

978,908.

W. J. LEARY.  
EXCAVATING APPARATUS.  
APPLICATION FILED MAY 22, 1909.

Patented Dec. 20, 1910.

5 SHEETS—SHEET 1.

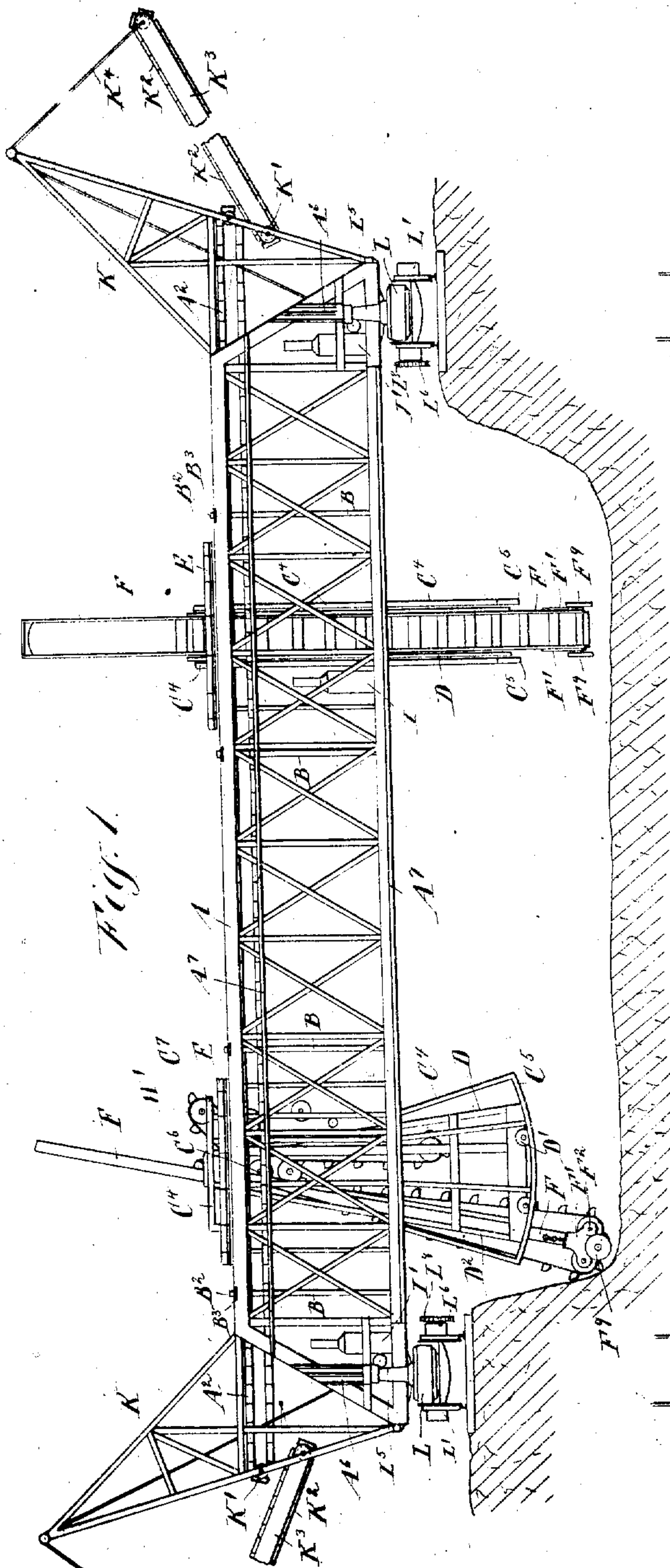


Fig. 1.

Witnesses:  
J. J. Greene  
A. J. Peterson

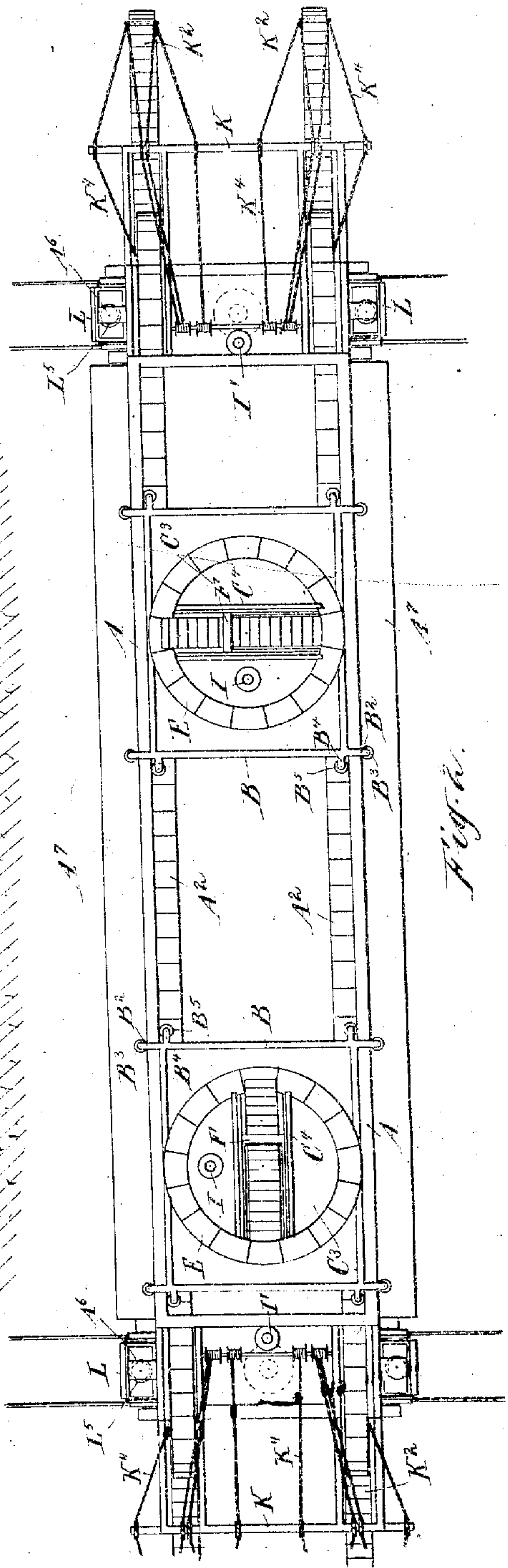


Fig. 2.

