

No. 765,016.

PATENTED JULY 12, 1904.

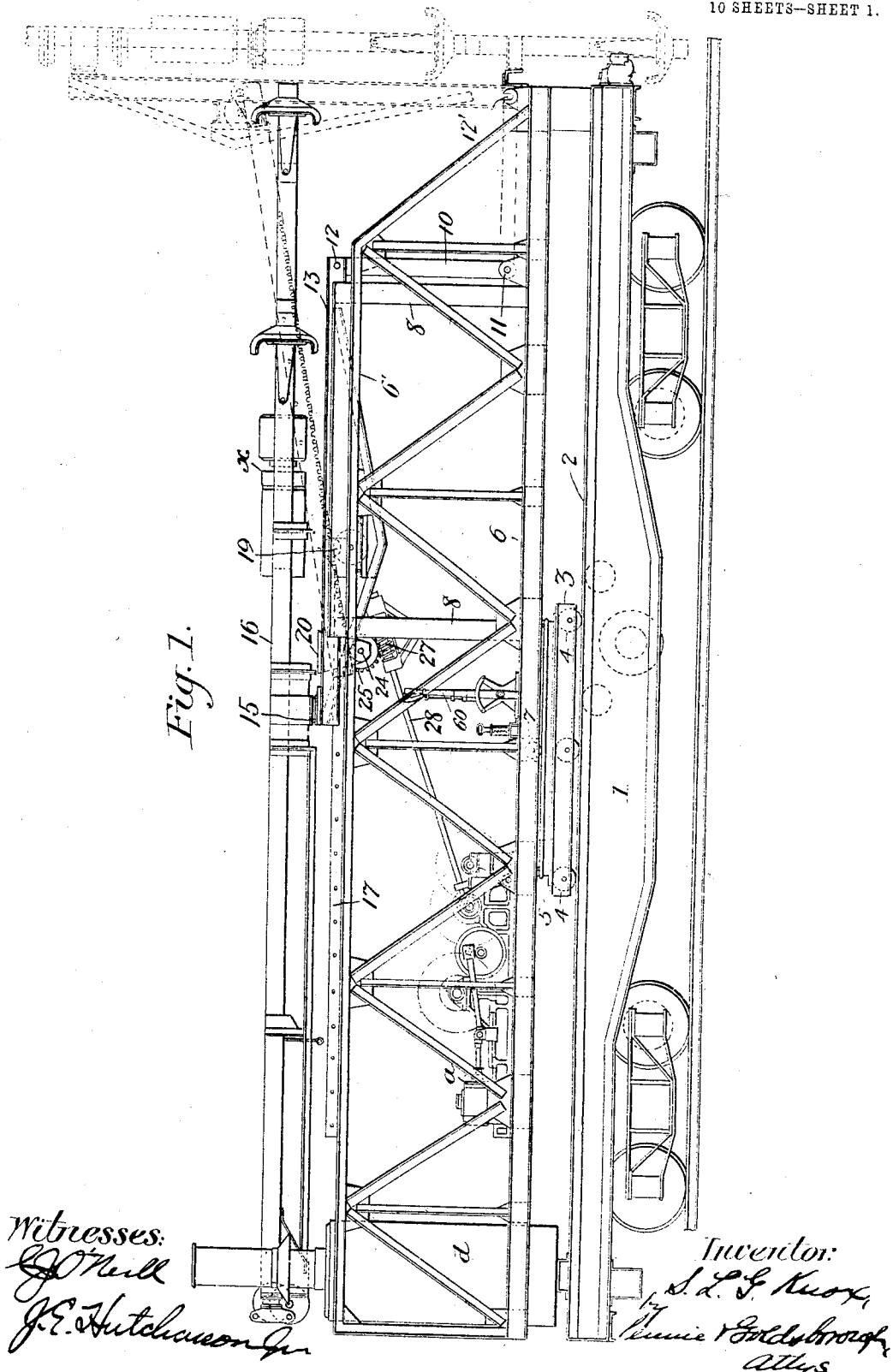
S. L. G. KNOX.  
PILE DRIVER.

APPLICATION FILED MAR. 8, 1904.

NO MODEL.

10 SHEETS—SHEET 1.

Fig. 1.



No. 765,016.

