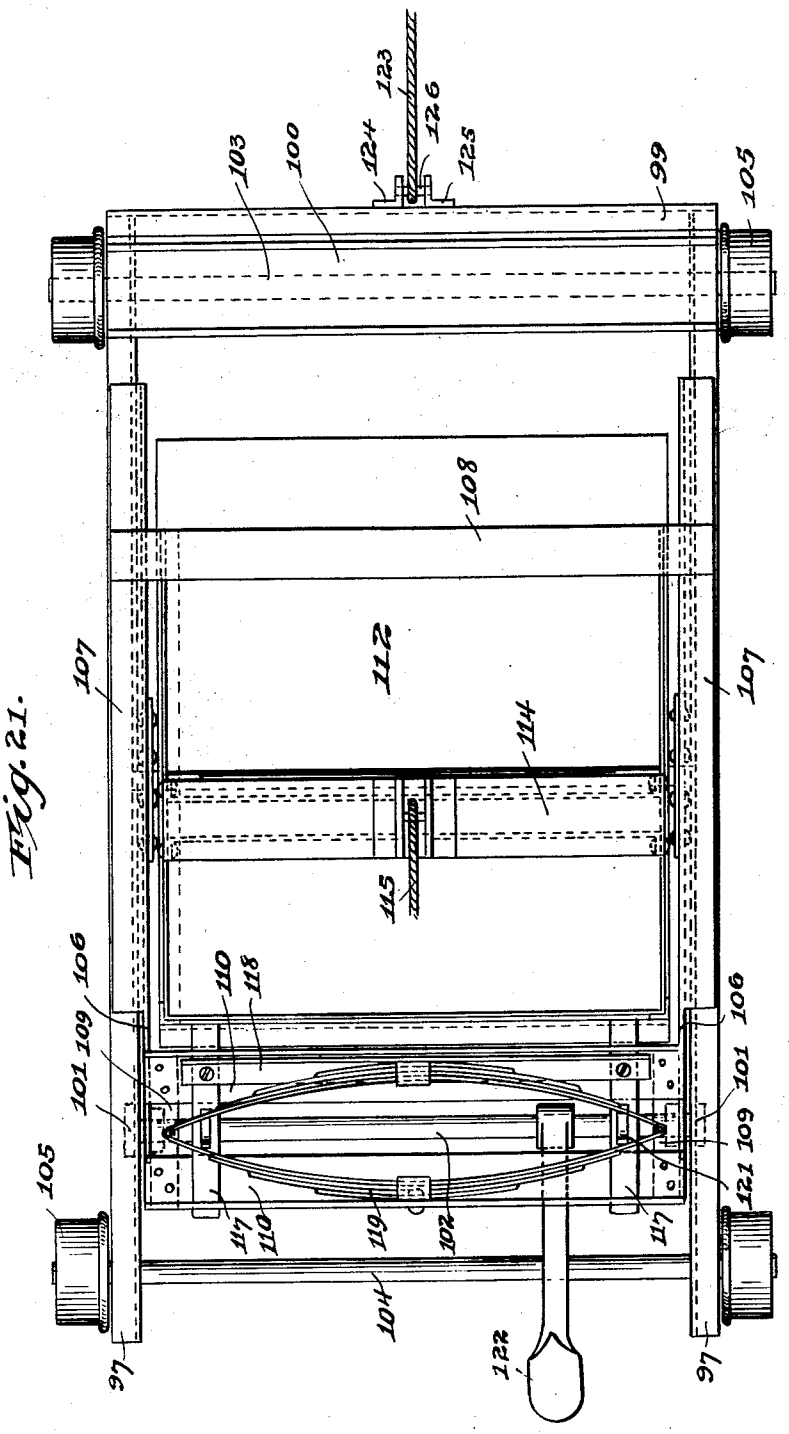

Fig. 21.

Witnesses,
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Inventor,
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Attys.

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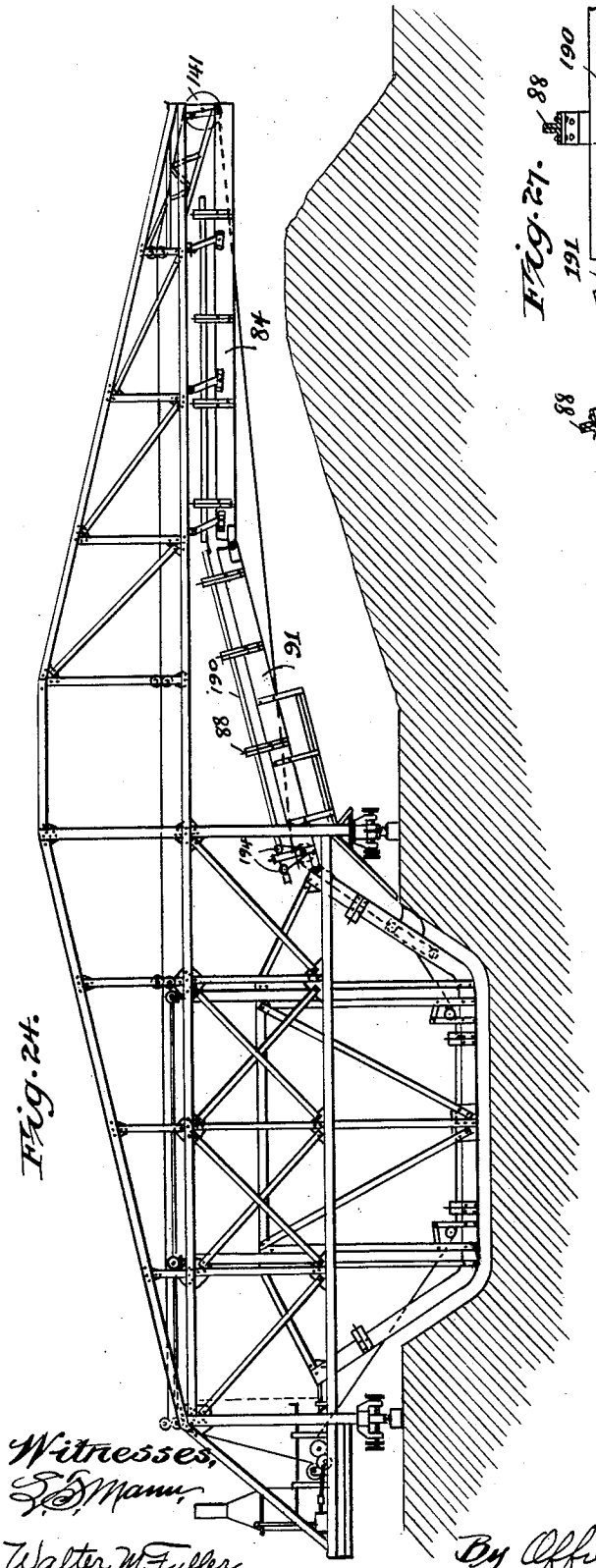