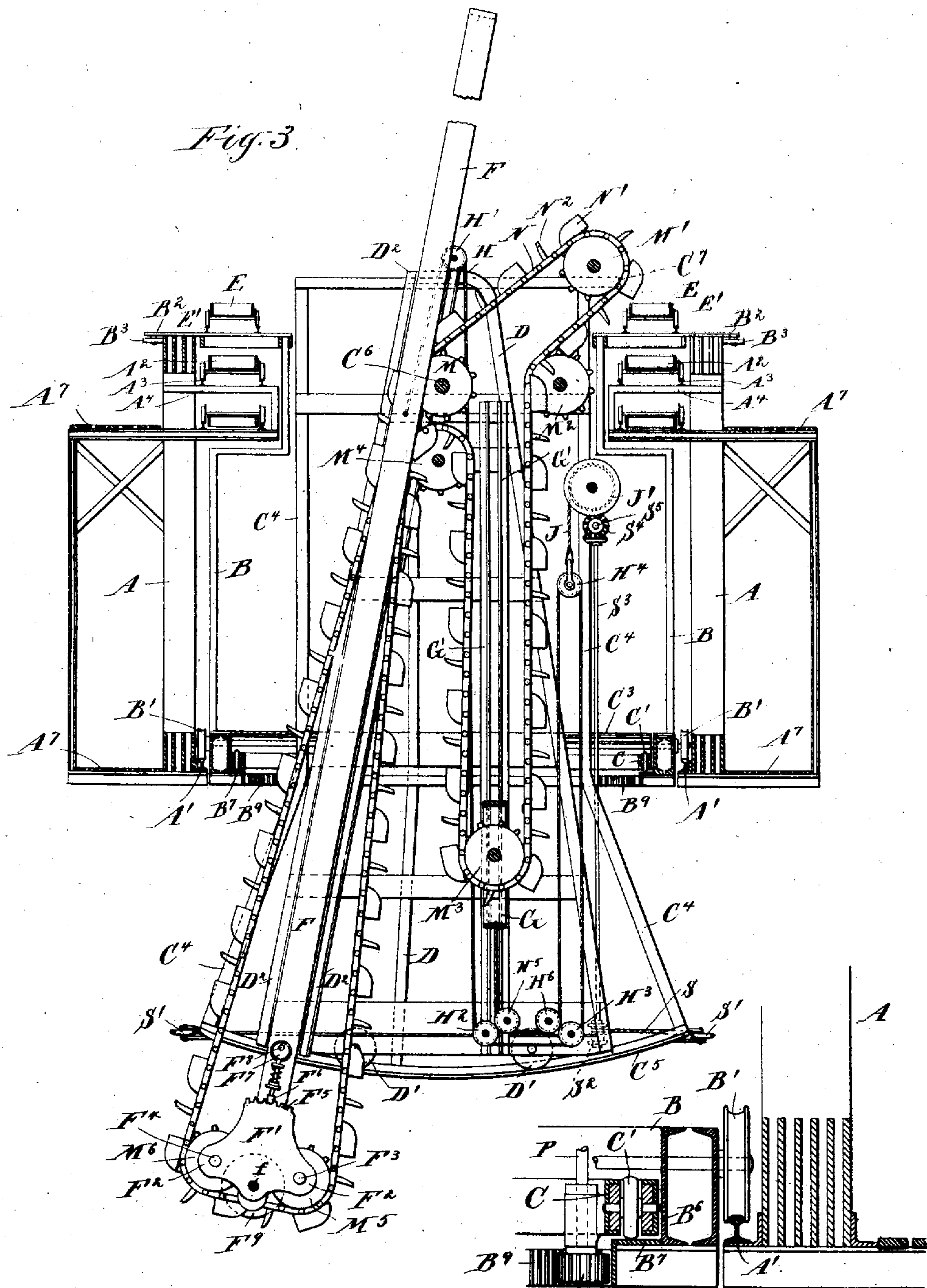
Inventor.  
William J. Leary,  
by his attorney,  
Charles K. Seale.

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5 SHEETS—SHEET 2.



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Fig. 13.

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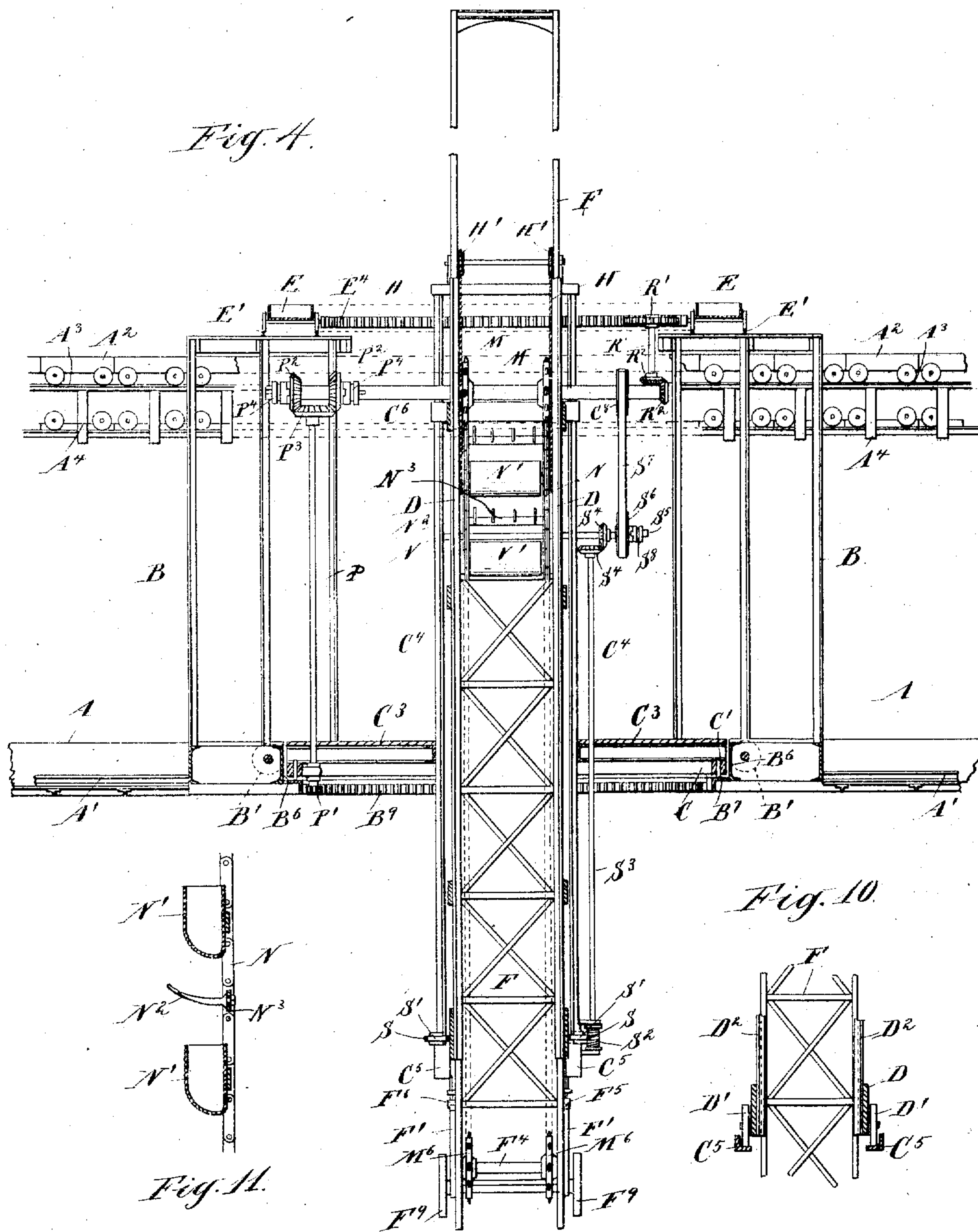


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Witnesses:  
J. J. Greene  
H. J. Peterson