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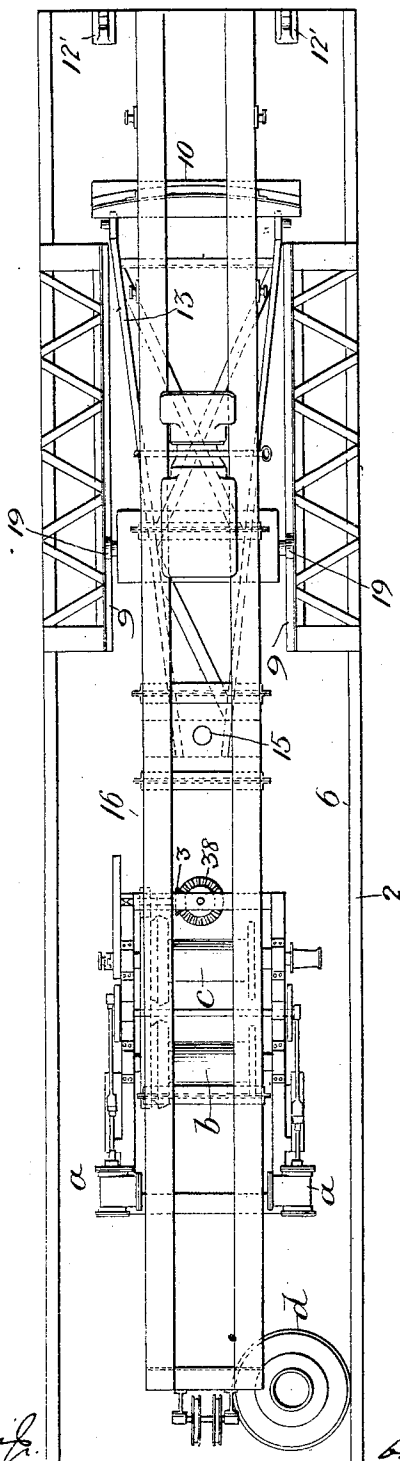
S. L. G. KNOX.

## PILE DRIVER.

APPLICATION FILED MAR. 8, 1904.

NO MODEL.

10 SHEETS—SHEET 2.



Witnesses:  
J. E. Hutchinson  
C. J. O'Neill

Inventor:  
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No. 765,016.

PATENTED JULY 12, 1904.

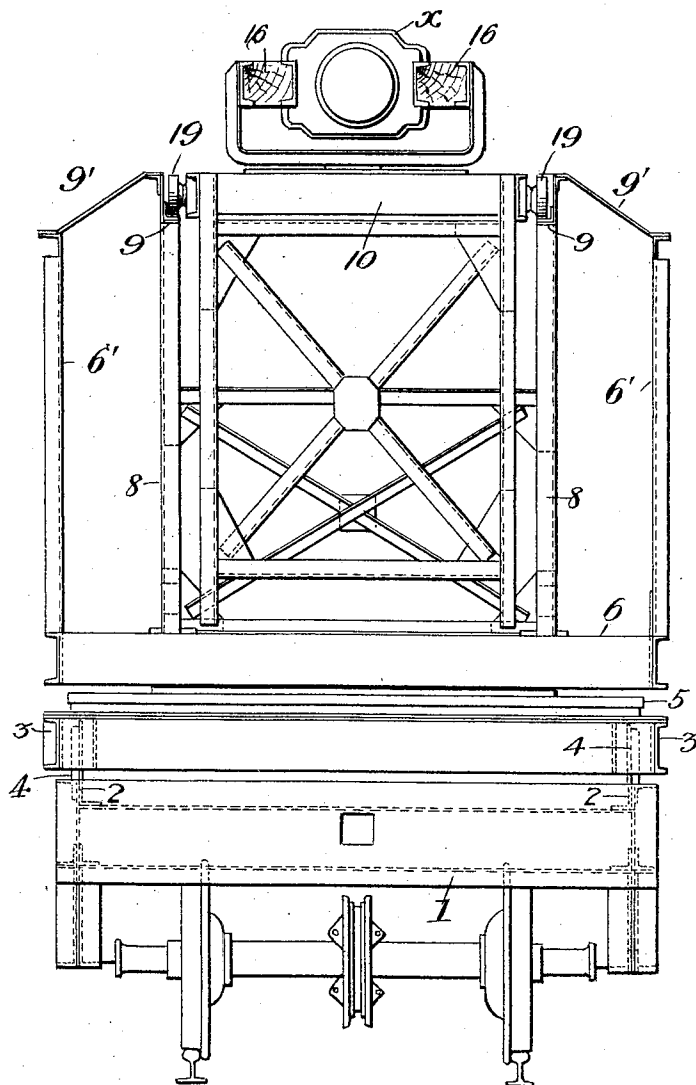
S. L. G. KNOX.  
PILE DRIVER.