Fig. 24.

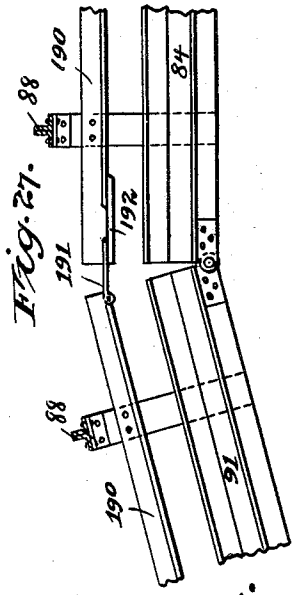

Fig. 27.

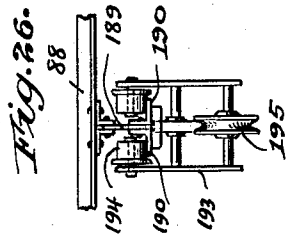

Fig. 26.

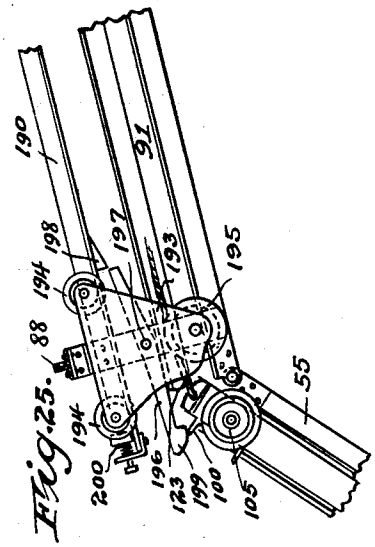

Fig. 25.

Witnesses,
E. B. Mann,
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Inventor,
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Attys.

UNITED STATES PATENT OFFICE.

CHARLES C. JACOBS, OF AMBOY, ILLINOIS, ASSIGNOR TO JACOBS STEEL EXCAVATOR COMPANY, OF AMBOY, ILLINOIS, A CORPORATION OF ILLINOIS.

EXCAVATING-MACHINE.

No. 832,609. Specification of Letters Patent. Patented Oct. 9, 1906.

Application filed January 12, 1906. Serial No. 295,828.

To all whom it may concern:

Be it known that I, CHARLES C. JACOBS, a citizen of the United States, residing at Amboy, in the county of Lee and State of Illinois, have invented certain new and useful Improvements in Excavating-Machines, of which the following is a specification.

My invention concerns ditch or trench excavating devices, and relates more particularly to machines of the general character set forth in my former United States Patent No. 794,410, granted July 11, 1905.

The present machine is especially adapted for digging a ditch or canal and at the same time building a bank or levee at one side of the trench with the excavated material; but it is also available for all kinds of digging or dredging. My new type of excavator includes a frame extending transversely of the ditch to be dug, one portion of which is directly over the ditch and another portion of which forms a prolongation of the first part and comprises a comparatively long overhanging arm or boom. On the trench part of the frame is mounted a vertically-adjustable track-section shaped to conform to the cross-sectional profile of the ditch, and on the boom or land-overhanging part of the frame is a track-section comprising an extension of this ditch-track. Mounted to reciprocate on these tracks is a shovel-truck having a pivoted dumping scoop or bucket with a cutting edge, the operation of which is to scrape a layer of earth from the trench, carry it out upon the boom-track, and dump it to form part of the levee. After each shovelful of dirt has been removed from the ditch the vertically-adjustable ditch-track is fed downwardly a small amount, so that upon the next forward movement of the truck and attached scoop another layer of earth will be shaved off and dumped on the bank. The frame is movable longitudinally of the ditch on temporary rails laid parallel to and near the edges of the trench, and after the latter has been excavated to the proper depth the frame is caused to travel forwardly on these ground tracks or rails an amount approximately equivalent to the width of cut of the shovel, so that a new cross-section of the canal may be excavated, the vertically-adjustable shovel supporting and guiding track having been previously raised to bring the shovel at the lowest point of its travel above the level of the unexcavated ground. By this means the ditch is dug by removing a series of cross-sections of the trench, the dirt being carried over the land some distance and discharged on the gradually-forming dike or levee. At the end of the frame remote from the boom is an engine which by means of drums, cables, clutches, shafts, gears, screws, and the like causes the shovel to travel to and fro on its track, feeds the shovel-track downwardly and upwardly as occasion demands, and moves the whole frame on the temporary ground-rails when a new section of the ditch is to be scooped out.