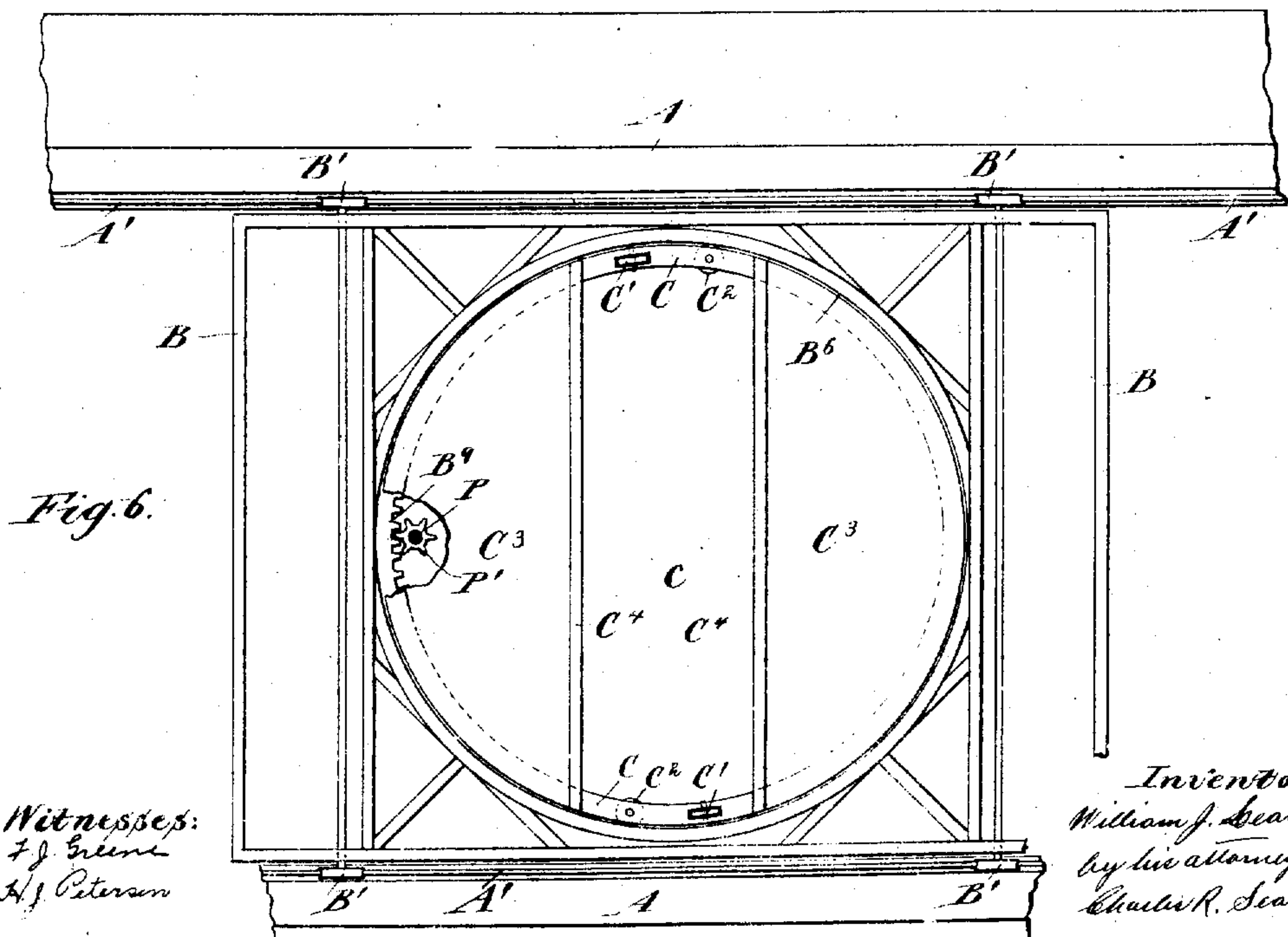
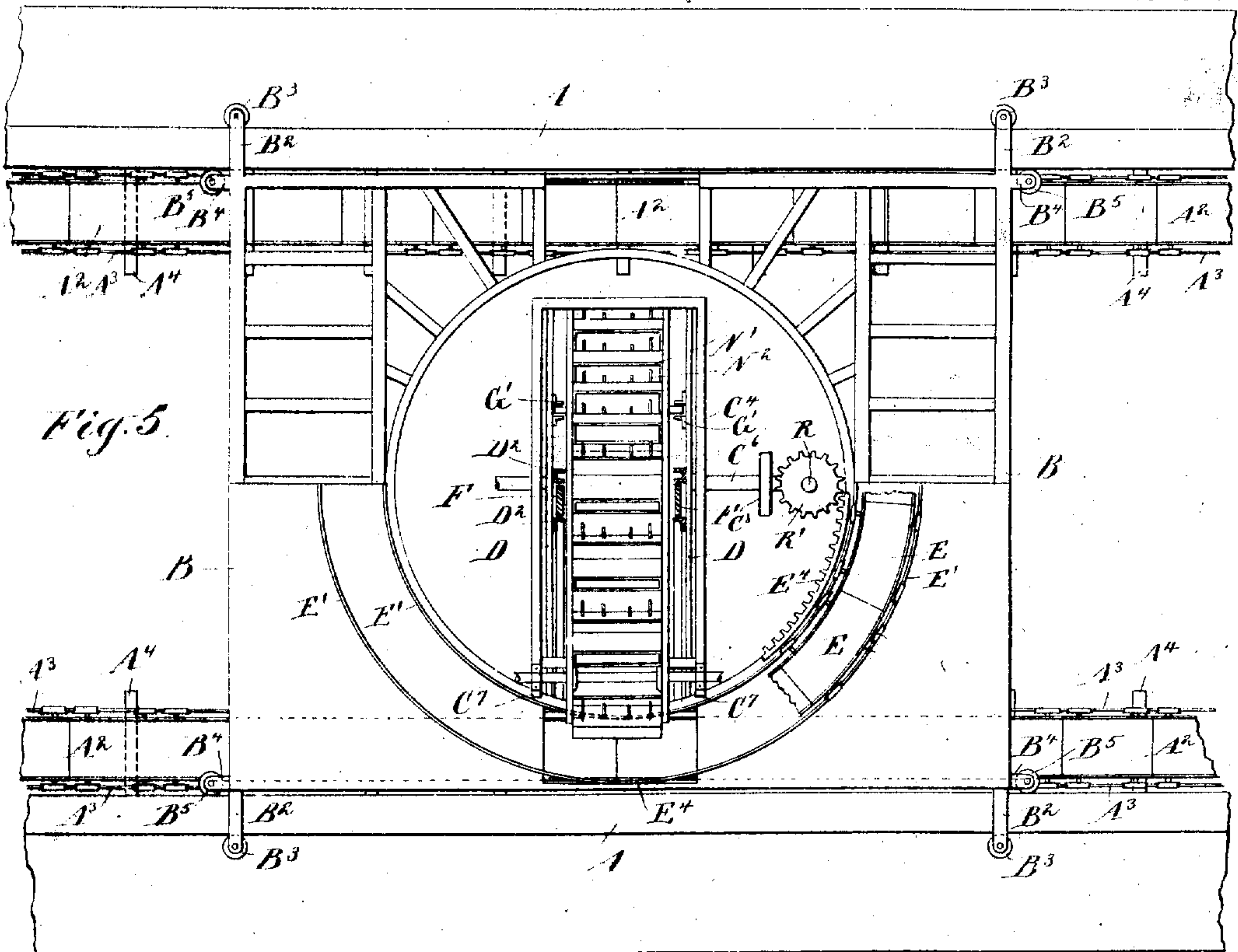
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5 SHEETS—SHEET 4.



