N. A. LYBECK.

EXCAVATOR.

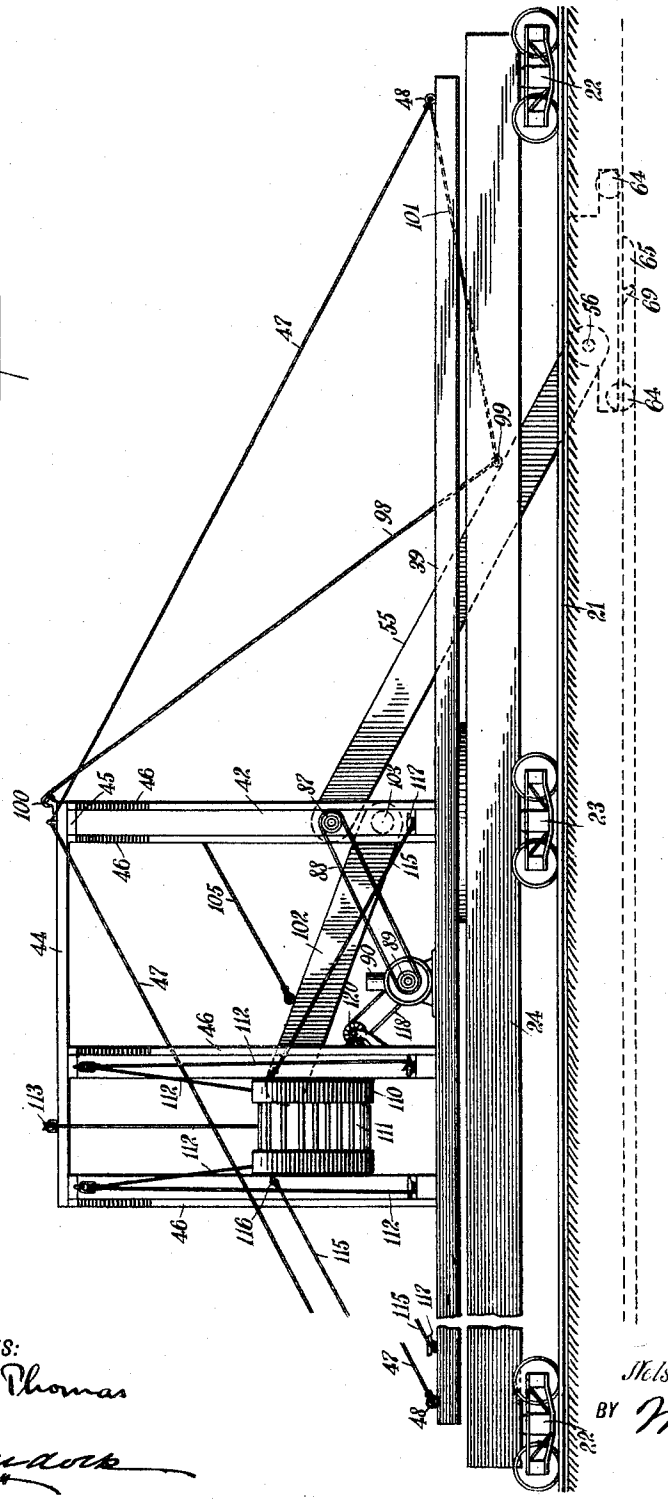
APPLICATION FILED DEC. 23, 1909.

1,032,845.

Patented July 16, 1912.

5 SHEETS—SHEET 1.

FIG. 1.



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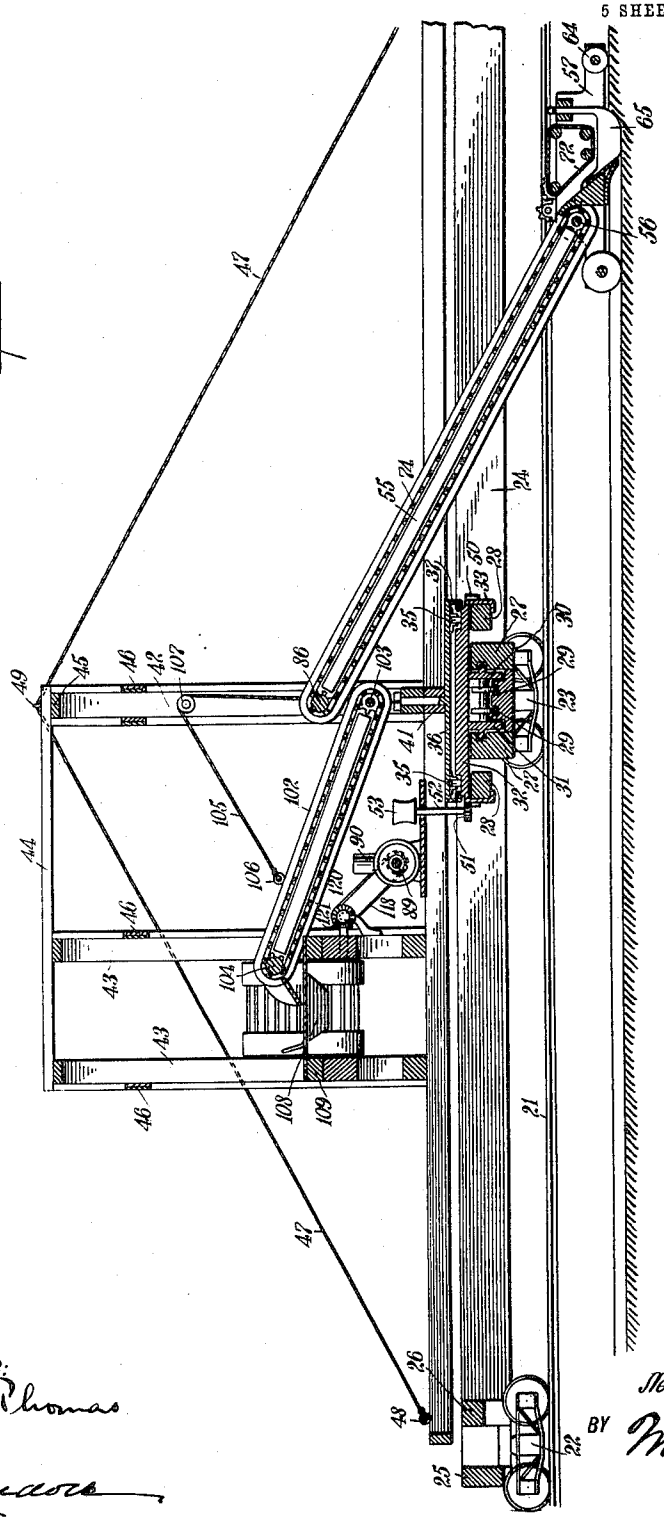
5 SHEETS—SHEET 2.

