No. 672,039.

Patented Apr. 16, 1901.

G. W. KING.

EXCAVATOR.

(Application filed July 19, 1897.)

(No Model.)

4 Sheets—Sheet 1.

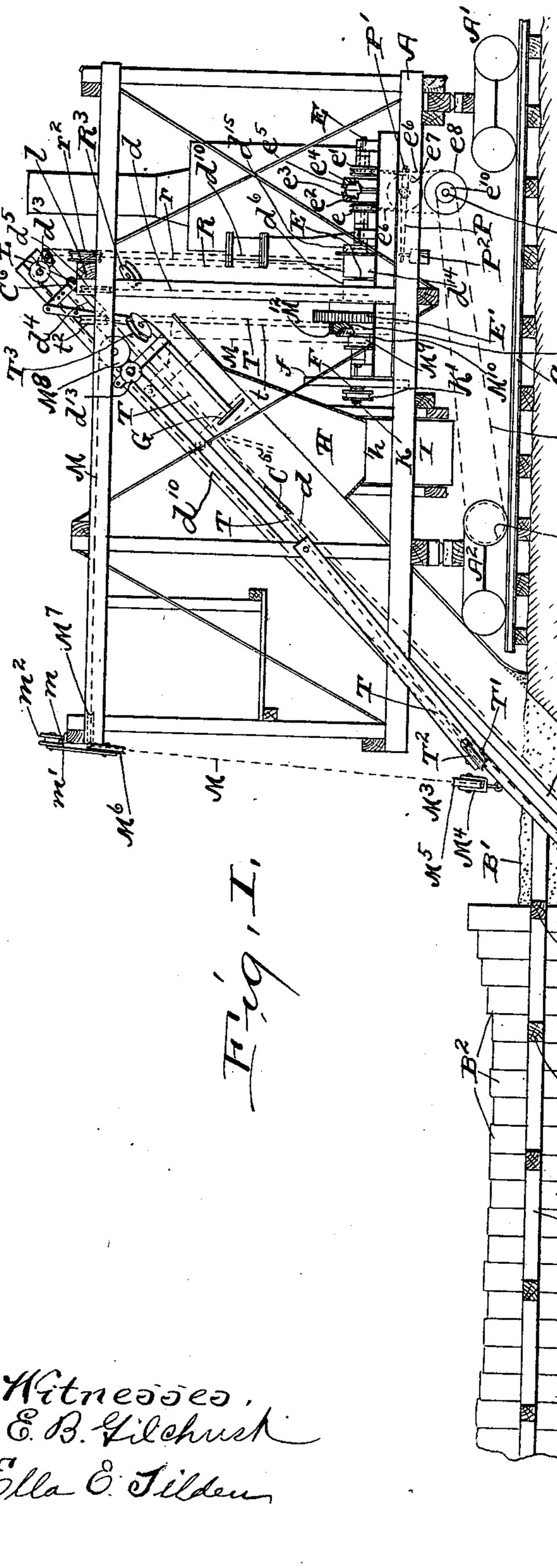

Fig. 1.

Witnesses,
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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(No Model.) 4 Sheets—Sheet 2.

Fig. II

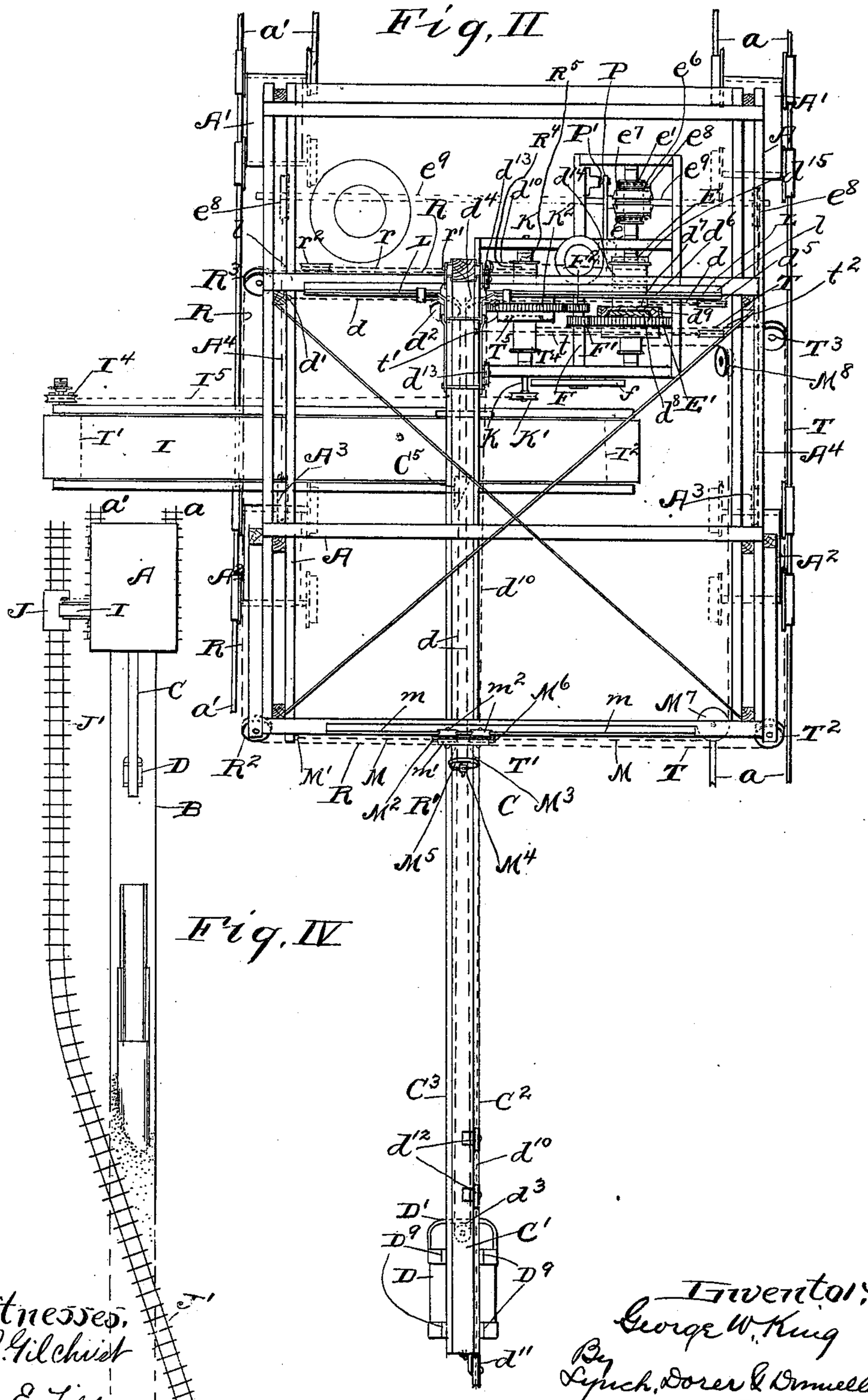

Fig. IV

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4 Sheets—Sheet 3.