Witnesses:  
F. J. Greene  
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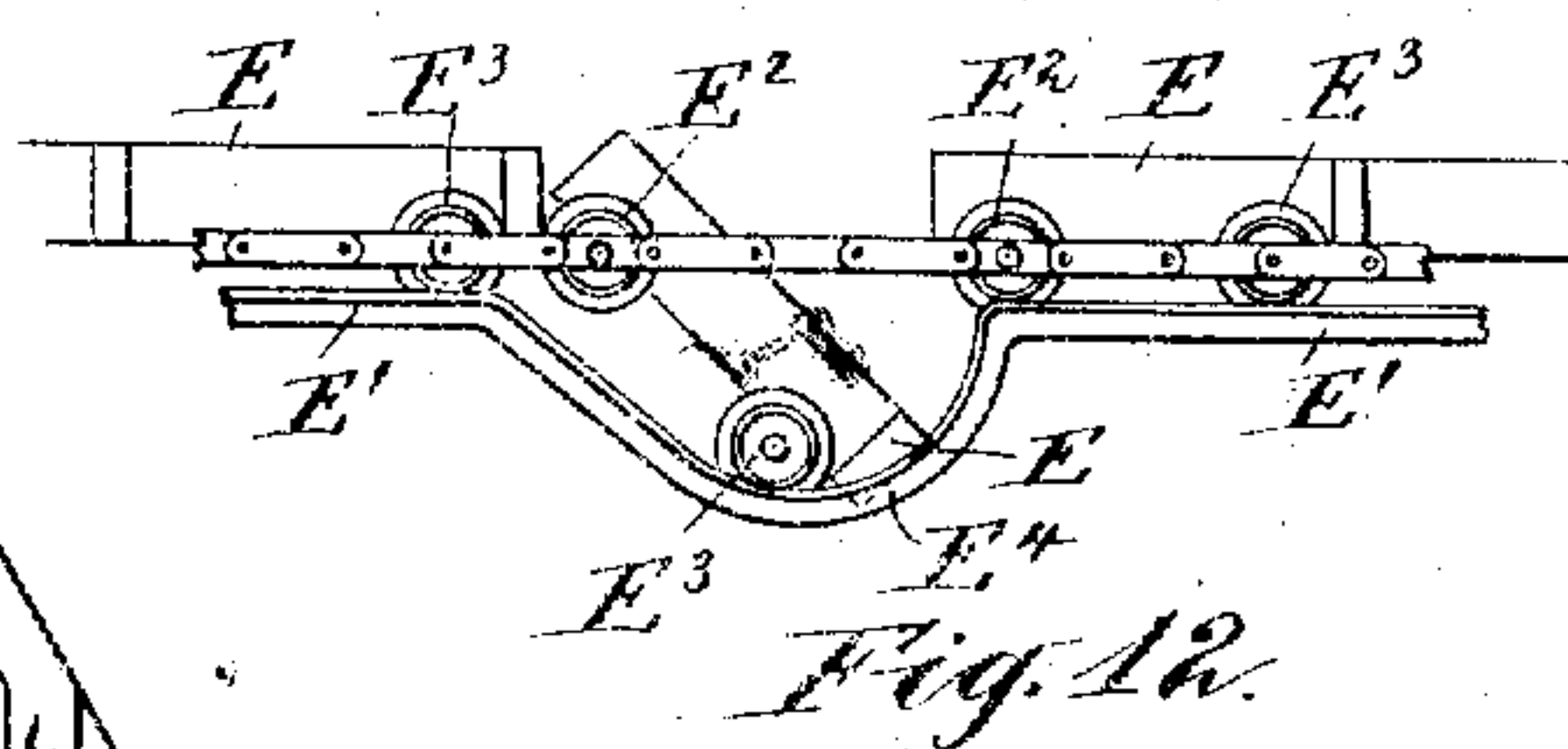
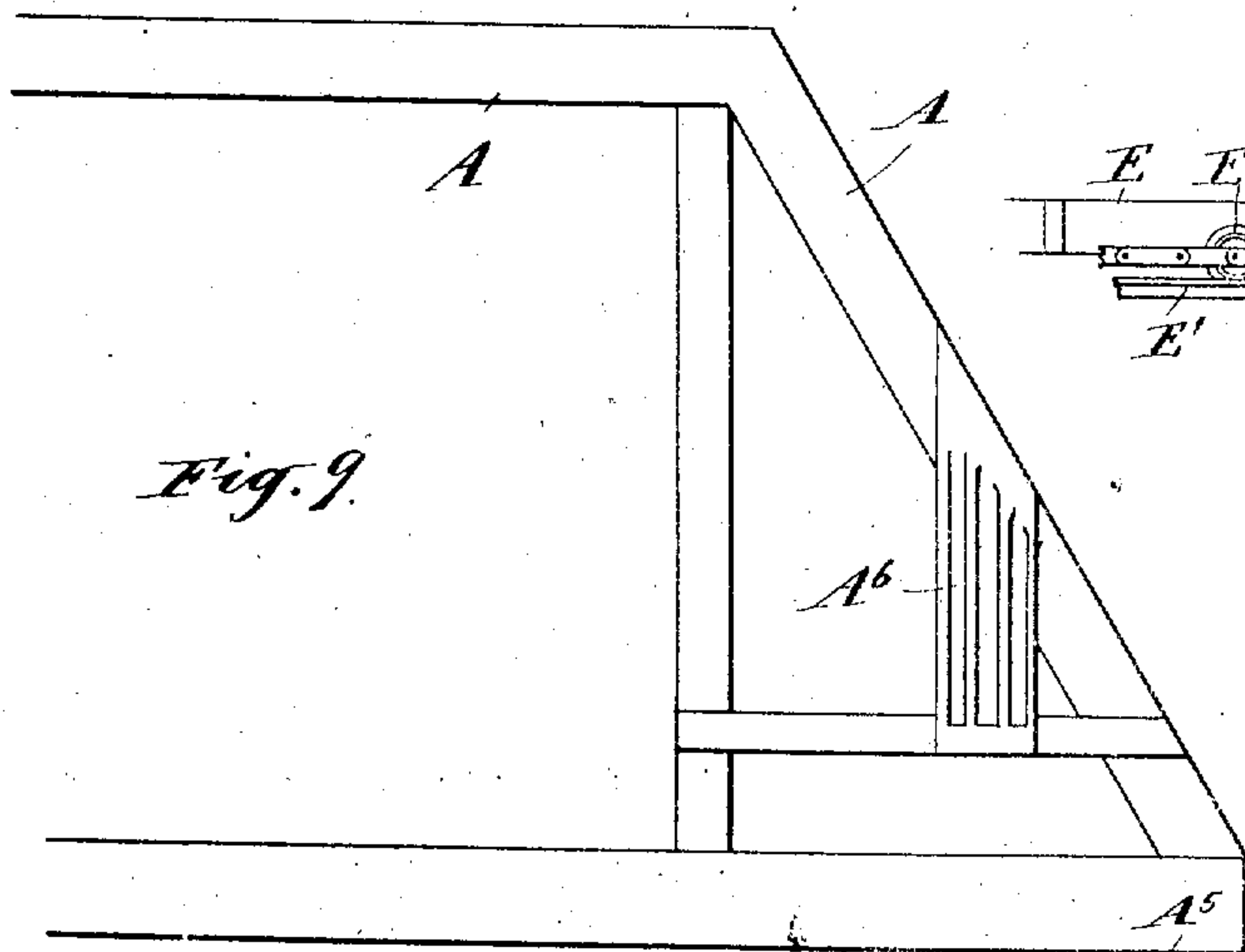
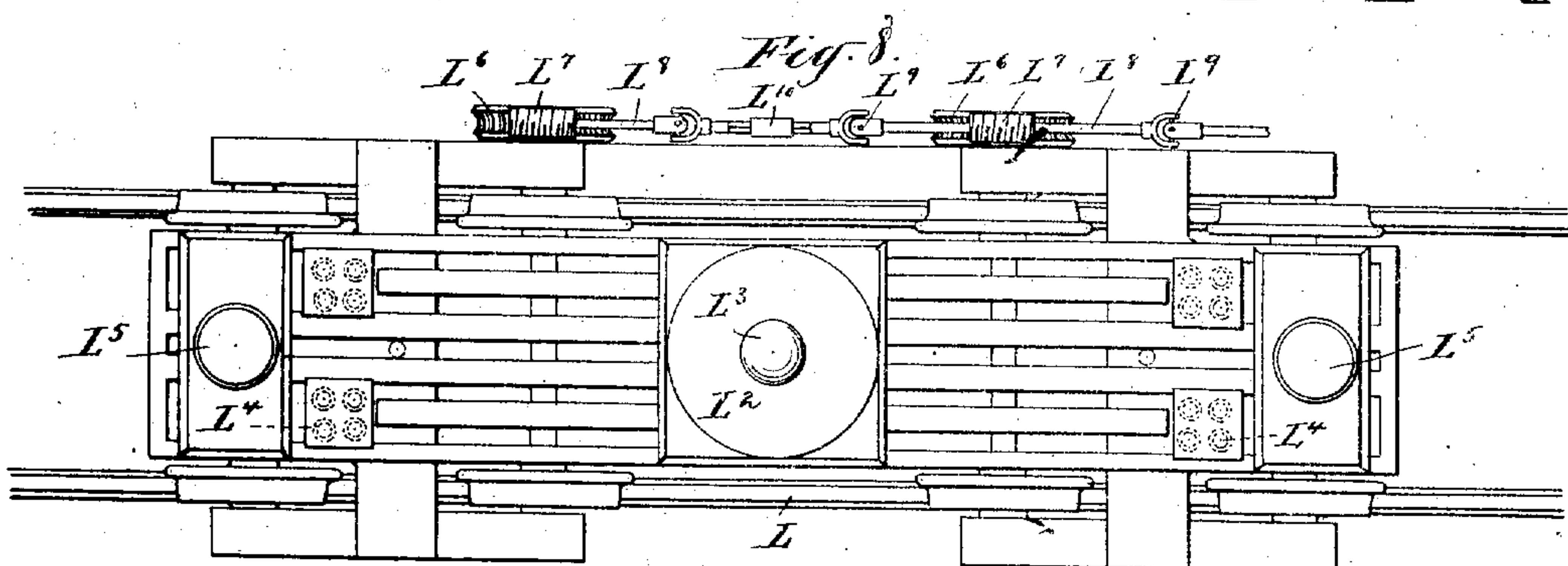