Several of the minor features of the structure form parts of my invention—for example, the means for supporting the track on the boom, which permits the ditch portion of the track to be moved up and down, and a suspended platform to prevent the dirt which is tipped out of the scoop due to the change of its angle of inclination from falling on the ground adjacent to the ditch instead of on the levee. A traveling sheave over which the advancing cable passes to change the direction of pull on the shovel to correspond to the changes in the direction of the shovel-track also forms a part of my invention.

I have illustrated the preferred embodiment of my invention in the accompanying drawings, wherein—

Figure 1 is a skeleton side elevation of the complete machine. Fig. 2 is an enlarged elevation of the left-hand part of the machine as viewed in Fig. 1. Fig. 3 is a detail view of the means for feeding the shovel-guiding track upwardly and downwardly. Fig. 4 is an elevation of the boom or overhanging portion of the structure. Fig. 5 is a vertical cross-section on line 5 5 of Fig. 4 as viewed in the direction indicated by the arrows. Fig. 6 is an elevation of the right-hand end of the structure shown in Fig. 4. Fig. 7 is a plan of the ditch portion of the machine, parts being broken away to more clearly show the construction. Fig. 8 is a horizontal section of the same and illustrates the coöperation between the supporting-frame and the vertically-adjustable guiding-track. Fig. 9 is a plan view of the boom portion of the machine shown in Fig. 4. Fig. 10 is a fragmentary enlarged vertical longitudinal section illustrating the support for the sheave at the boom end of the frame. Fig.

11 is a plan view of the structure shown in Fig. 10. Fig. 12 is an enlarged vertical cross-section on the line 12 12 of Fig. 2, showing the shovel in the lowest portion of the guiding-track. Fig. 13 is an enlarged elevation of one of the means for causing the frame to travel on the temporary ground-rails. Fig. 14 is a plan view of the same. Fig. 15 is an end elevation of the same. Fig. 16 is a detail elevation, partly in section, illustrating the means for operating the vertically-adjustable shovel supporting and guiding track. Fig. 17 is a horizontal section looking downwardly on line 17 17 of Fig. 16. Fig. 18 is a side elevation of the shovel comprising the rolling truck and scoop with its cutting edge. Fig. 19 is a section of the shovel shown in Fig. 18 on the line 19 19 as viewed in the direction indicated by the arrows. Fig. 20 is a longitudinal section of the shovel and shows the same in dumping position. Fig. 21 is a plan view of the shovel. Fig. 22 is a detail view illustrating a modified form of shovel-tripping means. Fig. 23 shows a portion of the parts illustrated in Fig. 22. Fig. 24 shows the machine equipped with a traveling sheave to guide the forwardly-pulling cable; and Figs. 25, 26, and 27 are detail views of the sheave and its trackway.

Each side of the frame includes a vertical post 25, built up of four angles, as shown in Fig. 8, mounted on the transverse horizontal beam 26, consisting of, besides other parts, spaced channel-bars 27, as illustrated in Fig. 15. Posts 30, similar to the posts 25, are mounted vertically on a horizontal beam 31, like the beam 26 described above, the latter posts being of approximately one-half the height of posts 25. Posts 25 and 30 are each braced against outward displacement by an inclined angle-bar 27, Fig. 12, secured at its upper end to the post and at its lower end to an upstanding plate 28, fastened near the end of the transverse beam 26 or 31, as the case may be. The bars 27 are tied to their respective posts and prevented from buckling by the bars 29. Joining posts 25 and 30 on each side near their lower ends is a beam 32, built up of two angle-bars, as shown in Fig. 12, and projecting beyond post 30, as shown in Figs. 1 and 2. Connecting the upper end of post 30 with approximately the central point of post 25 on each side is a horizontal beam 33, made of two angle-bars, Fig. 12, like the beam 32. The upper end of post 30 is connected to the top end of post 25 by an inclined bar 34, Fig. 2, which may also comprise two angles placed flange to flange, as shown in Fig. 7. An inclined brace 35, connected to the gusset-plate 36 at the top of post 30 and to the protruding end of beam 32, prevents the latter from deflection under the load of the engine and other parts which it supports. Horizontal bars 32 and 33 and the inclined tension-bar 34 are connected and spaced apart by vertical angle-bars 37 and 38, Fig. 2. Diagonal braces 39 are also connected to the horizontal bars, as is shown most clearly in Figs. 1 and 2, the structure being of the usual simple trussed type and possessing the requisite strength.