Fig. 2.



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5 SHEETS—SHEET 3.

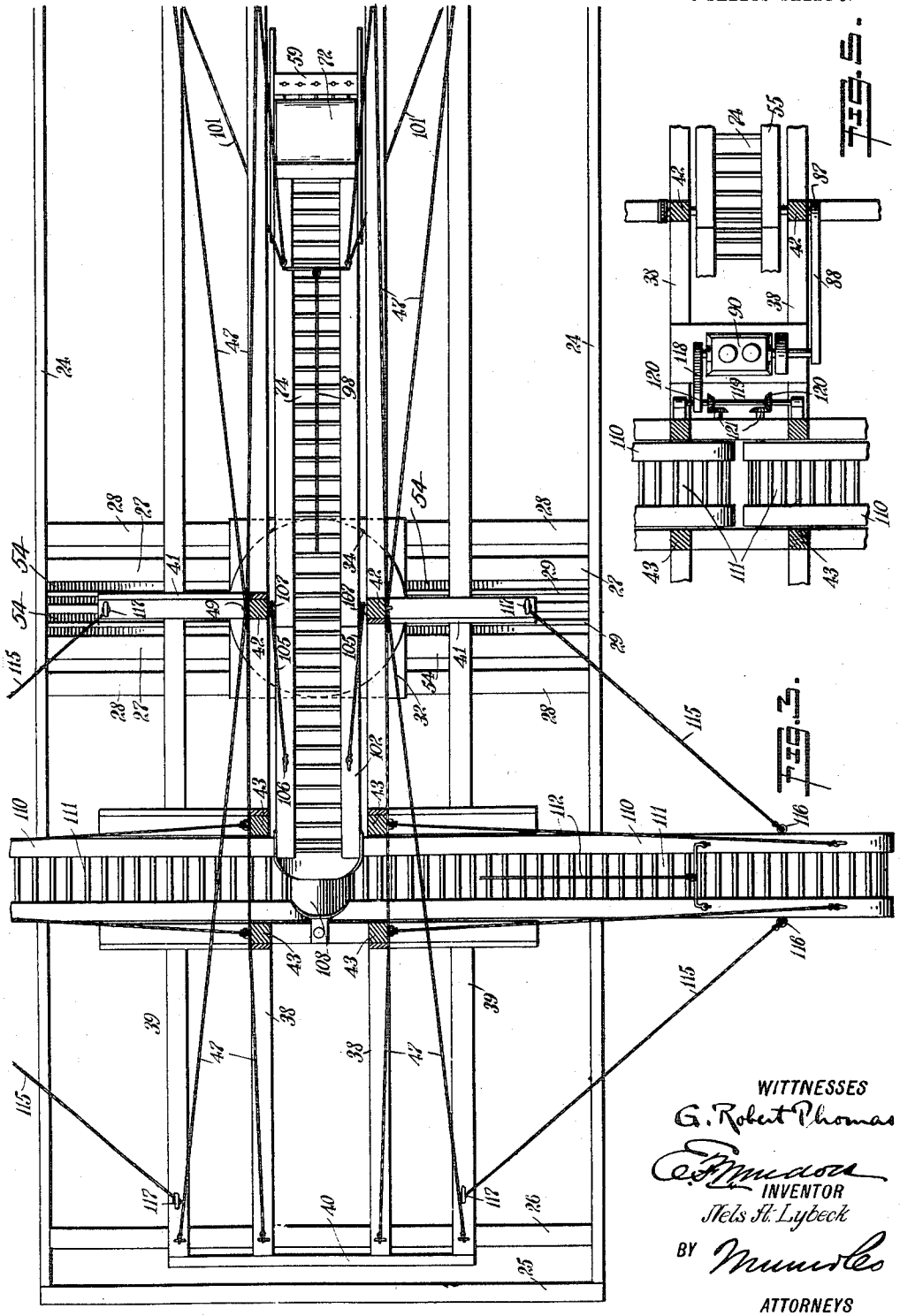

FIG. 3.