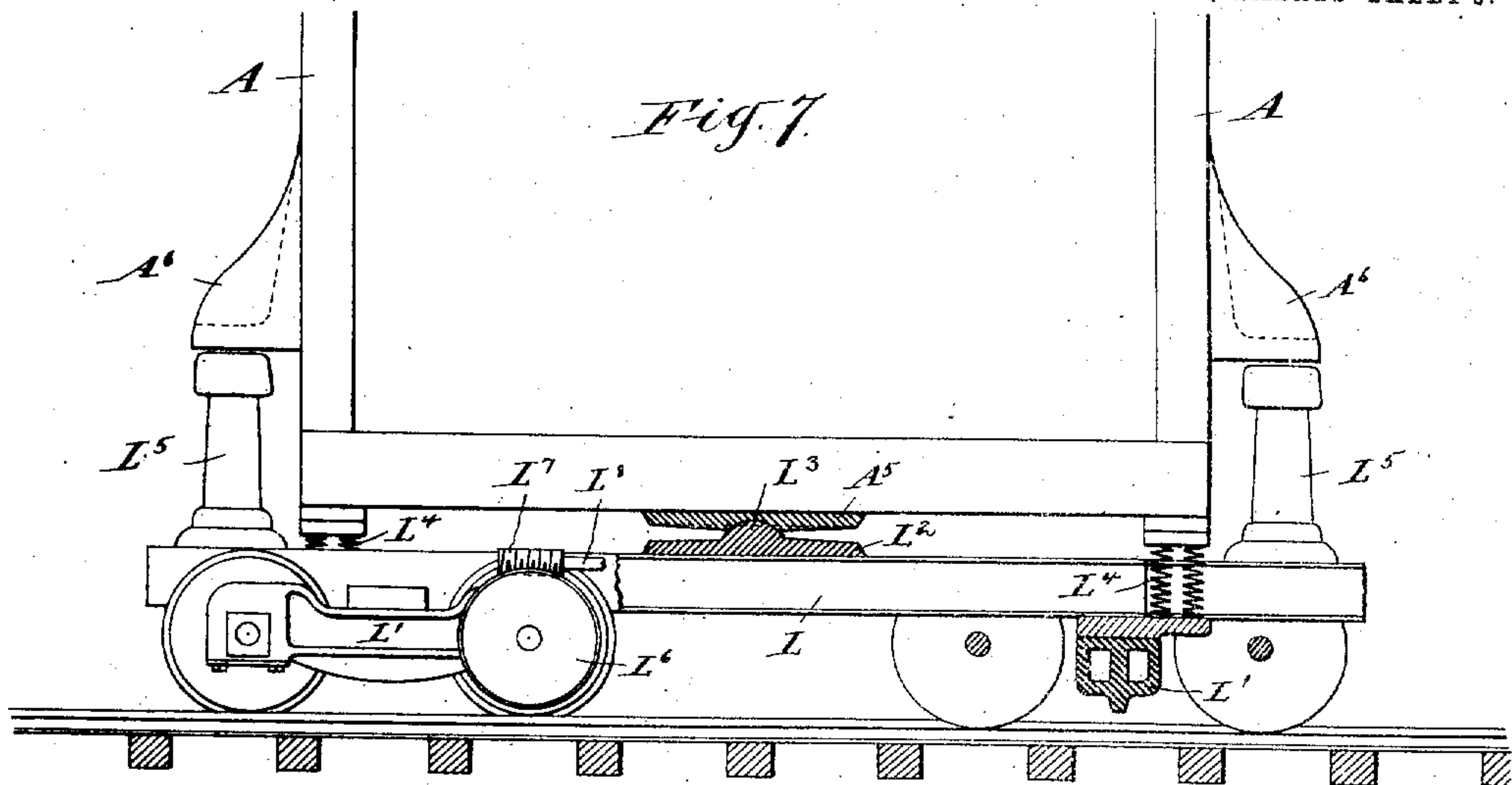
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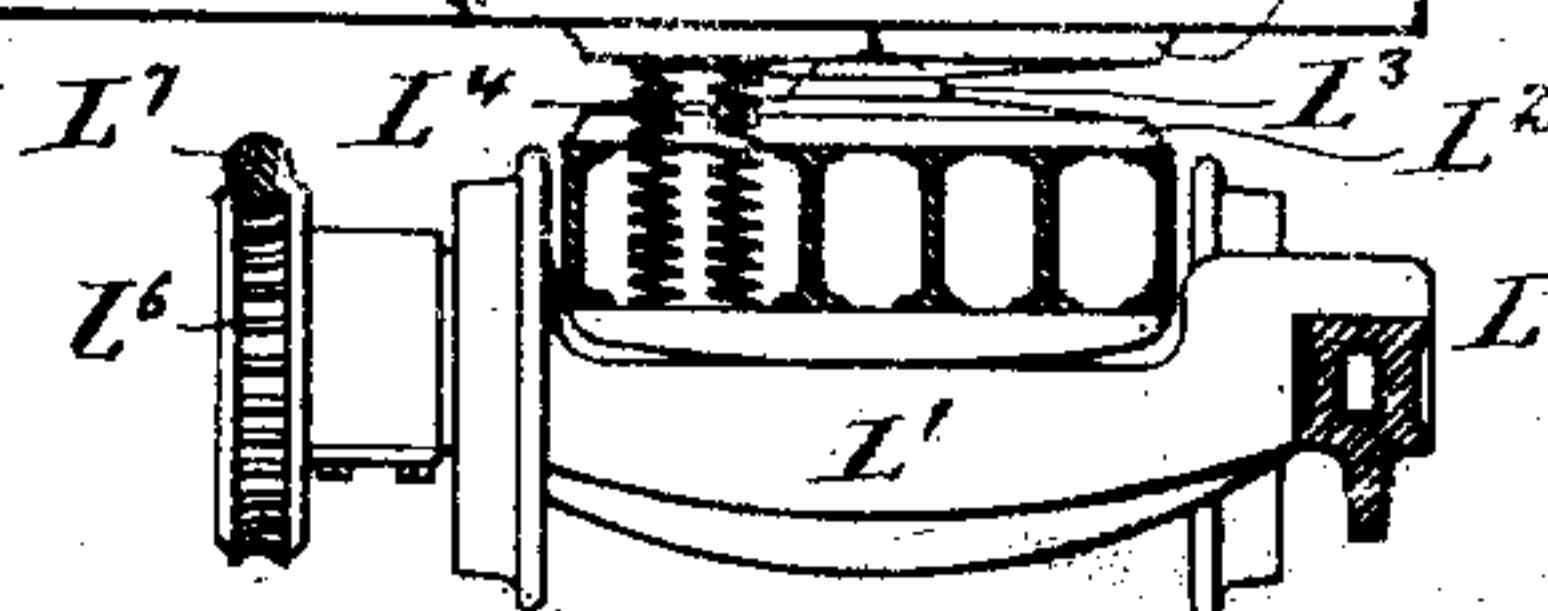
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5 SHEETS—SHEET 5.