Fig. III.

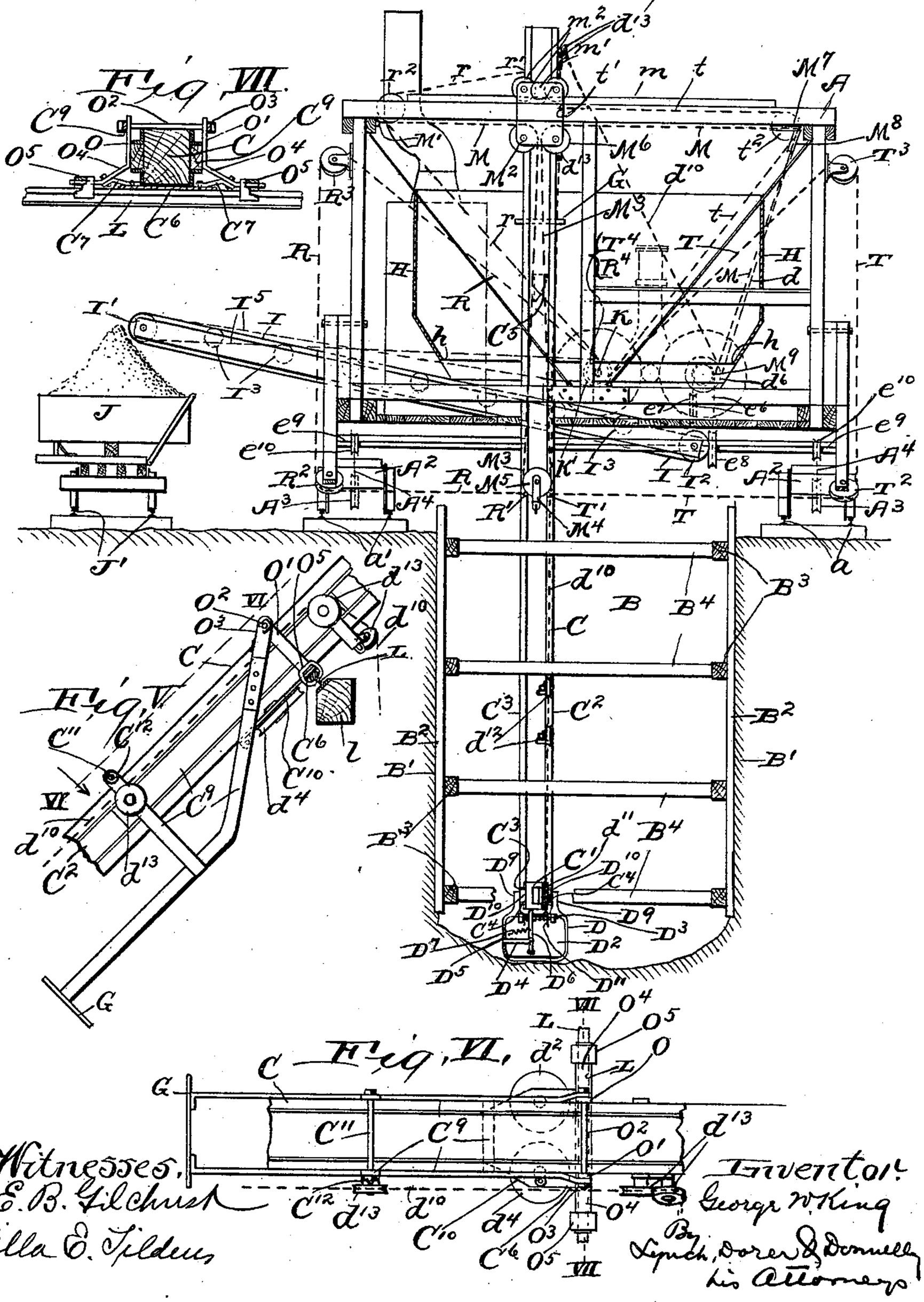

Fig. VII.

Fig. V.

Fig. VI.

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(No Model.) 4 Sheets—Sheet 4.