FIG. 4.

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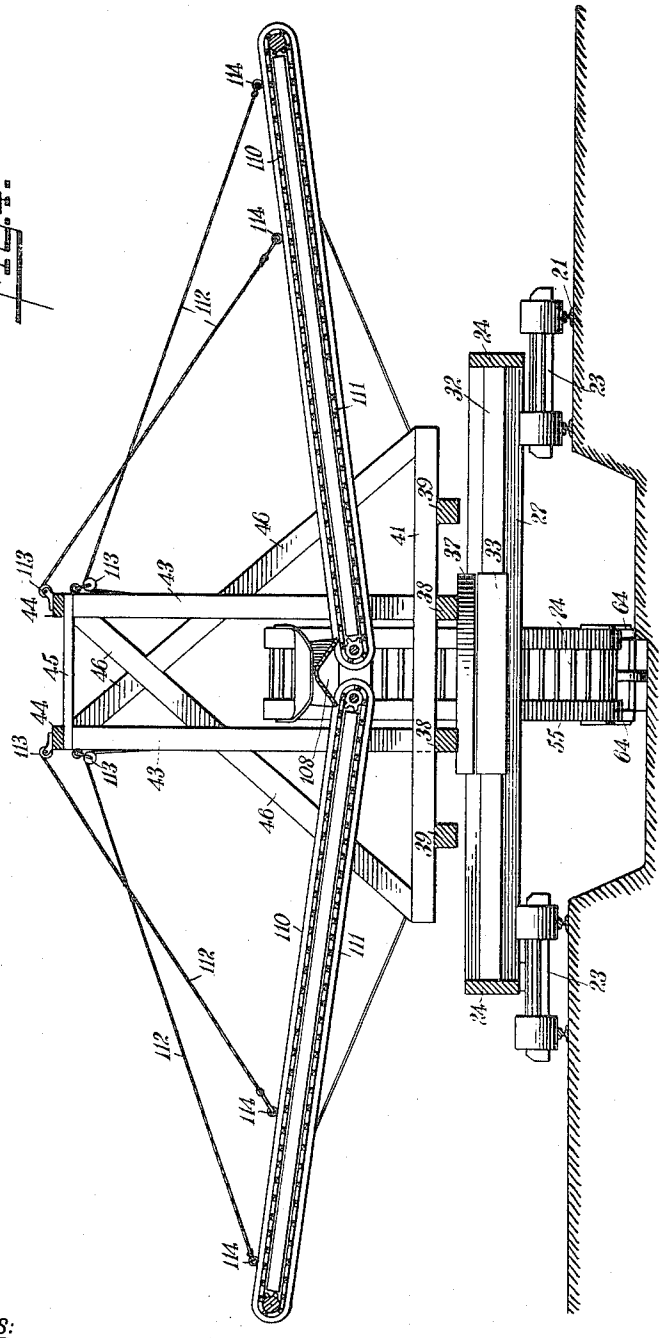
5 SHEETS—SHEET 4.

Fig. 4.



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5 SHEETS—SHEET 5.

Fig. 6.

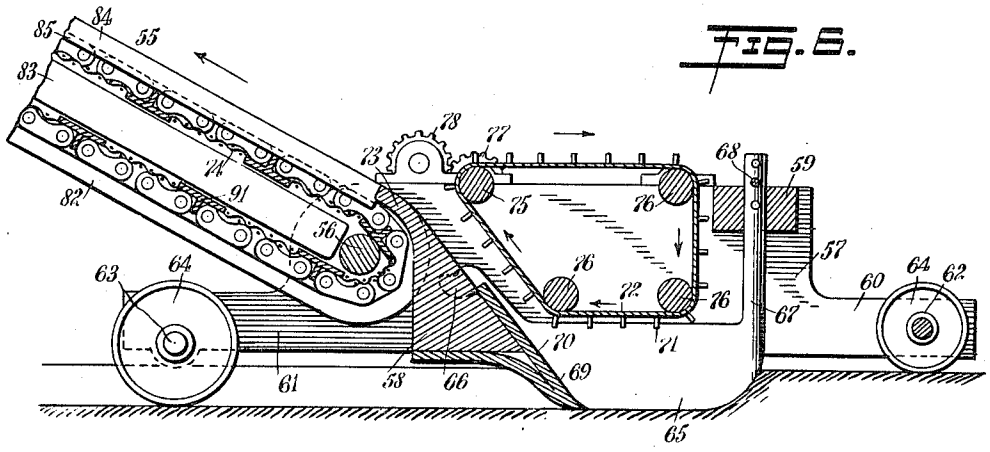


Fig. 7.