A horizontal beam 40, which may be integral with beam 33 or may be separate therefrom, extends outwardly from post 25 to the land end of the structure, as shown in Figs. 1 and 4. This beam also is made of two angle-bars; but it is to be understood that the specific structure of the whole frame and the particular type of bars used is immaterial. Projecting landward from the top of post 25 is a horizontal bar 41, the outer end of which is joined to the outer end of bar 40 by the inclined tension or sustaining bar 42. Between the latter and bar 40 are the uprights 43 and the inclined bars 44, as shown. The greater portion of this frame is made from spaced angles between which at the proper points are fastened gusset-plates which form convenient attaching means for other bars. It will be evident from this construction that the frame is of the cantaliver type, having a comparatively long boom or overhanging section. (Shown most clearly in Fig. 1.) These two outer side frames are spaced apart and tied together by transverse bars 45 and diagonals 46, Figs. 7 and 9, of which only a small portion is shown, the construction being that of the usual type. Inside of these side frames and spaced therefrom are two additional frames, which comprise, among other parts, the two horizontal beams 47, Fig. 7, in the plane of beams 32 and the upper bars 48 at the same height as beams 33. These horizontal beams are held in place by transverse beams 49 and diagonals 50. Vertical posts 51, Fig. 8, resting on transverse beams 26 and 31, form parts of these inner frames, and their tops are connected by inclined bars 52, Fig. 7, which are in the plane of and correspond to the bars 34. Attached to the inner sides of these inner frames are four comparatively large vertical I-beams 53, as shown in Figs. 8, 16, and 17.

Slidable upon the I-beams 53 and vertically adjustable is a shovel supporting and guiding track-frame which comprises on each side, as shown in Fig. 2, a lower track-plate 54, having its end portions 55 upwardly divergent, the shape of the plate conforming to the cross-sectional profile of the trench to be dug. Each plate 54 has riveted to its inner surface near its top and bottom edges two longitudinal angle-bars 56 and 57, Fig. 12, forming the tracks. Extended upwardly from each plate 54 at the points where its end sections 55 join the lower horizontal portion is a vertical plate 58, Figs. 16 and 17, to the outer surface of which are riveted spaced angle-bars 59, which are adapted to extend over the edges of the corresponding vertical I-

beam 53 and form guides for the movable shovel-track framework. A horizontal bar 60, Fig. 2, joins the upper ends of the two plates 58 on each side, and this bar 60 is connected to the central portion of the track-plate 54 by the vertical angle-bars 61, which inclined angle-bars 62 connect gusset-plates at the upper ends of plates 58 with the central portion of plate 54. Bars 63, Fig. 2, tie the ends 55 to the upper ends of plates 58. The sides of this vertically-movable shovel-track frame are held in proper upright position by horizontal spacing-bars 64 and crossed diagonals 65, Fig. 12.

The means for moving the adjustable track-frame includes an upright screw 66, Figs. 3 and 16, one for each plate 58, the screw passing through a nut 67, Fig. 17, bolted to the outer side of the plate 58 near its top end and fitting between the parallel flanges of the corresponding I-beam 53. The lower end of each screw has a step-bearing at 68 in a member 69, bolted to the beam 47. At its upper end each screw 66 has a bevel-gear 70, the upper end of the screw-shaft having a bearing in a box 71, mounted on cross-channels 72, the latter resting upon and being bolted or riveted to horizontal beams 33 and 48. Above the two pairs of bevel-gears 70 are transverse shafts 73, rotating in bearings 74, mounted on the channels 72 and having bevel-gears 75, meshing with and operating the gears 70 and screws 66. At one end of each shaft 73 is a bevel-gear 76, Figs. 7 and 12, meshing with a similar gear 77, mounted to turn with a shaft 78, extending longitudinally of the framework and rotatively mounted in bearings 79 on the cross-beams 49.

Suspended from the boom portion of the skeleton frame is a dumping-shovel track-section 84, Figs. 4, 5, and 6, supported on the frame by means of depending links 80, the upper ends of which latter are pivoted between the flanges of separated angle-bars 81, attached at their lower ends to transverse beams 82, joining the two side frames, and riveted at their upper ends to a similar transverse angle-bar 83. At its lower end each link is pivoted to the track-plate 84^a inside of a bracket 85, which acts as a bearing. To the inner side of each track-plate 84^a are riveted two angle-bars 86 and 87, which are vertically spaced apart the same amount that the angle-bars 56 and 57 are.

An intermediate track-section 91, similar to the dumping section 84 described above, is pivoted at one end at 92 to the inner end of the dumping track-section and at its other end at 93 to the adjacent end 55 of the movable track-frame. This intermediate section includes side plates 94, with upper and lower angles 95 and 96.

Track-plates 54, 94, and 84^a are spaced apart by yokes each consisting of an angle or other bar 88, Fig. 5, attached to the upper ends of plates 89, secured to the outer sides of the respective track-plates by angles 90. These supporting means for the bars 88 act also as stiffeners for the track-plates.