Witnesses:  
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# UNITED STATES PATENT OFFICE.

WILLIAM J. LEARY, OF NEW YORK, N. Y., ASSIGNOR TO W. J. LEARY MANUFACTURING CO., OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

## EXCAVATING APPARATUS.

978,908.

Specification of Letters Patent.

Patented Dec. 20, 1910.

Application filed May 22, 1909. Serial No. 497,589.

*To all whom it may concern:*

Be it known that I, WILLIAM J. LEARY, a citizen of the United States, residing in the city of New York, borough of Manhattan, in the county and State of New York, have invented certain new and useful Improvements in Excavating Apparatus, of which the following is a specification.

The invention relates to apparatus for digging, elevating, and conveying earth or other material, and is specially designed for excavating-work in the construction of canals, reservoirs, railroad cuts, and analogous engineering operations.

The object of the invention primarily is to provide means, movably supported at the sides of the area to be excavated and above such area, equipped with excavating machinery arranged to be operated in any direction and to any depth within the limits of the apparatus.

Another important object is to provide take-up mechanism by which the direction and depth of cut may be easily varied as required, and the material thus loosened delivered at either side of the excavated area.

Other objects of the invention include provisions for supporting the excavating apparatus with freedom to adjust itself automatically to inequalities of surface, and provisions for moving the apparatus as required in following the line of excavation.

The apparatus comprises parallel girders supported at the ends on cars running on tracks at each side of the area to be excavated, having one or more carriages mounted to travel longitudinally of the girders in the open space between them, with a rotatable frame or turntable mounted in each carriage, in which is suspended a swinging frame carrying a vertically movable boom along which travels an endless chain of buckets adapted to loosen and elevate the material to be removed and delivers such material to a moving circle of pans from which the material passes to longitudinally moving conveyers by which it is deposited at the sides of the excavation.

The invention consists in certain novel features of construction and arrangement by which the above objects are attained, to be hereinafter described and pointed out in the claims.

The accompanying drawings form a part

of this specification and show an approved form of the invention.

Figure 1 is a general side elevation. Fig. 2 is a corresponding plan view. The succeeding figures are on a larger scale. Fig. 3 is a section taken transversely of the girders and showing the excavating mechanism in side view, partly in section. Fig. 4 is a section taken longitudinally of the girders and showing the excavating mechanism in front view. Fig. 5 is a plan view of the same parts, with certain portions broken away or omitted. Fig. 6 is a similar view at a lower level. Fig. 7 is a side elevation of one of the supporting cars, partly in vertical section and showing a portion of the girders in end view. Fig. 8 is a plan view of the car. Fig. 9 is a transverse section of the car, partly in end elevation, showing a portion of the girders supported thereon. Fig. 10 is a vertical section, partly in elevation, corresponding to Fig. 4 and showing a portion of the mechanism illustrated in such figure. Fig. 11 is a vertical section and elevation showing a portion of the chain of excavating buckets. Fig. 12 is a side elevation showing a detail. Fig. 13 is a vertical section on a larger scale through a portion of the lower stringer of one of the girders, showing the connection therewith of the carriage and turntable.

Similar letters of reference indicate the same parts in all the figures.

A A are girders which may be understood to be of the usual lattice construction, long enough to reach across the area to be excavated, set on edge parallel with each other and strongly joined at their ends, with the remaining space between them open and unobstructed. On the inner face of the bottom stringer of each is a track  $A^1$  receiving wheels  $B^1$  on the lower portions of two open-work bridges or carriages B B each of general rectangular shape in plan view and each similar in all respects to the other.