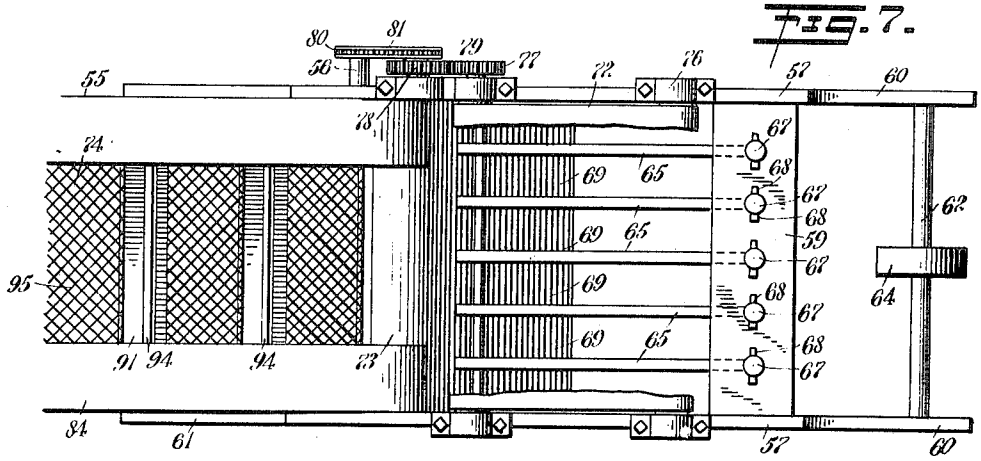


Fig. 8.

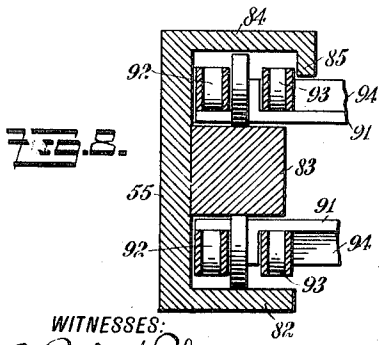
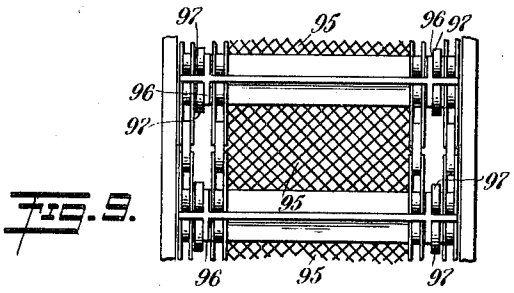


Fig. 9.



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UNITED STATES PATENT OFFICE.

NELS A. LYBECK, OF HOG ISLAND, RHODE ISLAND.

EXCAVATOR.

1,032,845. Specification of Letters Patent. Patented July 16, 1912.

Application filed December 23, 1909. Serial No. 534,595.

To all whom it may concern:

Be it known that I, NELS A. LYBECK, a citizen of the United States, and a resident of Hog Island, in the county of Bristol and State of Rhode Island, have invented a new and Improved Excavator, of which the following is a full, clear, and exact description.

Among the principal objects which the present invention has in view are: to provide an excavating machine arranged to operate over a laterally extended area; to provide an excavator adapted to distribute the earth laterally and at a distance from the line of cut when and as excavated; to provide a supporting structure adapted to be propelled in a straight line and to furnish a pivotal mounting for the excavating machinery whereby the same may be operated at a divergent line; to provide a simple and efficient excavating plow; to provide means for lifting water from the excavated trench and disposing of the same laterally; and to provide an excavator of modified form wherewith may be constructed narrow drainage and irrigating ditches.

One embodiment of the present invention is disclosed in the structure illustrated in the accompanying drawings, in which like characters of reference denote corresponding parts in all the views, and in which—

Figure 1 is a side elevation of an excavator constructed and arranged in accordance with the present invention; Fig. 2 is a longitudinal central section of the same; Fig. 3 is a fragmentary view in plan, of the construction illustrated in Fig. 2, the outer end of one of the wing carriers and the forward end of the supporting truck being removed; Fig. 4 is a cross section of the machine, taken on the central line of the laterally extended wing carriers; Fig. 5 is a detail view on an enlarged scale and in plan, of the juxtaposed ends of the wing carriers, the conveyer for delivering to the same, and the driving mechanism for operating the said carriers and conveyer; Fig. 6 is a detail view on an enlarged scale and in vertical longitudinal section, of the plow employed by me in conjunction with this invention; Fig. 7 is a plan view of the construction illustrated in Fig. 6; Fig. 8 is a detail view on an enlarged scale, of one of the sides of the elevator and of the conveyer belt used in conjunction therewith; Fig. 9 is a detail view in plan, of a fragment of the conveyer belts used in the elevator, conveyer and wing carriers.

The employment of the present invention is particularly designed for the construction of canals and for the maintenance of waterways, by preventing the same from being filled or impeded by sedimentary deposit or debris.

An incidental object is to economize in the cost of the operation of constructing the canal and of maintaining the clearway of the stream.

As forming a part of the necessary mechanism, the track rails 21 are either in the form shown in the drawings as carrying double wheeled trucks or as monorail tracks. These tracks are laid on opposite sides of the proposed excavation, and far enough removed from the proposed edges thereof to avoid the accidents of land slides or caving sides. Upon trucks 22, 22 and 23 are mounted stringers 24, 24 of what is herein termed the supporting carrying frame. The stringers 24, 24 are joined and held in rectangular arrangement by end braces 25, 25, 26, 26, and framing members 27 and 28, 28 extended between the stringers 24, 24 in mid section to form the bed upon which are formed grooves 29, 29. The grooves 29, 29 are extended transversely across the frame formed by the stringers 24, 24 and braces 25, 25, and therefore extend transversely across the proposed excavation.