The shovel which is adapted to be drawn to and fro on the ditch track-section 54, the intermediate section 91, and the dumping section 84 is illustrated in detail in Figs. 18 and 21, inclusive, and comprises an open truck-frame, within which is pivoted a scoop or bucket open at its top and forward side and having a cutting edge. The truck-frame includes two spaced channel-bars 97, disposed with their flanges extended outwardly, the bars being tied together and separated the proper distance by transverse angle-bars 98 and 99 and channel-bar 100 at the forward end of the truck, while at the rear the channels are prevented from spreading by the enlarged ends or collars 101 on trip-shaft 102. Mounted in bearings in the channels 97 are the forward and rear axles 103 and 104, respectively, equipped at their outer ends with the flanged wheels 105, adapted to travel on the lower angles 57, 96, and 87 of the track-sections 54, 91, and 84, the upper angle-bars of the track preventing the wheels from leaving the lower angles. Mounted to turn on shaft 102 is a frame consisting of the two side members 106, each of which has a top marginal outwardly-extended flange 107, which overlap and normally rest upon the top surfaces of side channels 97. Near their forward ends flanges 107 are connected by a flat bar 108, and to the inner surfaces of the rear ends of members 106, which are disposed between channels 97, are fastened short horizontal angle-bars 109, connected by transverse angle-bars 110. Rotatably mounted in plates 111, which are riveted to and depend from the inner surfaces of members 106, is an open-topped scoop 112, having an open front face with a lower cutting edge 113. To a transverse plate 114 on the top of the scoop is suitably attached a retracting-cable 115, and at the upper rear edge of the scoop is a beveled strip 116, Fig. 20, coöperating with two sliding catches 117, working in slots in the upstanding flanges of bars 110. Catches 117 are connected by an angle-bar 118 to cause them to operate in unison, and between the upright flanges of rear bar 110 and bar 118 is interposed an elliptic spring 119, whose function is to thrust the catches forwardly to project over the edge of the scoop and prevent the same from rotating on its shaft. For the purpose of withdrawing or retracting these catches I provide on shaft 102 two arms 120, rigid therewith, which extend into slots 121 in the catches. On shaft 102 is also an actuating-lever 122, pressure upon which draws back the catches, thereby allowing the scoop to discharge its contents. An advancing cable 123 is attached to the forward end of

the truck by means of angles 124 and 125 and an interposed pin 126.

The form of shovel shown in Figs. 18 and 21, inclusive, is intended to be released manually; but in some cases it may be desirable to release the catches automatically, and for that purpose I have illustrated a modified form of catch-actuating mechanism in Fig. 22. On a transverse shovel-trip shaft 127 are two arms 128, projecting into slots 129 in sliding catches 130. The operating-arm 131 on shaft 127 coacts with a trip-lever 132, pivoted on a transverse rod 133, attached to the boom portion of the frame, a fixed stop 134 preventing forward turning of the trip-lever, which, however, has free backward movement. I preferably employ a number of the parts 132, 133, and 134, disposed at intervals along the boom, the inactive levers 132 being slid lengthwise of their rods out of the path of lever 131. By these means the point of dumping of the scoop may be readily changed, the active lever 132 being held in place on its rod between collars 133[a], which are secured in position by set-screws, Fig. 23.

At the end of the skeleton cantaliver-frame remote from the boom or overhanging portion thereof I provide a boiler 135, Figs. 2 and 7, and a double engine 136, adapted to revolve clutch-shaft 136[a] and two drums 137 and 138, respectively, the former being adapted to wind up cable 123, attached to the forward end of the shovel, whereby the latter is advanced on the track to scrape out dirt from the trench and dump the same at the boom end of the structure, while the latter drum 138 operates cable 115 to draw the shovel back.

Cable 123 passes through four or more pairs of guide-pulleys 139, suitably mounted in angle-bars 140, as shown in Fig. 5. At the end of the boom cable 123 also passes over a sheave 141, rotatably mounted in bearings 142, which are supported from the frame by two pairs of depending angle-bars 143, which extend between transverse channels 144, Figs. 10 and 11, being riveted to the outer one. The lower ends of angles 143 are held in proper position by inclined bars 145, attached at their upper ends to horizontal bars 146, the latter resting at one end upon the channels 144 and at the other end upon the transverse angle-bar 83, connected to the uprights 43. Bars 147 connect bars 146 with the upper ends of uprights 140 and inclined bars 148 connect bars 145 and 146. After passing around the sheave 141 cable 123 passes directly to its point of attachment to the shovel. Cables 115 and 123 (depending upon the position of the shovel) pass beneath the sheaves or rollers 149, Fig. 2, suitably secured near the lower portion of the vertically-adjustable track-frame.

The horizontal beams 26 and 31, with the superposed frame, are movable longitudinally of the trench, the former on a pair of tracks or rails 150, mounted on a wooden beam 151, laid temporarily on the ground, beam 31 being movable on a single rail 152 on beam 153. Since the means for moving the beams 26 and 31 and the structure above them is the same in both cases, a description of one will suffice. Beam 26, Figs. 13, 14, and 15, is provided at each end with a pair of track-wheels 154, each having a central flange 154[a], adapted to fit between the spaced rails 150. The shaft of each inner wheel 154 is equipped with a gear 155, with which meshes an operating-pinion 156 on shaft 157, the latter being driven from a shaft 158, Fig. 13, running longitudinally of the supporting-frame by means of a sprocket-chain 159 passing over a sprocket-wheel 160 on the opposite end of shaft 157 and a sprocket-wheel 160[a] on shaft 158. The shaft of each outer track-wheel 154 has a gear 161, with which meshes a pinion 162 on a shaft 163, the latter being turned by shaft 157 through the sprocket-wheels 163[a] on shaft 162 and 164 on shaft 157 and a connecting sprocket-chain 165. Power is communicated from shaft 157 to the pair of wheels 154 at the other end of beam 26 by the sprocket-wheels 166 and 167 and the connecting-chain 168. A sprocket-chain 169, Fig. 12, connects a sprocket-wheel 170 on shaft 158 with the operating mechanism to rotate the wheels 171 traveling on rail 152.