FIG. VIII

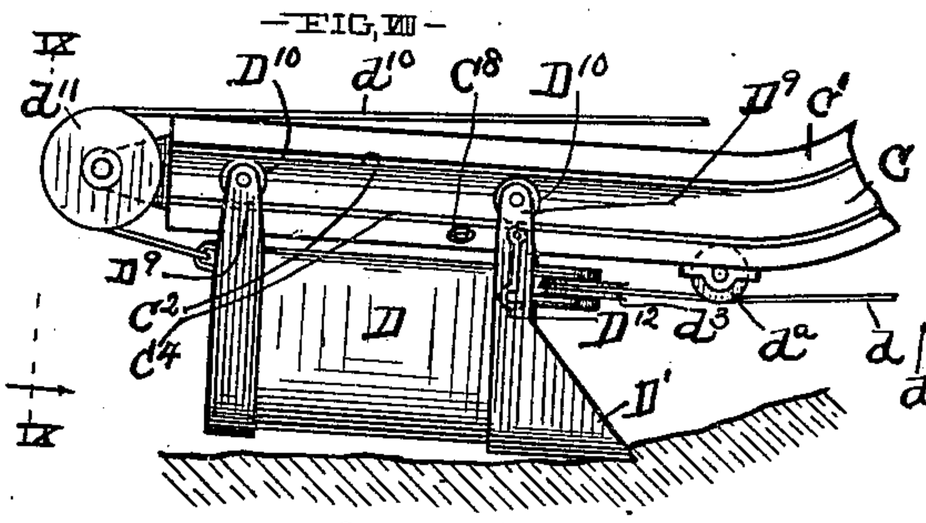


FIG. IX

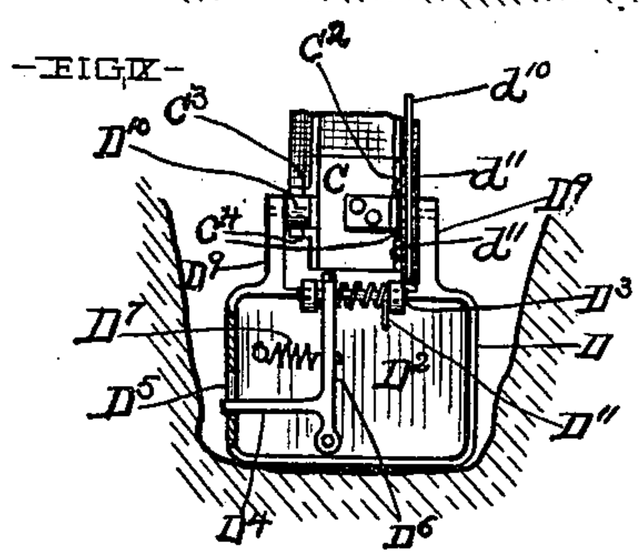


FIG. X

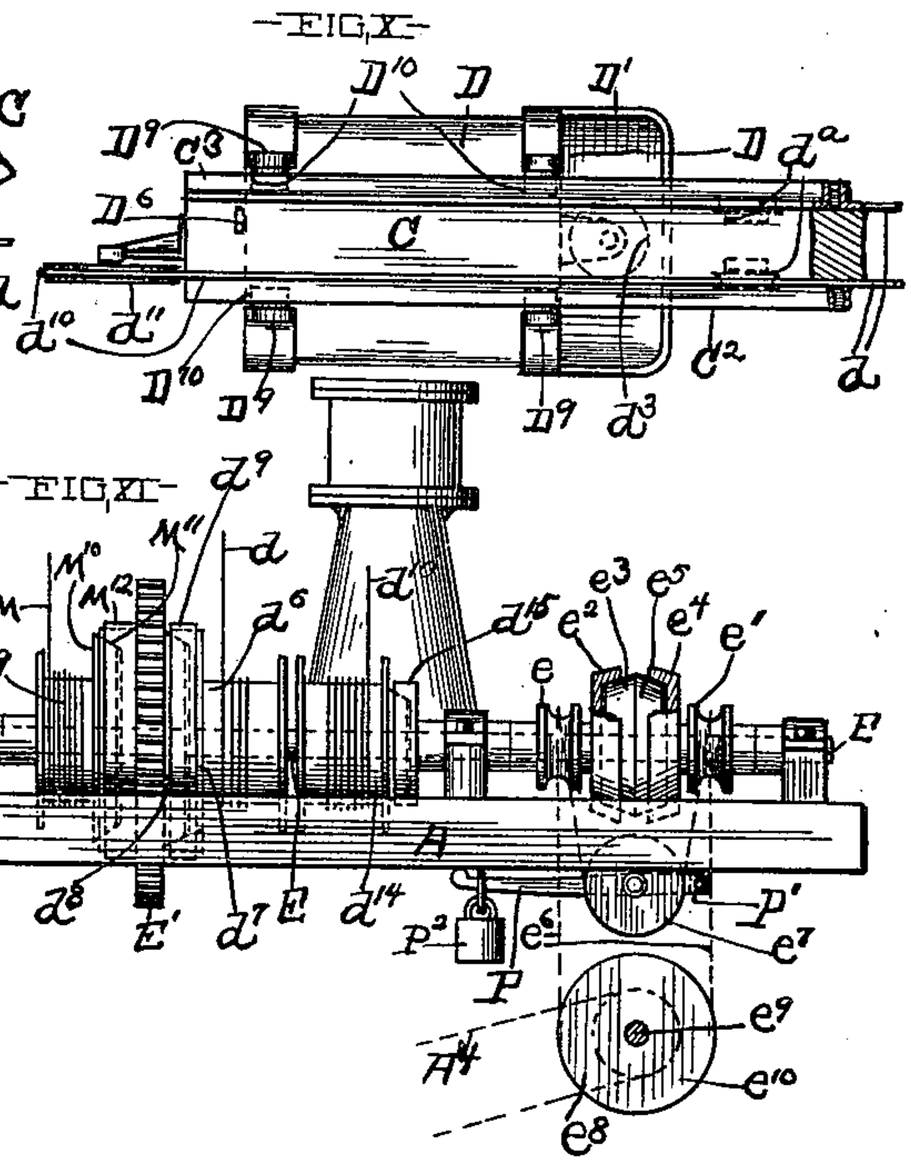
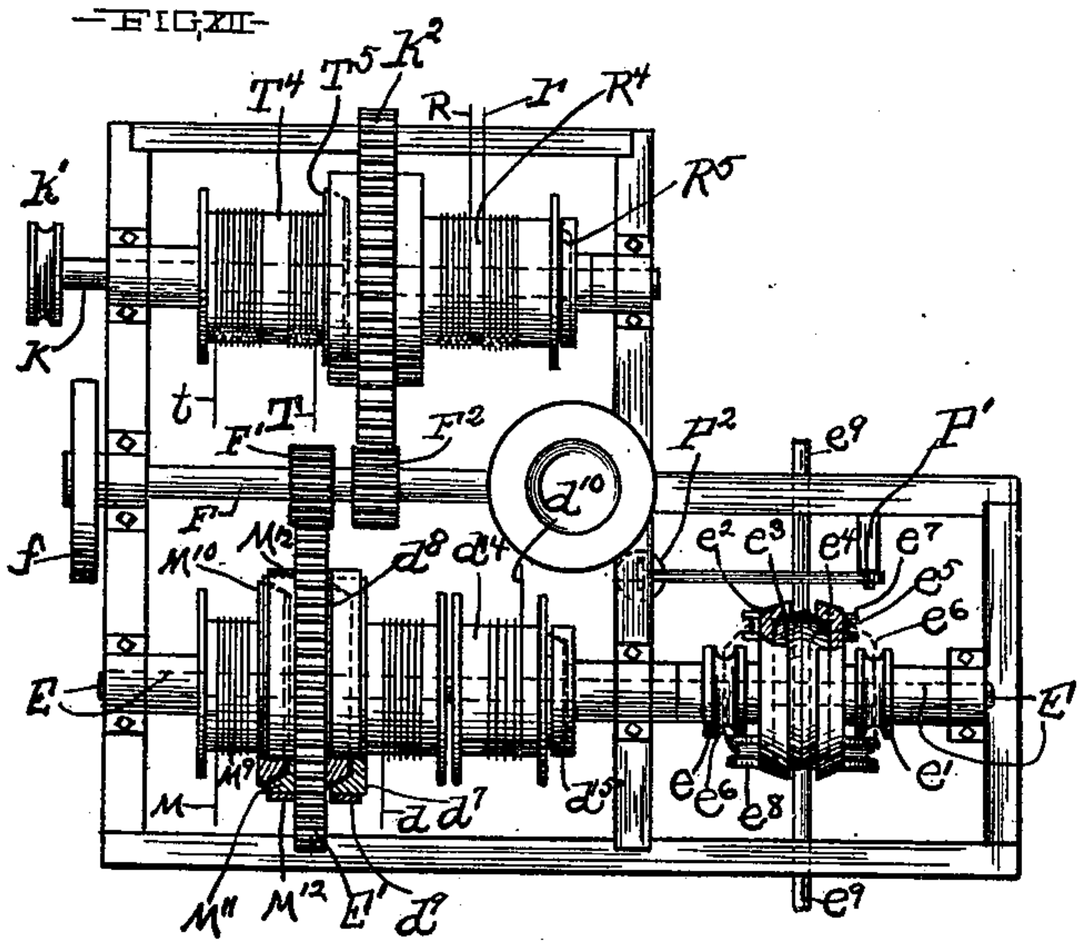


FIG. XII



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GEORGE W. KING, OF MARION, OHIO.