The grooves 29, 29 are provided to guide the operation of wheels 30, 30, which are pivotally mounted in depended cheek pieces 31, 31 forming the carrier frame of a truck platform 32. The platform 32 has depended guide stirrups 33, 33, which infold the framing members 28, 28 to steady the action of the platform 32. The platform 32 is rectangular in shape and has formed therein a circular groove 34. The groove 34 is provided to receive truck rollers 35, 35 which are mounted on the under side of a turn-table 36. The turn-table 36 is provided with depended flanges 37, 37, the lower ends or edges of which are turned under the outwardly extended edge of an annular flange forming the side of the groove 34, as shown in Fig. 2 of the drawings. This construction is of the usual type, and is therefore not shown in detail in the accompanying drawings.

Fixedly mounted on the platform 32 are

main carrying beams 38, 38. Extended parallel with the beams 38, 38 are framing beams 39, 39. The forward and rearward ends of the beams 38 and 39 are connected by end pieces 40, 40. As stated, the beams 38, 38 are fixedly mounted upon, and therefore supported by, the platform 32. The beams 39, 39 are supported by joists 41, 41 which are fixedly connected to the platform 32. Erected vertically on the platform 32, and framed into the beams 38, 38 and joists 41, 41, are standing masts 42, 42. The masts 42, 42, in conjunction with masts 43, 43, constitute the standing structure on which the various conveyers, elevators and wing carriers are supported. The said masts 42, 43 are framed at the edge with stringers 44, 44 and 45, 45. The masts are laterally braced and joined by braces 46, 46, which are secured to the beams 39, 39 and to the said masts, and to each other where overlaid, as illustrated in Fig. 4 of the drawings. This construction forms a light but rigid framing for supporting and manipulating the elevator, conveyers and carriers above mentioned, which are suspended and supported thereby.

The frame formed by the beams 38 and 39 has a longitudinal extension, as shown in the drawings, the forward section whereof is provided to form a guide way for operation of the elevator in raising and lowering the same. The rearward extension is provided to support the standing masts 43, 43 and the carriers connected therewith. The ends of the frame formed by the beams 38 and 39 are unsupported except by guy lines 47, 47. The guy lines 47, 47 are anchored in eye bolts 48, 48 and 49, the latter being mounted on the stringers 45 connecting the peaks of the masts 42, 42. The guy lines thus arranged form a springy but strong supporting structure for the frame constituted by the said beams 38 and 39.

The periphery of the flange 33 is provided with gear teeth 50. Meshed with the gear teeth 50 are the teeth of a small pinion 51. The pinion 51 is fixedly mounted on a vertical shaft 52 extended through a platform located between the beams 38, 38 as an operating station for the machine. At the upper end of the shaft 52 is formed a winch 53 of any suitable construction. By the rotation of the winch 53 the table 36 and the super-structure carried thereby, are turned on the pivotal center of the said table. In this manner the frame formed by the beams 38, 38 and 39, with the elevator extended in parallel line therewith, is disposed in triangular arrangement upon the carrying frame formed by the stringers 24, 24. In this manner the operative position of the plow at the lower end of the elevator may be laterally shifted to address the same into the corner of a vertical cut where the side of the elevator and supporting structure might otherwise interfere.

Sunk into the upper surface of one of the framing members 28 are a series of rack-like sockets 54, 54. By means of the sockets 54, 54 and a pinch-bar of any suitable construction, the platform 32 may be shifted laterally on the framing members 27, 27, and upon the wheels 30 provided therefor. By means of this construction the platform may be shifted laterally across the entire cut being formed by the machine here described. This operation, as at present performed, is a manual operation. It will be understood, however, that the adaptation of any well known form of power driven device may be substituted for the rack-like sockets and pinchbar above described.

With a movable supporting frame, and a carrying frame therefor, constructed and arranged as above described, a trench or open cut may be formed, limited only by the width of the carrying frame formed by the stringers 24, 24 and braces 25, 26. The lateral dimension of the carrying frame is practically unlimited, and hence the width of the cut for which this machine is designed is likewise, to all intents and purposes, unlimited.

At the lower end of an elevator 55 is pivotally mounted at 56 a plow. The plow is provided with side frames 57, which are connected by body bolsters 58 and 59. The frames are provided with forward extensions 60 and rearward extensions 61. In the said extensions are mounted axles 62, 63. On the said axles 62, 63 are suitably mounted carrying wheels 64, 64. The axles 62, 63, and wheels mounted thereon, are disposed at the front and at the rear of cutting colter blades 65, 65. The blades 65, 65 are pivotally connected with the bolster 58 at 66, a notched extension being formed to extend over a pivotal bearing formed in the said bolster. The forward ends of the colters 65, 65 are provided with vertical extensions 67, at the upper end whereof are formed perforations to receive a carrying pin 68. The vertical extensions 67 are extended through perforations formed in the bolster 59. When the pin 68 is inserted in the perforations provided in the extensions 67 the weight of the colters is carried by the said bolster. The forward ends of the colters 65 may be shaped to suit. The shape shown in the drawings, particularly in Fig. 6, is that preferred by me for use in alluvial soil. The shape is rounded at the nose. It will be understood, however, that in tough ropey soil, or soil having string weed, a horn or extended and sharpened nose may be used.