Inclined platforms 172 and 173, Fig. 2, extending over beam 26 and its numerous wheels, gears, &c., and supported by bent angle-bars 174, which are attached to posts 51 and bars 175, prevent the dirt pushed up in front of the scoop or shovel from falling on and clogging the mechanism.

Depending from the intermediate track-section 91 is a platform 176, Figs. 1 and 2, suspended below the track-section an amount slightly greater than that which the shovel extends below it. Platform 176 is suspended from the track-section by the braces 177, the brace adjacent to the ditch being equipped with bearings 178, in which is rotatably mounted a roller 179, over which the cables are adapted to pass. The function of platform 176 is to prevent the dirt which is spilled out of the shovel, due to the change of inclination of the latter as the shovel passes from the part 55 to the intermediate trackway 91. from falling on the ground near the trench.

The operator of the machine by standing near the engine has control of all the parts. Handle 180, Fig. 7, controls the engine, handles 181 and 182 control drums 137 and 138, and handle 183 actuates a rock-shaft 184, the latter connecting with clutches 185 and 186 on shaft 136[a], so that by throwing handle 183 in one direction clutch 186 will be operated to turn shaft 78 by means of sprocket-chain 187 and sprocket-wheels on the clutch-shaft and on shaft 78, so that the latter by means of the

bevel-gears and screws feeds the vertically-adjustable frame upwardly or downwardly, as occasion demands. By shifting handle 183 in the opposite direction clutch 185 is thrown into operation, so as to turn shaft 158 by chain 188 and sprocket-wheels on the clutch-shaft and on shaft 158, whereby the whole frame may be caused to travel longitudinally of the trench on the temporary tracks or rails 150 and 152.

The operation of the apparatus is as follows: Assuming that the shovel has been drawn rearwardly or toward the engine by the cable 115, so as to be above the level of the ground, the operator by actuating handle 181 causes the forward pulling-cable 123 to be wound up on drum 137, the cable 115 being paid out from the drum 138, whereby the shovel is caused to travel on its trackway, descending at the left-hand end of the track 55, as viewed in Fig. 2, its cutting edge shaving off a layer of dirt as it passes down this inclined path along the horizontal portion 54 and up the other inclined end 55. While traveling up this latter incline it pushes more or less dirt ahead of it, and to prevent the same from falling upon the beam 26 and its gears and sprocket-wheels the platforms 172 and 173 are used as a cover for these parts. The shovel in passing to the intermediate track-section 91 changes its angle of inclination, and in addition to the amount of dirt which the shovel has forced ahead of it some is spilled out of the mouth of the scoop, and to prevent the same from falling upon the land adjacent to the trench the platform 176 is provided, so that whatever dirt falls thereupon is pushed along the same by means of the shovel and dumped at the beginning of the bank or dike. The shovel continues its forward movement and passes upon the dumping-trackway 84 at some portion of which the latch or catch on the shovel is tripped either manually by a workman stationed on the frame or automatically by the stop-lever 132, (shown in Fig. 22,) so that the load is discharged. The operator at the engine then turns handle 182, so as to cause the winding up of cable 115 on its drum and the paying out of cable 123. When cable 115 begins to tighten, owing to striking the rear upper edge of the scoop, it causes the latter to assume its original position, the wedge-strip 116 forcing the catches 117 back, after which the catches, under the influence of spring 119, slide forwardly over the edge of the scoop to maintain it in position. In its backward movement the shovel passes over the dumping, intermediate, and ditch sections of the track, as will be readily understood. In case the scoop in this backward movement strikes any irregularities in the ground or other obstruction it is permitted, owing to its pivotal connection on the shaft 102, to rise sufficiently from the truck-frame to pass over the obstruction. Before the shovel is started on its next forward trip the vertically-adjustable ditch track-frame is fed downwardly a small amount by the operator, who turns the handle 183 in such a direction as to throw in the clutch 186, thereby causing the simultaneous rotation of the vertical screws through the means of chain 187, shaft 78, gears 77, 76, 75, and 70. Owing to the fixed nuts 67, with which the screws 66 coöperate, the track-frame is lowered by the turning of the gears and screws, as described above, the frame being guided in its movement by the angles 59 coöperating with the I-beams 53. The supporting of track-section 84 by links and the hinging of the intermediate section at both ends permits the ditch track-section to be raised or lowered, at the same time maintaining the continuity of the trackway. This lowering of the frame causes the cutting front edge of the scoop to scrape off a new layer of ground on its next trip and dump the same, as described above, upon the bank or dike shown in Fig. 1. Owing to the fact that the width of cut of the shovel is slightly narrower than the ditch track-frame, it may be necessary occasionally if the earth is particularly firm and compact to feed the whole frame backward a bit, so that the track-frame may be lowered. When the section of the trench which is being excavated has been dug to the proper depth, the ditch track-frame is raised sufficiently by means of the rotation of the vertical screws 66, so that the whole frame may be rolled forwardly on the ground-rails an amount approximately equivalent to the width of cut of the shovel. The operator causes the whole frame to travel forwardly on the tracks or rails 150 and 152 by throwing the handle 183 in such a direction as to throw in the clutch 185, thereby rotating shaft 158 through the means of the connecting sprocket-chain 188 and its coöperating sprocket-wheels. The rotation of shaft 158 is communicated, by means of sprocket-chains 159 and 169, to the wheels which roll upon the ground-rails through the means of the chains, sprocket-wheels, and gears shown in Figs. 12, 13, 14, and 15, as will be readily understood. When the frame has by this means been brought over a section of unexcavated ground, the shovel is caused to make a succession of trips forward and backward on its track-sections, each time scraping out of the trench a layer of dirt, the shape of the trench being determined by the shape of the shovel-track extending directly thereover.