EXCAVATOR

SPECIFICATION forming part of Letters Patent No. 672,039, dated April 16, 1901.

Application filed July 19, 1897. Serial No. 645,018. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. KING, of Marion, Marion county, Ohio, have invented certain new and useful Improvements in Excavators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

My invention relates to improvements in excavators; and it appertains more especially to a trenching-machine designed for digging deep narrow trenches or laying subterranean sewers, water-pipes, &c. In order to dig trenches of this kind, it is almost always necessary to use upright planks or sheet-piling supported by timbers and cross-braces for preventing caving of the banks. Up to the present time an excavator that would work successfully where sheet-piling and cross-bracing are necessary has not been made. Excavations of the character indicated have heretofore always been made by hand and were consequently quite expensive.

The primary object of my present invention is therefore to construct a machine that will not occupy much space in the trench at the head of the ditch, that will not interfere with the employment of cross-braces or supports for the sheet-piling very close to the place where the excavating is being done, and that will accommodate the location of all timbers and planks necessary to effectually prevent caving in of the banks.

With this object in view, and to the end of realizing other advantages hereinafter specified, my invention consists in certain features of construction and combinations of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure I is a side elevation, partly in section, of an excavator embodying my invention. In this figure the trench that is being made by the machine is shown in central longitudinal section. Fig. II is a top plan, partly in section, of portions of the machine. Fig. III is a front end view of the machine, partly in section, and this figure shows also a sectional end view of the trench made by the machine, and shows also a track laid along the outer side of one of the tracks upon which the machine is mounted, and a car upon said first-mentioned track for receiving the earth or material excavated and for conveying the latter to the place at which the trench is being refilled. Fig. IV, that appears on sheet containing Fig. II, is a small plan view showing the trench made by the excavator, a sewer that is building in said trench, the excavating-machine at the head of the trench, the two tracks upon which the machine is mounted and that are arranged at opposite sides, respectively, of the trench-line, the refilling of the trench's portion wherein the construction of the sewer has been completed, the track laid alongside one of the tracks upon which the excavator is mounted and leading to and extending across the refilled portion of the trench adjacent to where the construction of the sewer is still in progress, and a car upon the track that leads to the refilled portion of the trench and designed to receive the material that is excavated and transfer the same to the point at which refilling of the trench is being done. Fig. V is a side elevation of the plunger employed in forcing the excavating-shovel's contents out of the shovel, and shows also the lateral adjustability and the rocking capability of the shovel-guiding beam. Fig. VI is a view on line VI VI, Fig. V, looking in the direction of the arrow. Fig. VII is an end view in detail, partly in transverse section, on line VII VII, Fig. VI. Fig. VIII is a side elevation of the lower portion of a shovel-guiding beam C, shovel D, and connected cables d and d^{10}, and shows the shovel unlocked from the beam and ready to operate upon the bottom of a trench being made. Fig. IX is an elevation on line IX IX, Fig. VIII, looking in the direction indicated by the arrow. Fig. X is a top plan of the shovel and portion of the shovel-guiding beam illustrated in Fig. VIII. Fig. XI is a side elevation, partly in section, showing a considerable portion of the operating machinery of the excavator. Fig. XII is a top plan relative to Fig. XI, partly in section.

Referring to the drawings, A designates the body portion of the machine. Car-body A at its rear end is mounted upon two wheeled trucks A′ A′, arranged longitudinally of the car and under opposite sides, respectively, of the car-body. The car-body a suitable dis-

tance from its forward end and forward of its central portion is mounted upon two other wheeled trucks A^2 A^2, arranged longitudinally of the car and under opposite sides, respectively, of the car. The wheels of the trucks under one side of the car engage a track *a*, arranged parallel with and at one side of the line of the trench that is to be made by the machine. The wheels of the trucks under the opposite side of the car engage a track *a'*, laid at the opposite side of and parallel with the line of the trench that is to be made—that is, the excavator is mounted upon two parallel tracks arranged at opposite sides, respectively, of and parallel with the line of the trench or ditch being made.

In Figs. I and III of the drawings B designates the trench that is being cut; B', the side walls or banks of the trench; B^2, upright planks or sheet-piling placed against said walls or banks, and B^3 timbers placed against said planks or piling within the cut and extending horizontally across the planks or piling. B^4 represents cross-braces that extend transversely of the trench and that engage at one end a timber B^3 on the one side and engage at the opposite end a timber B^3 on the opposite side, and consequently said cross-pieces brace apart the two sets of piling.

The upright planks or sheet-piling B^2, the longitudinally-arranged timbers B^3, and the cross-pieces B^4 are employed for the purpose of preventing the earthen walls or banks of the cut from caving in. As already indicated, an excavator in order to render its use desirable and successful in digging deep narrow trenches should occupy as little room as possible in the head of the trench being made, so as not to interfere with the placing of the required number of cross-pieces that are employed in supporting the planks or sheet-piling with which the side walls or banks of the trench are lined during the process of excavation close to the head of the trench, so that no portion of the bank is unsupported. The head of the trench is worked, preferably, on a slope, as shown in Fig. I, for the purpose of preventing caving from the end. In the drawings, therefore, the head end wall B^5 of the trench slopes downwardly and inwardly from the excavator's body portion, that is placed just beyond or forward of the trench, and the tracks upon which the machine is mounted lead from said end of the trench in the direction in which the building of the trench is to be continued. The excavator's portion that extends into the trench comprises a long beam C, that is arranged, preferably, parallel or approximately parallel with the aforesaid sloping end wall of the trench and is curved or deflected inwardly at its lower end, as at C'. Said beam is long enough to enable it to reach, as will hereinafter more fully appear, from near the bottom of the trench upwardly a suitable distance above the top of the trench. A shovel D is arranged to move along the under or rear side of beam C. Shovel D has its body portion arranged longitudinally of the under side of beam C and excavates in the direction of car A. Said shovel at its open or digging end is provided with a cutter or scraper D', capable of cutting into and scraping up the earth. The shovel at its rear or discharging end is provided with a door or gate D^2, that is hinged at the top, at D^3, to the shovel's body portion and is held closed, if gravity is not sufficient, by any well-known mechanical device—such, for instance, as a latch D^4, (see Fig. III,) that is arranged transversely of the outer side of said gate and in its locking position engages a mortise D^5 in the shovel's body portion. Latch D^4 is operatively connected with one end of a swinging lever D^6, that is fulcrumed to gate D^2 and has its opposite end projecting into the space between the top of the shovel and the under and rear side of beam C and is automatically actuated in suitable proximity to and in advance of the place at which its contents are discharged, as will hereinafter appear, in the direction required to render the latch inoperative and against the action of a suitably-applied spring D^7, that acts to retain the latch in its operative position. Each end of the shovel is provided with two arms D^9 D^9, overlapping opposite sides, respectively, of the shovel-guiding beam C, and the upper end of each arm D^9, upon its inner side, is provided with a roller D^{10}. The rollers of the arms at one side of the shovel engage a groove or way C^2, formed in and extending longitudinally of one side of beam C, and the rollers D^{10} of the arms of the other side of the shovel engage a groove or way C^3, formed in and extending longitudinally of the opposite side of beam C—that is, beam C is provided with two ways C^2 and C^3, formed in opposite sides, respectively, of and extending longitudinally of the beam, and the shovel is suitably suspended from rollers or wheels that engage said ways.