The colter blades 65 are of knife-like form and serve to part the earth into layers. Extending between the colters 65 are plow shares 69. The shares 69 are provided with

a lower hook-like cutting edge, as shown in Figs. 6 and 7 of the drawings. The cutting edge parts the material as and when separated by the colters, and the pressure exerted upon the said material when parted by the forward movement of the machine lifts the same up an inclined shear 70, until the same is brought within the path of extended pins 71, 71 of a rotary apron 72. The pins and apron at this point carry the separated earth upward over a delivery table 73 and deliver the same upon a conveyer 74 with which the elevator 55 is provided. The apron 72 is moved in the direction shown by the arrows in Fig. 6 of the drawings. It is driven by a drum 75, and is supported by idler drums 76, 76. The drum 75 and idlers 76 are suitably mounted in bearings in the side frames 57, 57. On the end of the shaft upon which the drum 75 is mounted is fixedly secured a gear wheel 77. The gear wheel 77 is meshed with a gear wheel 78, both of said gear wheels being provided with bearings formed on one of the sides 57. On the shaft carrying the gear 78 is mounted a sprocket wheel 79. Fixedly mounted on the shaft 56 is a sprocket wheel 80 in line with and connected to the sprocket wheel 79 by means of a sprocket chain 81. It is by means of this gearing that the apron 72 is moved in the direction shown by the arrows in Fig. 6, while the conveyer 74 is moved in the direction also shown by the arrows in the same figure. It will be understood that suitable boxing, protective in character, will cover the said gears 77, 78, 79 and 80 and chain 81.

In the mounting and arrangement of the wheels 64, 64 it is designed that a single wheel be mounted on the axle 62 and in the center thereof, while on the axle 63 two wheels 64 shall be located in the path of the shares 69 and following the same. The variation in the height at which the said axles are placed maintains the plow frame 57 in the proper operative position with regard to the surface of the ground upon which it is working.

The elevator 55 is provided with side pieces from which is extended a track 83 and side flanges 82 and 84. The flange 82 forms a track for the lower extension of the conveyer 74. Depended from the flange 84 is an overhanging member 85 adapted to shed or divert any debris from extending inward and upon the track 83.

The conveyer belt is mounted between the side pieces of the elevator and reeved over a drum 86 at the upper end thereof. At the lower end of the elevator the said conveyer belt is reeved over the drum 56. The drum 86 is the driven drum for the elevator, on the shaft whereof is fixedly mounted a sprocket wheel 87, which is engaged by a sprocket chain 88, which in turn engages a sprocket wheel 89 on the driving shaft of an internal combustion engine 90. (See Fig. 1 of the drawings.) The construction of the conveyer belt 74 is illustrated in Figs. 6, 8 and 9 of the drawings. A series of cross bars 91 are connected by sprocket chains 92 and 93. The bars 91 are T-shaped, the raised flange 94 of which form ridges in the completed belt to prevent the slippage of material being carried by the said belt. Between the flanges of the bars 91 are extended woven sections 95, 95. The sections 95, 95 are made of any suitable material, that preferred by me being a suitable woven wire cloth, such as illustrated in Figs. 7 and 9 of the drawings. The chains 92 and 93 are formed in short link sections, as shown in Fig. 9, each section being pivotally connected to brackets 96, 96. On the same pivotal shaft by which the said links are joined to the brackets 96 are also pivotally mounted wheels 97, 97, which are provided to form carriers for the bars 91 and the links and body fabric connected therewith. The construction thus formed, and as illustrated in the drawings, provides a stiff carrying structure which is sufficiently flexible to quickly and readily make the bends over the drums 86 and 56. The second and inner series of links 93 are arranged substantially as shown in Figs. 8 of the drawings to form an upturned flexible ridge, which, when in operative position, has a close relation to the depended member 85 of the side pieces of the elevator. The links 93 being thus arranged practically close the opening between the member 85 and the said links, and thereby prevent the admission on to the track 83 of any of the debris or material carried on the body of the elevator.

The shaft for the drum 86 is mounted in bearings in the mast 42. The same shaft forms the pivot upon which the elevator, and the plow attached thereto are mounted. In its operation the plow is permitted to rest on the surface of the ground, bearing the full weight of the elevator, and in the event that the same proves not sufficient to cause the colters 65, 65 and the shares 69, 69 to enter the ground, added weight is provided for the plow. When, however, it is desired to raise the elevator and the plow attached thereto, this is accomplished by means of a hoisting cable 98, which is secured to eye-bolts 99 on the sides of the elevator and reeved over a sheave 100 mounted on the beam 45 extended between the masts 42, 42. The hoisting cable 98 is secured by any suitable form of belaying pin, or other holding structure, mounted on the side of one of the masts 42 and in convenient position for the handling by the operator. It will be understood that the

pull on the cable 98 as at present provided is a manual one. At the same time it will be understood that substitution of any form of power driven clutch or windlass may be used instead of the manually operated mechanism herein described, without necessitating invention, or passing beyond the scope of the present invention. To prevent the elevator, and the plow connected with the lower end thereof, being arrested by any obstacle in the path of the colters, I have provided guy lines 101, which are anchored to the eye-bolts 48, 48 to which the guy lines 47, 47 are likewise secured. This construction may be seen in Fig. 1 of the drawings. By it the breakage of the elevator frame and connections therefor is prevented.