An inspection of Fig. 2 will show that cable 123 in pulling the shovel up the right-hand end 55 of the ditch track-section extends more or less transversely to the track, so that its pull is not as effective as if the construction was such that the cable passed over a sheave near the end of track-section 55. In order to economize in the use of power, I

have devised a mechanism which when incorporated in the structure described above reduces the amount of power necessary to operate the shovel by a considerable extent.

Referring to Figs. 24 to 27, inclusive, on the yoke angle-bars 88 of the intermediate track-section 91 and the dumping track-section 84 I have attached a trackway consisting of depending plates 189, Fig. 26, and oppositely-disposed angle-bars 190. The ends of the angle-bars 190, secured to the intermediate track-section, are provided with a hinged plate 191, Fig. 27, adapted to rest upon a depressed portion 192 of the track 190, secured to the dumping track-section 84. As the gap between the two opens or closes more or less, the continuity of the trackway 190 is maintained by means of plate 191. A sheave-frame 193, provided at its upper portion with rollers 194, adapted to travel on the trackway 190, and provided near its lower portion with a pivoted sheave 195, is adapted to be maintained in a position adjacent to the end 55 of the ditch-track by means of a lever 196, pivoted at 197 to the sheave-frame, the lever coöperating at one end with a fixed stop 198, secured to the tracks 190. At its other end lever 196 has a hook 199, which under certain conditions is adapted to engage the upstanding front flange of the cross-channel 100 of the shovel-frame.

The operation of the traveling sheave is as follows: While the shovel is on the ditch-track, its forwardly-pulling cable 123 passes over the sheave 195, which is maintained in fixed position by the stop 198, against which abuts the end of lever 196. When the shovel is traveling up the end of the ditch-track adjacent to the intermediate track-section, cable 123 pulls longitudinally of the inclined end of the ditch-track, as is shown in Fig. 24. When the shovel reaches the upper end of this inclined ditch-track, its channel 100 strikes the protruding inclined end of catch-lever 196, releasing the same from the fixed stop 198, the forward end of the shovel-truck striking the end of the traveling sheave-frame and carrying the same forwardly on the trackway as far as the shovel travels. The two are hooked together during this travel, since the latch portion 199 engages the channel 100. During the rearward movement of the shovel the traveling sheave is pulled along, due to its locked connection therewith, and when the sheave reaches the end of its travel, striking against a spring-buffer 200, the shovel-truck in turning down the incline 55 automatically releases itself from the hook 199, at the same time permitting the lever 196 to turn on its pivot, owing to the superior weight of its hook end, and engage the stop 198. It will be apparent from this construction that by means of the traveling sheave the pull of the cable upon the shovel-truck is applied in a direction to conserve the power necessary to operate the machine.

I claim—

1. In an excavating-machine, the combination of a frame comprising a main or ditch portion extending transversely over the trench to be dug, and a boom or overhanging dumping portion, a main shovel supporting and guiding track-section supported by the ditch portion of said frame, and a boom track-section forming an extension of said main track-section supported by the overhanging portion of said frame, substantially as described.

2. In an excavating-machine, the combination of a frame comprising a main or ditch portion extending transversely over the trench to be dug and a boom or overhanging dumping portion, a main shovel supporting and guiding track-section shaped to conform to the cross-sectional profile of the trench and supported by the ditch portion of said frame, a boom track-section forming an extension to said main track-section supported by the overhanging portion of said frame, a shovel to remove the dirt from the trench and dump the same, and means to move said shovel to and fro on said supporting and guiding track-sections, substantially as described.

3. In an excavating-machine, the combination with a main frame having a projecting boom, of a shovel supporting and guiding track mounted thereon, including a vertically-movable section carried by the main frame and a longitudinally-movable section carried by the boom, substantially as described.

4. In an excavating-machine, the combination with a main frame having a laterally-projecting boom, of a shovel supporting and guiding track mounted thereon including a vertically-movable section carried by the main frame, and a longitudinally-movable inclined section suspended from the boom, substantially as described.

5. In an excavating-machine, the combination of a main frame having a boom, a shovel supporting and guiding track mounted thereon including a vertically-movable section shaped to conform to the cross-sectional profile of the trench to be dug, and a section suspended from said boom by links, a shovel, and means to move said shovel to and fro on said track, substantially as described.

6. In an excavating-machine, the combination of a supporting-frame, and a shovel supporting and guiding track mounted thereon including a vertically-movable section, a dumping-section connected to said frame by links, and an intermediate section pivoted to said vertically-movable and dumping sections, substantially as described.

7. In an excavating-machine, the combination of a supporting-frame adapted to ex-

tend transversely of the trench to be dug, a shovel supporting and guiding track mounted thereon including a vertically-movable section shaped to conform to the cross-sectional profile of the trench, a dumping-section connected to said frame by links, and an intermediate section hinged to said vertically movable and dumping sections, a shovel adapted to travel on said track, and means to move said shovel to and fro on said track, substantially as described.

8. In an excavating-machine, the combination of a supporting-frame adapted to extend transversely of the trench to be dug comprising a main or ditch portion and a boom or overhanging dumping portion and a shovel supporting and guiding track mounted on said frame and including a section shaped to conform to the cross-sectional profile of the trench and vertically movable on the main or ditch portion of said frame, and a dumping-section connected to the overhanging portion of said frame by links, substantially as described.