APPLICATION FILED MAR. 8, 1904.

NO MODEL.

10 SHEETS—SHEET 3.

*Fig. 3.*



Witnesses:

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No. 765,016.

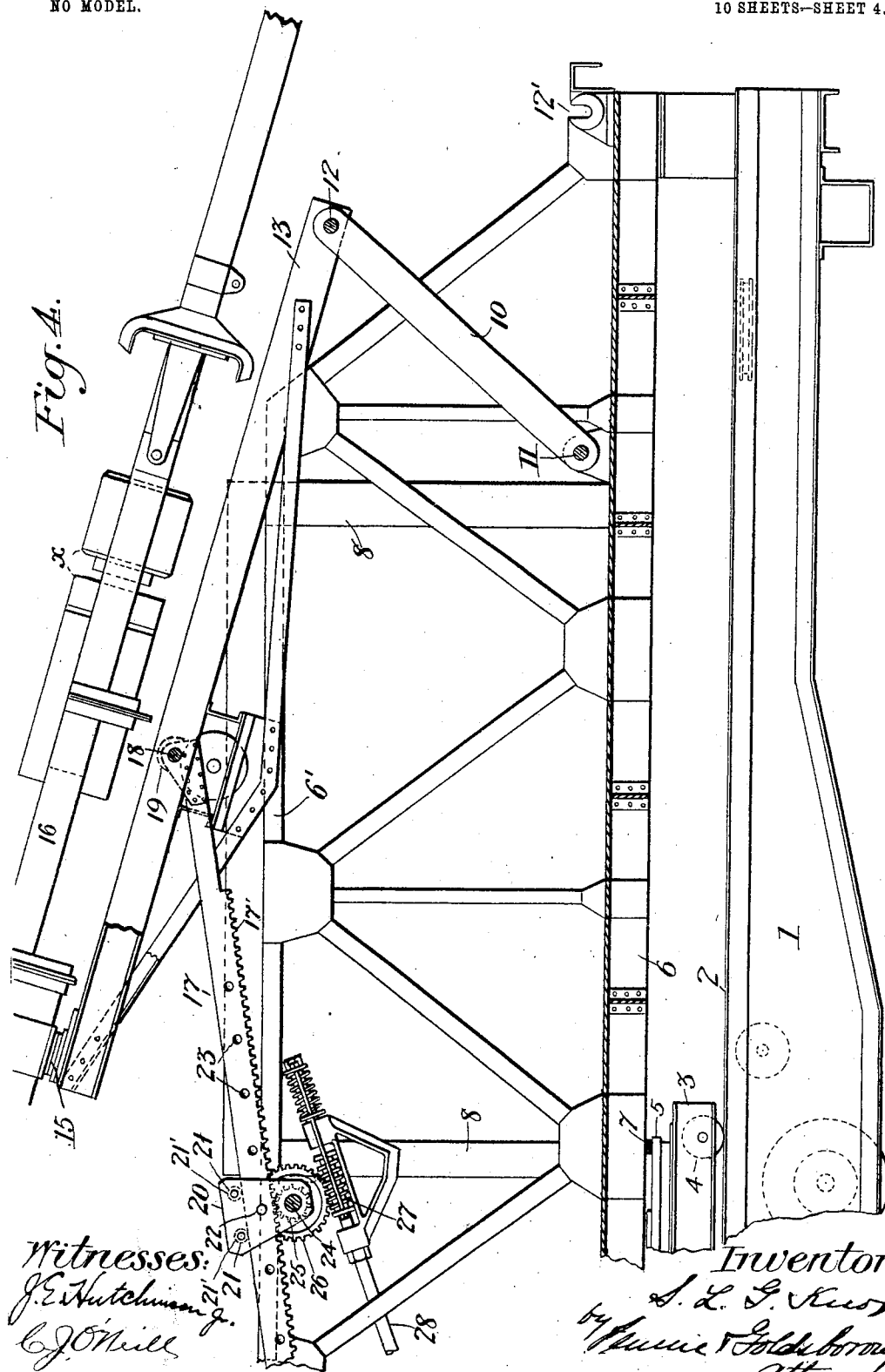
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NO MODEL.