The elevator 55 is so arranged that the delivery end, which passes over and around the drum 86, is suspended over a conveyer 102. The conveyer 102 is pivotally mounted at 103 between the masts 42, 42. The designating numeral 103 also indicates the shaft or drum on the end of which is fixedly mounted a sprocket wheel. The said sprocket wheel may be driven in any suitable manner. The conveyer belt is preferably constructed in a manner similar to that above described with reference to the belt 74. The conveyer 102 is pivotally mounted, as stated, at 103, between the masts 42. It is supported in its extended position by a hoisting cable 105. The hoisting cable 105 is connected to the frame of the elevator and to the eye-bolts 106 thereon provided. The cable 105 is reeved over a sheave 107, from whence it is extended downward and anchored in position upon the masts 42 by any suitable belaying pin or other fastening device. The operation of the cable 105 is, as shown, by means of man power.

In its extended position the delivery end of the elevator 102 is located over the doubly inclined shed 108, which is fixedly mounted in suitable framing 109 extended between the masts 43, 43. The extended delivery ends of the shed 108 are disposed above the lower receiving ends of wing carriers 110, 110. The carriers 110, 110 are constructed in a manner similar to that above described with reference to the elevator 55, both in respect to the frame and with regard to the conveyer belts 111, 111 provided therefor, and the construction of these elements will not be repeated. The length of the carriers 110 is practically unlimited. It is intended that in any event the extension in each direction of the carriers 110 shall be such that when the plow and elevator are working on one side of the trench being cut, the carrier extended toward the opposite side of the trench shall extend beyond the edge of the cut upon the said opposite side, so that in all positions of the plow and elevator, the carriers in both directions are operating to deliver the material as and when received by them upon the ground alongside of the trench. In this manner of distributing the material it will be observed that on each side of the trench will be formed a mound equal in width to the trench from which the material is taken, due to the fact, as herein described, that the elevator and plow attached thereto are gradually shifted from one side of the carrying frame formed by the stringers 24, 24 to the opposite side thereof, and from the one side to the opposite side of the trench being cut.

It will be understood that the extreme extension of the wing carriers 110 may be supported by as large a number of guy lines 112 as circumstances require. For the purpose of illustration I have shown in Fig. 1 two such lines to each of the wing carriers. These lines are extended over sheaves 113 mounted upon the stringers 44 of the super-structure. From the sheaves 113 the guy lines are depended and suitably belayed or otherwise anchored upon the framing structure.

The guy lines 112 are secured to eye bolts 114, 114 formed in the sides of the carriers. When it is desired to elevate the lower and delivery end of the carriers this is accomplished by gradually manipulating the various guy lines in the manner usually performed by riggers. It will be understood that while I have here shown a manually operated means for supporting and varying the disposition of the carriers, I may substitute therefor a power driven mechanism.

Due to the extreme extension of the carriers 110 it becomes necessary to brace the same against disadjustment in a direction lateral to their extension. For this purpose I have provided guy lines 115, 115, which are suitably secured to eye bolts 116, 116 in the side of the frames and at points near the end thereof, and to eye bolts 117, 117 suitably mounted upon the structural frame of the machine. Any suitable tightening device for taking up the slack may be used in conjunction with the present invention without altering the scope thereof.

It will be noticed that the anchorage of the various guy lines and braces for the structure and superstructure is extended above the beams 38, 38 and 39. It will also be noticed that the operating structure mounted upon the said beams may be shifted laterally by moving the platform 32 on the wheels 30, without disturbing any of the anchorages or other attachments of the said guy lines. It will also be noticed that the structure mounted upon the said beams 38, 38, and 39 may be pivotally shifted upon the turn table formed on the said platform, without moving in any way the said anchorages.

The method of operating the present ma-

chine is as follows: The tracks 21, 21 having been laid, the carrying frame having the stringers 24, 24, end braces 25 and 26, and mid section framing 27 and 28, with the movable frame 38, 38 and 39 mounted thereon as above described, is placed thereon. If the magnitude of the work is such as to require power, small working locomotives or other motor devices, are mounted upon the tracks 21, 21 in front of, or in the rear of, the carrying frame, abutting against or drawing upon the end braces 25, 25. By means of this power the carrying frame is advanced and withdrawn while in operative position with the elevator 55 lowered. With each advance of the frame, and with the elevator 55 lowered, the plow connected therewith is impelled to dig into the earth to raise the same to the conveyer belt 74 of the elevator in the manner as above described. In practice, the carrying frame is advanced to an extent approximately equal to its own length. It is then retracted and the elevator 55 is slightly raised, while, by means of the pinchbar placed in engagement with the rack-like sockets 54, the platform 32, and the machine mounted thereon, are shifted laterally a distance equal to less than the width of the colters 65, 65. In its operation the elevator is slacked, so permitting the plow to again engage the ground to dig a furrow therein as the carrying frame is again advanced. This operation is continued until the entire width of the trench to be formed has been traversed. The result of this operation is to produce, in the initial cut, a shallow cut of the desired depth. The operation is continued until a trench of a desired width and depth is formed between the carrying frame operating back and forth in about the same area. The particular section upon which the work has been performed having been constructed, the upper structure carried above the turn table formed on the platform 32 is then reversed, the elevator and plow connected therewith having been raised above the stringers 24, 24. The carrying frame is then moved over the next succeeding section, and the operation commenced at a distance about equal to the length of the frame beyond where the first section was terminated. In this operation the plow will be carried to near or over the end of the former cut in each of the cutting progressions. In each backward or retarding movement of the carrying frame it will be seen that as the cutting proceeds the cutting at the end of the forward travel of the carrying machine will be gradually inclined. It is to overcome the need for trimming or reworking the excavation that I, at the completion of each section, raise the elevator and plow connected therewith, and reverse the super-structure upon the carrying frame. In doing this I advance the plow at the beginning of each of its forward cuts from the intersection of the inclined wall forming the finishing wall of the previous cut. The result of this method of operating, which is permissible by this machine only, is that each section is completed as the work progresses.