Apparatus for propelling shovel D along the beam is provided and comprises, preferably, a cable *d*, (see Figs. I and II,) that is attached at one end at *d'* (see Fig. II) to the upper portion of the body portion of the machine, at the latter's left-hand side. From point *d'* cable *d* leads to the right to and over a guide-sheave d^2, supported from the upper end of beam C. Thence cable *d* leads downwardly along the under side of said beam to and over a sheave d^3, supported from the upper portion of the shovel's forward end. Thence cable *d* returns along the under side of beam C, upwardly to and over a sheave d^4, supported from the upper end of beam C. From sheave d^4 cable *d* leads to and over a vertically-arranged sheave d^5, supported from the upper portion of car A, and thence said cable leads to and in under and operatively engages a winding-drum d^6, that in the case illustrated is loosely and slidably mounted upon a shaft E, that is suitably supported from and arranged horizontally and longitudinally of the

car. A gear E′ is fixed upon shaft E and meshes with a pinion F′, (see Fig. II,) fixed upon the driving-shaft F, that is provided with a driving-wheel *f*, to which power is applied in any approved manner. Shaft F is arranged parallel with and at one side of shaft E and is supported from car A. A clutch, (see Fig. II,) preferably a friction-clutch, is employed for controlling operative connection between drum d^6 and shaft E. One member d^7 of the clutch is rigid with the drum, and consequently slidable upon the shaft, and the companion clutch member d^8 is rigid with gear E′, and consequently fixed upon the shaft. The establishment of operative engagement between the clutch members results in an operative connection of the drum with the shaft, and when the drum is operatively connected with the shaft cable *d* is wound thereon and shovel D is hoisted or propelled in the direction required to excavate. A brake-band or brake d^9 (see Fig. II) is provided in any approved manner for drum d^6 and is instrumental in holding said drum stationary when the drum is not operatively connected with the shaft or in retarding the drum's movement, and consequently the excavating-stroke of the bucket can be arrested or retarded, if desired. If the shovel-guiding beam is arranged uprightly, as in the case illustrated, the weight of the shovel is sufficient to effect by gravity the bucket's return movement; but the return movement of the shovel can be effected positively by a suitably-operated and suitably-guided cable d^{10}, operatively connected with the shovel. For instance, in the case illustrated the cable d^{10} (see Figs. I, II, and III) is attached to the upper portion of the rear or closed end of the shovel, thence leads to and over a guide-sheave d^{11}, that is suitably supported from the lower end of beam C, and thence leads to and over any suitable number of suitably-arranged and suitably-supported guide-sheaves d^{12} and d^{13} to a suitably-supported winding-drum d^{14} on the machine's body portion. Hence by actuating this drum in the direction required to wind up the engaging cable the idle or return movement of the shovel is positively effected. Said drum d^{14} is upon shaft E, next to drum d^6, and d^{15} designates a clutch for controlling operative connection between drum d^{14} and the shaft, (see Figs. I and II,) which clutch is of any approved construction.

I would remark that beam C at the bend in its lower end is provided with any suitable number of sheaves *d a* for guiding the shovel-actuating cable *d* around the bend.

The shovel, of course, preparatory to its excavating-stroke is in position at the lower end of beam C and upon the bottom of the trench and has the cutter or scraper at its forward end slightly embedded in the earth, as shown in Fig. I—that is, the shovel, when it is lowered into its lowermost position, at the forward extremity of its excavating-stroke has its rear end automatically raised slightly, so as to cause the cutter or scraper to be placed in an operative position. The means for effecting the downward tilt of the scraper or cutter consists, preferably, of the inclines C^4, (see Figs. I and III,) that are formed upon the lower inwardly-deflected end of beam C and form an outward extension of the lower or rear walls of the grooves or ways C^2 C^3 of said beam, and consequently are engaged by rollers or wheels D^{10} of the shovel, and thereby tilt the shovel, as indicated, when the shovel is lowered into the lower extremity of its path.

A plunger G (see Figs. I, V, and VI) is supported from the upper end of beam C. Said plunger is arranged at the lower side of the beam and in the path of the excavating-shovel and is sufficiently smaller in dimensions than the transverse area of the shovel's interior to enable it to enter the shovel and to accommodate the pulling of the bucket forwardly over the plunger, and thereby force the shovel's contents out of the rear end of the bucket. The gate or door at the shovel's rear end is swung open in any approved manner immediately preparatory to the pulling of the shovel over the plunger and against the action of a spring D^{11}, (see Fig. III,) that is suitably applied to the said gate's hinged end and acts in the direction required to retain said gate in its closed position. In dotted lines, Fig. I, the shovel is shown at the upper or forward extremity of its excavating-stroke pulled over the aforesaid plunger and having its hinged gate open. The unlatching of said gate is automatically effected by incline or guide C^5, that is attached to or formed upon beam C and has the arrangement and trend required to be engaged by the free end of lever D^6 of the latch mechanism just before the shovel arrives at the discharging extremity of its excavating-stroke preparatory to the operation of plunger G, and thereby result in withdrawing the latch from the mortise in the shovel's body portion and rendering the latch inoperative and accommodating the discharge of the shovel's contents by said plunger.