At the top of each at each side and end is an arm  $B^2$  extending over the upper stringer of the girder and carrying a horizontal wheel or roller  $B^3$  in rolling contact with the outer face of the stringer, and  $B^4$   $B^4$  are similar arms at right angles to the first, carrying rollers  $B^5$   $B^5$  in contact with the inner face of the stringer. The carriages thus mounted may be moved longitudinally



of the girders on the tracks  $A^1$ , the arms and rollers serving to steady the carriage and also to hold the girders against spreading.

$B^6$  is an annular vertical flange or narrow wall in the bottom of each carriage, forming with a horizontal circular flange  $B^7$  a rabbet or angular annular channel in which is mounted a ring  $C$  having vertical rollers  $C^1$  running on the flange  $B^7$  and horizontal rollers  $C^2$  in contact with the wall  $B^6$ , free to rotate in such channel and serving as an antifriction bearing for the parts supported by the ring. On this ring is a deck  $C^3$  having a diametrical opening  $c$  surrounded by a frame  $C^4$  extending upwardly above the tops of the girders and downwardly a considerable distance below the deck  $C^3$ , terminating in curved ways  $C^5$ ; the ring and its frames thus constitute a turntable rotatable horizontally in each carriage.

On a transverse shaft  $C^6$  near the upper end of the turntable frames is suspended a swinging frame  $D$  of triangular form having supporting guide-rollers  $D^1$   $D^1$  on each side at the lower end, running on the curved ways  $C^5$  which are concentric to the shaft  $C^6$ ; the frame  $D$  thus mounted is free to vibrate in the opening  $c$ .

On the inner faces of the frame  $D$  on one inclined edge are guide-ways  $D^2$  parallel with such edge, receiving a boom  $F$  arranged to slide up and down therein and comprising side-bars joined by suitable angular and cross braces to insure the required stiffness.

At the lower end of each boom on each side thereof is a plate  $F^1$  pivoted at  $f$ , having lugs  $F^2$  serving as bearings for transverse shafts  $F^3$   $F^4$ , and having a segmental rack  $F^5$  at the upper edge of each plate, engaged on each side of the boom by a sliding bolt or dog  $F^6$ ; the dogs are operated by eccentrics  $F^7$  mounted on a shaft  $F^8$  by which both may be turned simultaneously to free the plates and permit the latter to be tilted relatively to the boom as may be required in presenting the chain of buckets, to be described, at the desired angle to the material to be removed.

On the shaft  $C^6$  serving as a center for the swinging frame  $D$  are a pair of sprocket wheels  $M$  engaged by a pair of endless sprocket-chains  $N$  carrying a series of buckets  $N^1$  alternated with a series of digging fingers  $N^2$ ; the chains extend from the wheels  $M$  to similar wheels  $M^1$  mounted on overhung arms  $C^7$  at the top of the turntable, thence downwardly over idlers  $M^2$  mounted in the same frame, to and partially around the wheels  $M^3$  in a vertical slide  $G$ , thence again upwardly to and over idlers  $M^4$  mounted in the swinging frame  $D$  immediately below the wheels  $M$ , and then downwardly along the inner face of the boom to the wheels  $M^5$  on the shaft  $F^3$ ,

thence across the lower end of the boom to the wheels  $M^6$  on the shaft  $F^4$  and again upwardly along the outer face of the boom to the wheels  $M$ , completing the circuit.

As seen clearly in Figs. 1 and 4, the line of buckets  $N^1$  is movable between the side-bars of the boom so as to pass through between the same, as seen clearly in Fig. 3, thus permitting raising or lowering of the boom to vary the depth of cut without interfering with the proper movement of the buckets or the delivery of the material delivered thereby.

Material taken by the buckets  $N^1$  in their traverse around and below the end of the boom is carried directly upward over the wheels  $M$  to the wheels  $M^1$  where it is dumped into an annular series of pans  $E$  moving continuously on the circular tracks  $E^1$  on the top of the carriage  $B$  and encircling the upper end of the turntable frame in such relation to the latter as to receive material at any portion of the circuit.

Attached to the inner faces of the boom side-bars are the ends of cables  $H$  or other flexible connections by which the boom is raised and lowered, extending over fixed pulleys  $H^1$  at the top of the swinging frame  $D$ , and downward below and around the pulleys  $H^2$   $H^3$  and thence upward over a sheave  $H^4$  in a block suspended from a cable  $J$  on a drum or windlass  $J^1$ , thence again downward below and around the fixed pulleys  $H^5$   $H^5$  and up to the lower end of the slide  $G$  to which the ends are connected. The slide  $G$  carries the sprocket wheels  $M^3$  above described and is movable vertically in ways or guides  $G^1$   $G^1$  in the swinging frame according to the length of the loop formed in the sprocket-chains in their passage around the wheels  $M^3$ .

The arrangement of the sprocket wheels and chains with the cables and drum  $J^1$  permits the boom to be elevated or depressed by taking in or paying out the cables  $J$  without slackening the sprocket-chains or in any way interfering with the delivery of excavated material; as the boom is lowered by unwinding the cables  $J$  the slide  $G$  correspondingly rises and automatically supplies the additional working length required in the sprocket-chains  $N$ , and in raising the boom the slide  $G$  lowers and automatically takes up the slack.

$A^2$   $A^2$  are endless chains of conveyers moving longitudinally of the girders along the inner faces of the latter on tracks  $A^3$   $A^3$  supported on brackets  $A^4$   $A^4$  fixed to the girders, the carriages  $B$  being narrowed at the upper ends to provide space therefor, as shown in Fig. 3, and the conveyers pass immediately below the pans  $E$  at opposite sides to receive material deposited thereon by the buckets  $N^1$ .

Various means may be employed for trans-



ferring the material from the pans to the conveyers but the automatic dumping arrangement shown in Fig. 12 is preferred; in this arrangement the pans are connected by  
 5 links and supported on tracks  $E^1$  by two wheels  $E^2$   $E^3$  on each side, one shaft being loosely connected to the links and the other free; at opposite points above the conveyers  $A^2$  the tracks  $E^1$  are depressed to form a  
 10 loop  $E^1$  and allow the unsupported end of each pan in passing to drop sufficiently to dump its load, and again be raised in traversing the ascending portion of the loop to the horizontal position, as will be under-  
 15 stood.

At each end of the girders is a derrick frame  $K$  in which the wheels  $K^1$  for the endless conveyers are mounted, and the material collected may be dumped at either end  
 20 of each conveyer according to the direction in which the conveyers are moved, and the material thus delivered may be received in suitable wagons or cars for transportation, or, as illustrated in Figs. 1 and 2, may be  
 25 deposited on endless chains of carriers  $K^2$ . The carriers  $K^2$  are shown as supported on arms  $K^3$  held by cables  $K^4$  by which they may be raised or lowered as required or swung within certain limits, to deposit the  
 30 material along each side of the excavation at sufficient distance to avoid interference with the cars  $L$  carrying the girders.

Each car is supported on a pair of trucks  $L^1$  and is made up of I-beams suitably joined  
 35 and extending longitudinally resting on bolsters and connected to the trucks by king-pins as usual. At the center of the car is a plate  $L^2$  having a rounded boss  $L^3$  matching to a corresponding cavity in a plate  $A^3$   
 40 attached to the cross beams joining the girders  $A$  and forming a spherical bearing supporting the girders with liberty to tilt slightly in all directions. Beneath the girder-ends are springs  $L^4$  mounted on the  
 45 bolsters, and the latter are rounded laterally, as shown in Fig. 9, to allow the truck to rock slightly under them.