In the excavating operation above described, as the plow is forced forward the ground is separated, parted and delivered to the conveyer 74, which, being constantly operated, carries the same to the delivery end and there dumps the broken material upon the conveyer 102. The conveyer 102, operating in unison with the elevator 55 and the conveyer belt mounted thereon, delivers the material as received upon the doubly inclined shed 108. The shed 108 divides the material equally and delivers a half thereof to each of the laterally extended wing carriers 110. The wing carriers 110, as above stated, are provided with conveyer belts which are being driven at a rate uniform with the rate of travel of the belts on the elevator 55 and conveyer 102. The material is in time delivered over the outward end of the conveyer belts of the wing carriers, and thus distributed equally on all sections of the ground next adjacent to the trench being formed. It will be understood that if it be desired that the dirt, instead of being banked on the side of the trench, shall be removed, a suitable hauling device or carrier drawn by horse or motor driven, may be moved under the delivery end of the said conveyers while the same are operating. If it be desired that the embankment shall be formed by the distribution of the material, it will be seen that of the material thus distributed one half of that removed from the trench will be evenly spread over an area equal in width to the trench and on each side thereof, forming thereby a natural dike or embankment.

The driving mechanism for operating the carriers is illustrated in the drawings in Fig. 5. The motor 90 is connected by means of a belt 118 to a driving shaft 119, upon which are fixedly mounted miter wheels 120, 120. The miter wheels 120, 120 are meshed with mated miter wheels 121, 121 which are fixedly mounted upon the lower or inner driving drums of the endless belts 111, 111. The miter wheels 120, 120 are arranged to engage the miter wheels 121, 121 from opposite sides of a common center, thereby driving the shafts connected with the said wheels 121 in opposite rotary directions.

In an accompanying application filed herewith entitled "an oyster dredging and manipulating machine" and bearing the Serial Number 534,752, I have described a method of propelling a boat, and for turning the same upon a self-contained center.

In some instances I mount the structure herein described as upon the turn-table 36, upon the hull of the said boat, directly connecting it to the said boat with the interposition of the turn-table. When, as is sometimes desired, the excavator above described is used as a dredger for establishing and maintaining a clearway in canals or rivers of comparatively small width, the same is mounted upon the hull above mentioned. In this connection it will be understood that the operation of the excavator is in all respects similar to that above described and the material raised from the bottom of the river or water-way is handled in all respects similar to that above described with reference to the dry dirt removed from the trench.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In an excavator a plow comprising a plurality of parallel colters longitudinally disposed in spaced relation; a plurality of shares disposed between said colters; an inclined delivery table adjacent to said shares; an endless conveyer belt mounted in the plow frame and having outward extensions said belt being arranged to travel up the said delivery table and in juxtaposed relation thereto; an inclined elevator embodying an endless conveyer belt mounted thereon; a driving mechanism for operating said belt on said elevator; a transmission mechanism connecting the said conveyer belt and said endless belt on said plow frame to cause the same to operate in unison; and carrying wheels mounted on said plow, certain of said wheels being arranged to track on the ground in advance of said colters.

2. In an excavator a plow comprising a plurality of parallel longitudinally extended colters disposed in spaced relation; a plurality of shares disposed between said colters; an inclined delivery table adjacent to said shares; delivery means arranged to travel over the said table to elevate the material thereon; an elevator pivotally connected to said plow and embodying an endless belt movably mounted thereon; a driving mechanism for operating said belt; a transmission mechanism connecting said belt and said delivery means to cause the same to operate in unison; and carrying wheels mounted on said plow, certain of said wheels being arranged to track on the ground in advance of said colters.

3. In an excavator a plow comprising a plurality of parallel longitudinally extended colters disposed in spaced relation; a plurality of shares disposed between said colters; an inclined delivery table adjacent to said shares; delivery means arranged to travel over the said table to elevate the material thereon; an elevator pivotally connected to said plow and embodying an endless belt movably mounted thereon; a driving mechanism for operating said belt; a transmission mechanism connecting said belt and said delivery means to cause the same to operate in unison; a carrying truck for said plow having carrying wheels, certain of which are disposed in advance of said plow to track along the earth in advance thereof; and means located on said truck for elevating the said plow thereon to vary the depth of cut of the said plow.

4. In an excavator such as described, in combination, a digging mechanism; an elevator supporting said digging mechanism and adapted to receive the dirt therefrom for delivery above the excavation; a supporting frame, having carrying wheels disposed to travel on the opposite banks of a trench; a plurality of conveyers extending laterally from the delivery point of said elevator, each of said conveyers being of a length greater than the width of the trench being cut; means for dividing the material as delivered from the elevator to the conveyers; and means for, at will, moving the said elevator and conveyers transversely across the said trench.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

NELS A. LYBECK.

Witnesses:
E. F. MURDOCK,
PHILIP D. ROLLHAUS.