A hopper H (see Figs. I and III) is arranged below plunger G, below the path of the shovel, and in the position required to receive the earth or material discharged from the shovel by said plunger. Hopper H at its lower end is provided with an opening or outlet *h*, arranged to discharge upon a suitably-actuated and suitably-supported endless belt or apron I. Belt I is arranged transversely of the machine, as shown in Figs. II and III, and extends upwardly beyond one side of the body portion of the machine. Said belt leads over two suitably-supported rollers I′ I^2, arranged at opposite ends, respectively, of the belt, and leads also over any suitable number of suitably-supported intermediate and guiding rollers I^3. Said belt is actuated in the direction required to feed the material outwardly, and its outer or discharging end is arranged to

overhang a car J upon a track J′, by which car the material received thereby from the belt is conveyed to the place at which the trench is being refilled. The material received by belt I from hopper H is therefore, it will be observed, conducted off and deposited in car J. One of the end rollers of conveyer I—roller I′ in the case illustrated—is positively driven in the direction required to move the belt in the required direction, and to this end a chain-pulley I^4 (see Fig. II) is operatively connected with one end of said roller and is operatively connected, by means of a chain I^5, with a chain-pulley K′, that is operatively mounted upon a shaft K, arranged horizontally and longitudinally of the machine's body portion at one side of and parallel with shaft F. A spur-gear K^2 is fixed upon shaft K and meshes with a pinion F^2, operatively mounted upon the driving-shaft F.

Beam C is adjustable laterally to accommodate the excavation of the bucket of the entire width of the trench, and to this end the beam, at or near its upper end and under side, is provided with a slide C^6, (see Figs. V and VII,) arranged to slide upon a rail or slideway L, that is arranged horizontally and transversely of the upper portion of a car A and is supported, preferably, from a beam *l*, (see Figs. I, II, and V,) arranged horizontally and transversely of and suitably secured to the top of the car. The apparatus employed for effecting the lateral movements or lateral adjustments of beam C comprises, preferably, two cables R *r*, instrumental in moving the beam sidewise in one direction, and two cables T *t*, used in moving said beam in the opposite direction. Cable R (see Figs. II and III) is fastened to one side of the beam, as at R′, thence leads in an approximately horizontal plane to and over a sheave R^2, supported from the forward end of the said side of the lower portion of the framework of car A, thence leads rearwardly and upwardly to and over a sheave R^3, supported from the upper portion of said framework, and thence leads downwardly and inwardly to and operatively engages a winding-drum R^4, that is loosely and slidably mounted upon shaft K. Cable *r* (see Figs. II and III) is fastened at *r′* to the same side of and at the upper end of beam C, thence leads leftwardly to and over a vertically-arranged sheave r^2, supported from the top of the said side of the framework of car A, and thence leads downwardly and inwardly to and operatively engages the aforesaid winding-drum R^4. When cables R and *r* are wound upon the drum, cable *r* pulls laterally in the one direction upon the upper end of the beam and cable R pulls in the same direction upon the central portion of the beam, and hence a pull in that direction is exerted upon said beam at two points located a suitable distance apart and the beam and any load carried by the latter is easily shifted in the direction indicated. Any suitable clutch R^5 for establishing operative connection between said drum and the shaft is provided. (See Fig. II.)

Cable T (see Figs. II and III) is fastened at T′ to the opposite side and at or near the central portion of beam C′ and preferably directly opposite the point at which cable R is attached to said beam. Cable T leads outwardly from point T′ in a direction opposite to the direction taken by cables R *r* from the beam in an approximately horizontal plane to and over a sheave T^2, supported from the forward end of the lower portion of the framework of car A, thence leads rearwardly and upwardly to and over a sheave T^3, supported from the upper portion of the said framework, and thence leads downwardly and inwardly to and operatively engages a winding-drum T^4, that is loosely and slidably mounted upon shaft K. Cable *t* is fastened to the same side of and at the beam's upper end at *t′*, thence leads parallel with cable T to and over a vertically-arranged sheave t^2, supported from the upper portion of the framework of car A, and thence leads downwardly and inwardly to and operatively engages winding-drum T^4. The said cables T and *t*, when they are wound upon drum T^4, exert a pull upon the beam a suitable distance apart and in a direction opposite to the direction of the pull exerted by cables R *r*. Any suitable friction-clutch T^5 (see Fig. II) for controlling operative connection between drum T^4 and the shaft that supports said drum is provided.

Of course drum R^4 is rendered free to pay out the cables engaging said drum R^4 when cables T and *t* are wound upon drum T^4 and the latter is rendered free to pay out cables T and *t* when cables R and *r* are wound upon drum R^4.

To prevent the shovel from being struck between beam C and the head end wall of the trench during the lowering of the shovel after the latter's excavating stroke, or, in other words, to enable the shovel after an excavating stroke to return unobstructedly to the bottom of the trench, I provide apparatus for hoisting beam C away from said trench-wall, and this hoisting apparatus comprises, preferably, a cable M, (see Figs. II and III,) fastened at one end at M′ to the upper portion of one side of the forward end of the framework of car A. From point M′ said cable leads to and over a vertically-arranged sheave M^2 of a carriage *m′*, that has wheels m^2, mounted upon and arranged to travel endwise of a track *m*, that is arranged horizontally and transversely of and suitably supported from the upper portion of the framework of the forward end of car A. Cable M at carriage *m′* is provided with a fall and tackle M^3, and the sheave-block M^4 of this tackle is attached to the upper side of the central portion of beam C. Cable M leads from the sheave M^5 of said tackle upwardly to and over a sheave M^6, carried by carriage *m′*, and thence leads to and over a horizontally-arranged sheave M^7, that