On the outer faces of the girders above the cars  $L$  are strong brackets or lugs  $A^5$   $A^6$  and  
 50 below their plane under faces are supports  $L^5$  securely seated on the ends of the cars. Thus equipped the girders may be held upright without regard to inequalities and roughness of track roadbed usually encountered in this class of work.  
 55

Power for driving the various moving parts may be derived from any source and applied in any convenient manner, electric  
 60 motors may be employed if current be available. The driving mechanism is therefore only partially indicated in the drawings; the turntable is revolved by a vertical shaft  $P$  and pinion  $P^1$  in mesh with a fixed annular rack  $B^2$  on the carriage  $B$ ; the vertical shaft  
 65  $P$  is driven by beveled gears  $P^2$   $P^3$  and  $P^4$

on the main shaft  $C^6$  and shaft  $P$  respectively is turned in one direction or the other through clutches  $P^4$   $P^4$ .

Another vertical shaft  $R$  driven by beveled gears  $R^2$   $R^2$  on the main shaft  $C^6$  and shaft  $R$  respectively carries a pinion  $R^1$  in  
 70 mesh with an annular rack  $E^4$  connected to the circle of pans  $E$  and drives the latter.

The swinging frame is moved and held by a cable  $S$  running on horizontal pulleys  $S^1$   $S^1$   
 75 at the corners of the turntable frame  $C^4$ , attached to the swinging frame and making a number of turns about a drum  $S^2$  on a vertical shaft  $S^3$  driven by beveled gears  $S^4$   $S^4$  respectively on said shaft  $S^3$  and on a coun-  
 80 tershaft  $S^5$  carrying a pulley  $S^6$  on which runs a belt  $S^7$  from a pulley  $C^3$  on the main shaft. A clutch  $S^8$  permits the pulley to engage the countershaft when the swinging frame is to be moved.  
 85

A stationary engine  $I$  on the turntable may supply power for these purposes, and engines  $I^1$   $I^1$  at the ends of the girders may  
 90 supply power for running the conveyers  $A^2$  and carriers  $K^2$ , and other purposes.

The cars  $L$  supporting the entire apparatus are moved along the tracks by worm-  
 wheels  $L^6$  on the axles, driven by worms  $L^7$  on a shaft  $L^8$  having universal joints  $L^9$  to  
 95 provide flexibility, and a slide  $L^{10}$  in the midlength to permit telescoping for variations in length as in traversing curves. The shafts  $L^8$  may be driven each independently from the engine  $I^1$  on the adjacent end of the girders or in any other convenient  
 100 manner.

Importance is attached to the construction of the excavating buckets  $N^1$  and fingers  $N^2$  in their relation to each other; the  
 105 fingers are arranged in transverse rows on bars  $N^3$  between each pair of buckets and serve to loosen the earth or other material to be moved. The fingers all project beyond the line of the working edges of the buckets, and the outermost fingers of each row are of  
 110 greater length than those between to insure a clear path for the sides of the succeeding bucket, thus tending to relieve the latter and the boom from torsional strains.

At the extreme lower end of the boom are  
 115 rollers  $F^9$  serving to support the boom and facilitate its movements while in contact with the surface.

On the outer side of each girder near the top and bottom are runways or walks  $A^7$   
 120 serving as decks or platforms for the attendants, and their supporting brackets and cross-bracing greatly stiffen the girders.

Modifications may be made in the forms, proportions and various details of construction within wide limits without departing  
 125 from the invention, and parts may be used without the whole.

Although the apparatus is shown and described as having two carriages, each  
 130



equipped with a turntable and boom, three or more may be employed, or one alone used if preferred. The two are preferable in that the two sets of pans E may deliver each to one of the conveyer belts independently of the other. If more were installed they would deliver to the same belts.

Such portions of the apparatus as are not fully shown may be understood to be of any ordinary or approved construction, and although the invention is described as applied to canal or analogous engineering operations it will be understood that it may be applied to dredging, and to handling ores, coal or other materials, and in other work to which it may be adapted.

I claim:—

1. In an apparatus of the character set forth, a pair of girders disposed horizontally and parallel and provided with bottom stringers, a carriage supported by the bottom stringers only of said girders and movable longitudinally thereof in the space between them, a turn table in said carriage, a boom having side bars, a conveyer of the chain and bucket type mounted on said boom, the buckets of which are movable between the side bars of said boom, cars movably supported on the turn table on said carriage, and a swinging frame in which said boom is mounted to slide, said frame being carried by and rotatable with said turn table.

2. In an apparatus of the character set forth, a pair of girders disposed horizontally and parallel to each other, a carriage supported by said girders and arranged to move longitudinally thereof in the space between them, a boom and a swinging frame in said carriage, said frame being mounted on a horizontal axis on the carriage and the boom mounted to slide longitudinally in said frame, an annular series of pans on said carriage and means for moving them, a series of conveyers mounted for movement longitudinally of said girders beneath and tangentially to said series of pans, means for dumping the contents of said pans on said conveyers, and excavating means carried by said boom and arranged to deliver excavated material to said pans.

3. In an apparatus of the character set forth, a pair of horizontal parallel girders, a carriage supported by the lower stringers of said girders and arranged to move longitudinally thereof in the space between them, a swinging frame mounted on a horizontal

axis on said carriage, a boom in said carriage and mounted to slide longitudinally in said frame, an annular series of pans on said carriage and means for moving them, a series of conveyers arranged to move longitudinally of said girders beneath and tangentially to said series of pans, means for dumping the contents of said pans on said conveyers, excavating means carried by said boom and arranged to deliver excavated material to said pans, an arm supported by said girders, means for swinging said arm vertically, and a chain of carriers carried by said arm to which said conveyers deliver its material.

4. In an apparatus of the character described, a pair of horizontally disposed parallel girders having bottom stringers, a carriage supported by said bottom stringers only, a turn table on said carriage, a swinging frame suspended from said turn table, guideways on said frame, a boom mounted to slide up and down in said ways and having side bars, a conveyer of the chain and bucket type mounted on said boom with the buckets movable between said side bars, a series of pans movably mounted on the top of said carriage, and means for dumping the contents of the pans.

5. In an apparatus of the character set forth, a pair of girders disposed horizontally and parallel and provided with lower stringers, a plurality of carriages supported by the lower stringers only of said girders and arranged to move longitudinally thereof in the space between them, a turn-table mounted on each of said carriages, a frame pivotally mounted on a horizontal axis on said turn-table, a boom mounted to slide longitudinally in said frame, an annular series of pans on each of said carriages, means for moving said pans, two series of conveyers arranged to move longitudinally of said girders beneath and tangential to said series of pans, means for dumping the contents of said pans on said series of conveyers, and excavating means carried by each of said booms and arranged to deliver excavated material each to its series of pans.

In testimony that I claim the invention above set forth I affix my signature, in presence of two witnesses.

WILLIAM J. LEARY.

Witnesses:

ALEXANDER SHAW,  
CHARLES R. SEARLE.