9. In an excavating-machine, the combination of a supporting-frame adapted to extend transversely of the trench to be dug comprising a main or ditch portion and a boom or overhanging dumping portion, a shovel supporting and guiding track mounted on said frame including a ditch-section shaped to conform to the cross-sectional profile of the trench to be dug and vertically movable on the main or ditch portion of said frame, a dumping-section connected to the boom or overhanging portion of said frame by links, and an intermediate section hinged to the ditch and dumping sections, a shovel adapted to travel on said track, and means to move said shovel to and fro on said track, substantially as described.

10. In an excavating-machine, the combination of a supporting-frame and a shovel supporting and guiding track mounted thereon including a vertically-movable section and a section connected thereto for conveying the shovelful of dirt away from the trench, said latter section being provided with a platform to prevent dirt spilling on the ground therebeneath, substantially as described.

11. In an excavating-machine, the combination of a supporting-frame, a shovel supporting and guiding track mounted thereon including a vertically-movable section shaped to conform to the cross-sectional profile of the trench to be dug, a dumping-section connected to said frame by links, and an intermediate section hinged to said movable and dumping sections, a platform suspended from said intermediate section to prevent dirt from spilling from the shovel to the ground beneath it, a shovel to travel on said track, and means to move said shovel to and fro on said track, substantially as described.

12. In an excavator of the character described, a shovel comprising an open truck-frame, wheels on said frame, an open-mouthed scoop pivoted in said frame and adapted to tip to discharge its contents, and a catch to maintain said scoop in load-retaining position, substantially as described.

13. In an excavator of the character described, a shovel comprising an open truck-frame, wheels on said frame, an open-mouthed scoop pivoted in said frame and adapted to tip to discharge its contents, a catch to maintain said scoop in load-retaining position, means on said frame for the attachment of a cable to pull the shovel forwardly, and means on said scoop for the attachment of a cable to draw said shovel rearwardly and to tilt the scoop to load-retaining position after being dumped, substantially as described.

14. In an excavator of the character described, a shovel comprising an open truck-frame, wheels on said frame, an open-mouthed scoop pivoted in said frame and adapted to tip to discharge its contents, a spring-actuated sliding catch to maintain said scoop in load-retaining position, means to withdraw said catch to permit the scoop to dump its load, means on said frame for the attachment of a cable to pull the shovel forwardly, and means on said scoop for the attachment of a cable to draw said shovel rearwardly and to tilt the scoop to load-retaining position after being dumped, substantially as described.

15. In an excavator of the character described, a shovel comprising an open truck-frame, wheels on said frame, an open-mouthed scoop pivoted in said frame and adapted to tip and discharge its load, means at the forward end of said truck-frame for the attachment of a forwardly-pulling cable, a reciprocating slotted catch, a beveled nose on said scoop coacting with said catch, a shaft, a catch-operating arm on said shaft projecting into the slot of said catch, an actuating-arm on said shaft, an elliptic spring actuating said catch to proect it in a position to maintain said scoop in load-retaining position, and means on said scoop for the attachment of a retracting-cable adapted to right said scoop from dumping position and cause said beveled nose to force said catch back and become locked thereby, substantially as described.

16. In an excavator of the character described, a shovel comprising an open truck-frame, wheels on said frame, a trip-shaft, an inner frame pivoted on said shaft, a scoop pivoted on said inner frame, a catch to hold said scoop in load-retaining position, and means on said trip-shaft for retracting said catch and allowing the scoop to discharge its load.

17. In an excavating-machine, the combination of a supporting-frame, a ditch track-

section, a conveying track-section forming an extension of said ditch track-section, a shovel adapted to travel on said track-sections, a cable to pull said shovel, and a guiding-sheave over which said cable passes movable on said conveying track-section, substantially as described.

18. In an excavating-machine, the combination of a supporting-frame, a vertically-movable ditch track-section shaped to conform to the cross-sectional profile of the trench to be dug, a conveying track-section forming an extension of said ditch track-section, a shovel adapted to travel on said track-sections, a cable to pull said shovel, a guiding-sheave over which said cable passes movable on said conveying track-section, means to hold said sheave in a fixed position, and means on said shovel to release said holding means, substantially as described.

19. In an excavating-machine, the combination of a supporting-frame, a vertically-movable ditch track-section shaped to conform to the cross-sectional profile of the trench to be dug, a conveying track-section forming an extension of said ditch track-section, a shovel adapted to travel on said track-sections, a cable to pull said shovel, a guiding-sheave over which said cable passes movable on said conveying track-section, means to hold said sheave in a fixed position, means on said shovel to release said holding means, and means to detachably connect said sheave and shovel, substantially as described.

20. In an excavating-machine, the combination of a supporting-frame, a vertically-movable ditch track-section shaped to conform to the cross-sectional profile of the trench to be dug, a dumping track-section supported on said frame by links, and an intermediate track-section hinged at its opposite ends to the ditch and dumping sections, a shovel adapted to travel on said track-sections, a cable to pull said shovel, a sheave-trackway on said intermediate and dumping sections, a guiding-sheave adapted to travel on said trackway, means to hold said guiding-sheave in a fixed position on said trackway, means on said shovel to release said holding means, and means to latch said sheave and shovel together, substantially as described.

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