is suitably supported from the upper portion of the framework of the forward end of car A, and thence said cable leads rearwardly in an approximately horizontal plane to and over an upright sheave M^8, that is suitably supported from the upper portion of the framework of car A at or near the latter's central portion, and thence cable M leads downwardly and inwardly to and operatively engages a winding-drum M^9, that is loosely and slidably mounted upon shaft E. A friction-clutch is provided for controlling operative connection between the said drum M^9 and shaft E. One member M^{10} (see Fig. I) of said clutch is rigid with the drum, and consequently slidable upon the shaft, and the companion clutch member M^{11} is formed upon gear E', and consequently fixed to the shaft. Beam C is hoisted or lowered according as cable M is wound upon or paid out by drum M^9, and the operation of the latter is effected or interrupted according as the two clutch members M^{10} and M^{11} are caused to operatively engage or disengage each other. A brake-band or brake M^{12} (see Fig. I) is provided for drum M^9 in any approved manner and is instrumental in holding beam C at any desired elevation or position relative to the head end wall of the trench. The application and operation of brakes are so well understood that a more extended description or illustration of this brake is not considered necessary. Said brake is also instrumental in retarding the movement of beam C when the latter is moved from and toward the head end wall of the trench. Referring again to the operation of hoisting-cable M, it will be observed that upon actuating drum M^9 in the direction required to wind up said cable the fall of the cable at carriage m' is shortened and beam C is hoisted away from the head end wall of the trench as required in order to enable the shovel to unobstructively lower or return after the shovel has discharged its contents. Slide C^6 of beam C is capable of oscillating or rocking upon its bearing L in a rearwardly and forwardly direction, and member L serves, therefore, as a fulcrum upon which beam C turns in hoisting and lowering the beam from and toward the head end wall of the trench. Beam C is also adjustable endwise or longitudinally and transversely of slide C^6 to accommodate the excavation of trenches having different depths, and means for holding the beam downwardly upon the slide and clamping it in the desired longitudinal adjustment is provided and comprises, preferably, two plates or bars O O', (see Figs. V, VI, and VII,) arranged to bear against opposite sides, respectively, of beam C and supported from the aforesaid slide. The clamping members O and O' are secured in their operative position by a bolt and nut O^2 and O^3. The bolt extends transversely of and engages the upper side of the beam and prevents displacement of the beam upwardly from slide C^6. The bolt's head is arranged to bear against the outer side of one of the clamping members, and the nut upon the screw-threaded shank of the bolt is arranged to bear against the outer side of the companion clamping member. By tightening this nut the clamping members are firmly secured in their operative position, and by loosening said nut said clamping members release their grip upon the beam, and thereby accommodate the endwise or longitudinal adjustment of the beam. The beam's slide C^6, that has a bearing, as already indicated, at the top of car A, consists, preferably, of a plate interposed between said beam and the rail or slideway L. Said slide at each end is provided with an arm or bracket C^7, (see Fig. VII,) to which the adjacent clamping member of the clamping device is suitably secured. In fact, each of said clamping members at its lower end is provided with a downwardly, laterally, and outwardly extending leg O^4, that is suitably secured to an arm C^7 of said slide and at its outer end is held in connection with the rail or slideway C^6 by a clip O^5, that extends over said end and in under the head of rail C^6 and is slidable along the rail and is capable of rocking or oscillating upon the rail with slide C^6 during the movements of beam C from and toward the shovel's path.

The bucket is locked to the track-forming shovel-guiding beam preparatory to a change in the endwise adjustment of the beam, and to this end the shovel (see Fig. I) is provided with a hook D^{12}, arranged to be capable in the shovel's lowermost position of engaging an eye C^8, fixed to the beam. Beam C when it is locked to the shovel, as just indicated, can be adjusted endwise in an upward direction by winding up the shovel-hoisting cable D and is lowered or adjusted endwise in a downward or opposite direction by gravity or by cable d^{10}. Of course nut O^3 is loosened to render the clamping device that is instrumental in securing the beam in the desired longitudinal adjustment preparatory to a change in said adjustment and is again secured in the desired adjustment by tightening said nut, after which the beam is unlocked from the shovel and the latter is ready for excavating.

I would here remark that plunger G and sheaves d^2, d^4, and d^{13} are not directly supported from beam C and that the position of the said members is not changed during the endwise adjustment of the beam. Said members G, d^2, d^4, and d^{13} are therefore attached to a framework C^9, (see Figs. V, VI, and VII,) that is of any suitable construction, and clamped to the beam by bolts C^{11} and O^2 and nuts C^{12} and O^3, and by loosening said nuts, and thereby loosening the said framework upon the beam, the latter can be adjusted endwise without moving the aforesaid members G, d^2, d^4, and d^{13} with it. It will also be observed that slide C^6 is extended forwardly, as at C^{10}, and is rigid with and constitutes a member of said framework.

Apparatus for propelling the machine upon

tracks a a' is provided and comprises, preferably, two chain-pulleys e e', loosely and slidably mounted upon shaft E (see Figs. I and II) a suitable distance apart, and two friction-clutches are interposed between said pulleys for controlling operative connection between the pulleys and the shaft. e^2 and e^3 (see Fig. I) designate the members of the clutch for pulley e, and e^4 e^5 represent the members that compose the clutch for pulley e'. Members e^3 and e^5 of the two clutches are fixed to the shaft centrally between the pulleys. Clutch member e^2 is carried by pulley e and is consequently slidable upon the shaft. Clutch member e^4 is borne by pulley e' and is slidable with said pulley e'. Operative connection between the shaft and either one of the pulleys is established or interrupted according as the members of the clutch for said pulley are caused to operatively engage or disengage each other. An endless chain e^6 leads over both of said pulleys, leads downwardly at one side of said pulleys to and in under a tightening-sheave e^7, and leads downwardly at the opposite side of said pulleys to and in under a chain-pulley e^8, that is operatively mounted upon a shaft e^9, arranged below and transversely of and supported from the rear portion of car A. Each forward truck of the machine has the axle that connects the rear wheels of said truck operatively provided with a chain-pulley A^3, that is operatively connected, by means of an endless chain A^4, with a pulley e^9. It is obvious, of course, that the machine is backed up the distance required to accommodate the advancing work, and it will also be observed that the machine is propelled in the one direction or the other according as pulley e or pulley e' is operatively connected with shaft E and that the machine will not be propelled at all when operative connection between both of said pulleys and the shaft is interrupted. Any slack in chain e^6 is taken up by the tightening-sheave e^7, that is carried by and at or near the rear end of a lever P, (see Figs. I and II,) that is arranged longitudinally of the machine and is fulcrumed at its rear end at P' to any stationary member of the machine and has its forward end provided with a weight P^2, (see Fig. I,) that acts to depress the lever and attached sheave, and thereby avoids the formation of slack in the chain.

What I claim is—

1. An excavator provided with the following: a downwardly and outwardly sloping beam provided with two channels or ways formed at opposite sides, respectively, of the beam and longitudinally of the latter; the excavating-shovel held to and movable endwise of said track, and arranged to excavate in the direction of the body portion; apparatus for actuating the shovel along the said ways, and the inclines or guides C^4 forming an extension of the lower ends of the said ways, substantially as and for the purpose set forth.

2. In an excavator, a track arranged to be moved alongside of and in suitable proximity to the surface that is to be excavated; the excavating-shovel held to and movable longitudinally of said track, said shovel having its forward or digging end open and having a gate or door for closing its opposite end, apparatus for actuating the shovel along the track, and a device arranged in the shovel's path in position to engage and force the shovel's contents out of the shovel, substantially as set forth.

3. In an excavator, a track arranged alongside of and the distance, from the surface that is to be excavated, necessary to accommodate the operation of an excavating-shovel upon said surface between the latter and the track; the excavating-shovel arranged longitudinally of the track and arranged to engage and excavate the aforesaid surface, said shovel having its forward or digging end open, and having a gate or door for closing its opposite or discharging end; a plunger arranged at the point, at which the shovel discharges, in position to force the shovel's contents out of the shovel, and apparatus for actuating the shovel along the track, substantially as and for the purpose set forth.

4. The combination of the excavator's body portion; the shovel-guiding track extending upwardly and downwardly below the bottom of said body portion; the excavating-shovel held to and movable endwise of said track, said shovel being arranged longitudinally of the track and arranged, furthermore, to excavate in an upward direction, and provided at its rear or discharging end with a gate or door; a plunger arranged in the path of the shovel above the body portion's bottom and having the dimensions required to accommodate the pulling of the shovel over it, and apparatus for hoisting the shovel along the aforesaid track and pulling the shovel over the aforesaid plunger, substantially as and for the purpose set forth.

5. The combination of the excavator's body portion, an inclined shovel-guiding track supported from and extending below said body portion, and deflected or curved outwardly at its lower end; the excavating-shovel held in connection with and movable endwise of said track, said shovel being arranged to excavate in the direction of the body portion, a suitably-actuated cable for hoisting the shovel, and the cable-engaging guide-sheaves for guiding the cable around the aforesaid curve, substantially as set forth.

6. The combination with the excavator's body portion, an inclined shovel-guiding beam supported from and extending below said body portion, the excavating-shovel held in connection with and movable endwise of said beam, and said shovel being arranged to excavate in the direction of the body portion; of the cable d fixed to the body portion at one side of the beam; the two guide-sheaves d^2 and d^4 supported from the beam, the sheave d^3 carried by the shovel, the winding-drum op-

eratively engaging the said cable, and the latter leading from its fixed end to and over one of the beam-sheaves, thence to and over the shovel-sheave, and thence guided to the winding-drum, substantially as shown, for the purpose specified.

7. The combination of the excavator's body portion; the track-forming shovel-guiding beam extending above and below the lower part of said body portion; means for supporting said beam at or near the latter's central portion; a bearing or support for the upper end of the beam, and the suitably-propelled excavating-shovel held in connection with and movable endwise of said beam, and arranged to excavate in an upward direction, substantially as set forth.

8. The combination of the excavator's body portion, the shovel-guiding track extending above and below the lower part of said body portion; a suitably-supported cable connected with said track's central portion and instrumental in the suspension of the track; a bearing or support for the upper end of the track, and the suitably-propelled excavating-shovel held in connection with and movable endwise of the track, and arranged to excavate in an upward direction, substantially as set forth.

9. In an excavator, the combination with the body portion an inclined shovel-guiding beam arranged to be moved alongside of a wall of the cut made by the machine, and a bearing upon which the said beam can swing toward and from the said wall; of a track *m*, a carriage *m'* supported from and movable endwise of said track and provided with two guide-sheaves, a sheave attached to the beam, a winding-drum, a cable fixed at one end and thence leading to and over one of the carriage-sheaves, thence to and in under the beam-sheave, thence to and over the other carriage-sheave, and thence to the drum, substantially as and for the purpose set forth.

10. In an excavator, the combination of an endwise-shiftable shovel-guiding track, the excavating-shovel held in connection with and movable endwise of the track, means for propelling the shovel, and means for locking the track to the shovel, substantially as and for the purpose set forth.

11. The combination of the excavator's body portion; a shovel-guiding track extending above and below the lower part of said body portion; the suitably-propelled excavating-shovel held in connection with and movable endwise of said track, said shovel being arranged to excavate in an upward direction and provided with a gate or door at its rear or discharging end, and a plunger supported from the upper portion of said track and detachably or adjustably secured to the track, said plunger being arranged in the shovel's path and having the dimensions required to enable the shovel to be pulled endwise over it, substantially as and for the purpose set forth.

12. The combination of the excavator's body portion, a rail or slideway arranged transversely of the upper part of said body portion, a laterally-adjustable inclined beam provided at or near its upper end with a slide that engages and is movable endwise of said slideway, means for supporting said beam a suitable distance below and forward of said slideway, apparatus for moving the beam laterally, the excavating-shovel held in connection with and movable endwise of the under side of said beam and arranged to excavate in the direction of the body portion, and apparatus for actuating the shovel along the beam, substantially as and for the purpose set forth.

13. The combination with the excavator's body portion provided with an inclined track-forming and shovel-guiding beam that is provided, at or near its upper end, with a slide; a slideway for said slide, said slideway being arranged transversely of the upper portion of said body portion, and means for supporting the beam a suitable distance below said slideway: of two suitably-operated cables operatively connected with said beam a suitable distance apart, and arranged to move said beam laterally in the one direction, and two suitably-operated and suitably-guided cables operatively connected with the beam and arranged to move the beam laterally in the opposite direction, substantially as and for the purpose set forth.

14. The combination with the excavator's body portion and the laterally-adjustable shovel-guiding track; of a suitably-operated winding-drum, two cables arranged to be wound upon said drum simultaneously, said cables leading from the drum to and being operatively connected with the aforesaid track a suitable distance apart, sheaves for guiding said cable, another suitably-operated winding-drum, two cables arranged to be simultaneously wound upon said last-mentioned drum and leading from the said drum to and being operatively connected with the track a suitable distance apart, sheaves for guiding said last-mentioned cables, and the arrangement of parts being such that one of said drums and the engaging cables are instrumental in shifting the track laterally in the one direction, and the other drum and engaging cables are instrumental in shifting the track in the opposite direction, substantially as and for the purpose set forth.

15. The combination with the excavator's body portion, and the shovel-guiding beam suitably supported from said body portion and adjustable endwise; of a clamping device that is stationary relative to the beam's endwise adjustability and comprises two clamping members arranged to bear against opposite sides, respectively, of said beam, and means for securing said clamping members in their operative position, substantially as and for the purpose set forth.

16. The combination with the excavator's

body portion, and a longitudinally-adjustable shovel-guiding beam suitably supported from said body portion; of a clamping device that is stationary relative to said adjustability of the beam, and comprises two suitably-supported members arranged to bear upon opposite sides, respectively, of the beam, and a bolt and a nut for rendering said clamping members operative, substantially as and for the purpose set forth.

17. In an excavator, the combination with the body portion and the two trucks under opposite sides, respectively, of the said portion: of pulleys A^3 operatively connected with wheels of the said trucks; a reversible shaft C^9 supported from the rear part of the body portion; pulleys e^8 operatively mounted upon the said shaft; cables operatively connecting the said shaft-pulleys with the aforesaid truck-pulleys; a suitably-driven shaft arranged above and transversely of the reversible shaft; two pulleys loose upon the last-mentioned shaft; a clutch for each of said last-mentioned pulleys for controlling operative connection with the pulley and the shaft; the weighted tilting lever P; a sheave attached to the said lever between the lever's fulcrum and the lever's weight; the pulley e^8 operatively mounted upon the reversible shaft, and the endless cable e^6 leading in under the last-mentioned pulley and in under the lever's sheave and over both of the aforesaid loose pulleys, substantially as shown, for the purpose specified.

In testimony whereof I sign this specification, in the presence of two witnesses, this 24th day of April, 1897.

GEORGE W. KING.

Witnesses:
W. R. WADDELL,
C. H. DORER.