10 SHEETS—SHEET 4.



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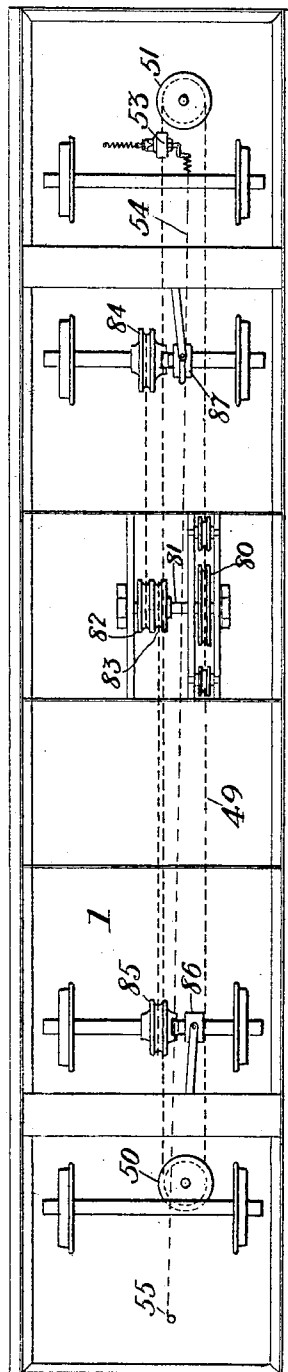
S. L. G. KNOX.  
PILE DRIVER.

APPLICATION FILED MAR. 8, 1904.

NO MODEL.

10 SHEETS—SHEET 5.

Fig. 5.



Witnesses:

J. E. Hutchinson  
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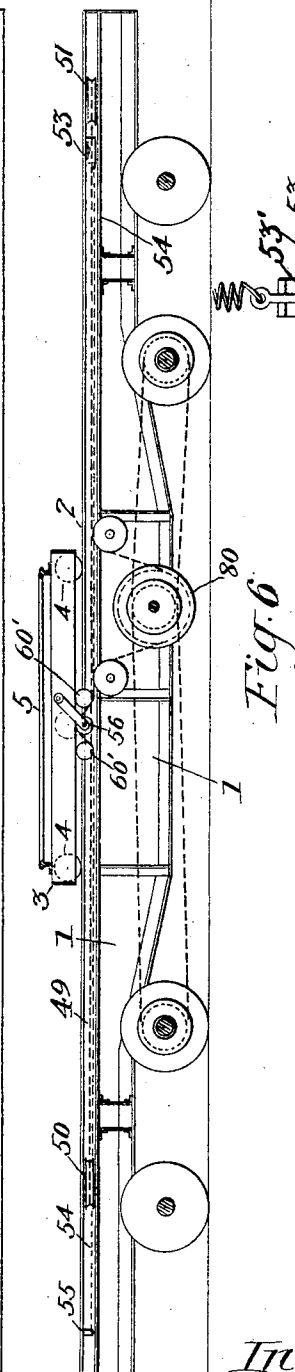


Fig. 6.

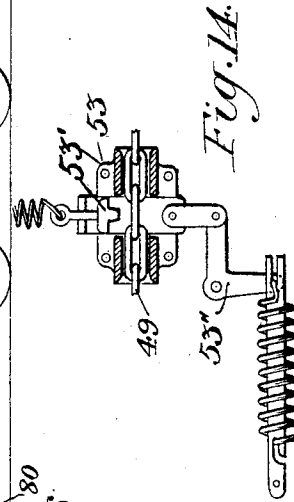


Fig. 14.

Inventor:

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No. 765,016.

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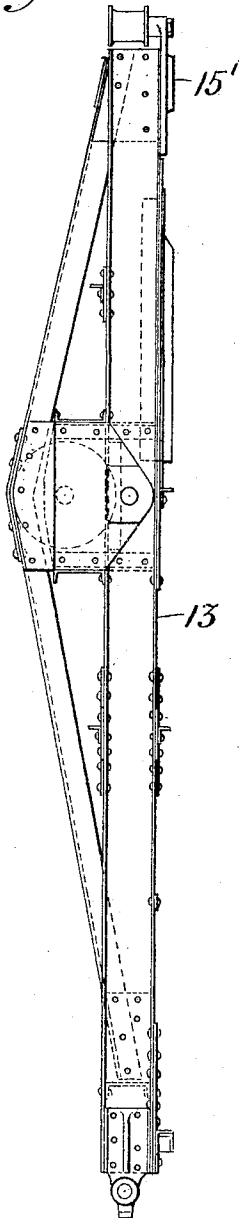
S. L. G. KNOX.  
PILE DRIVER.

APPLICATION FILED MAR. 8, 1904.

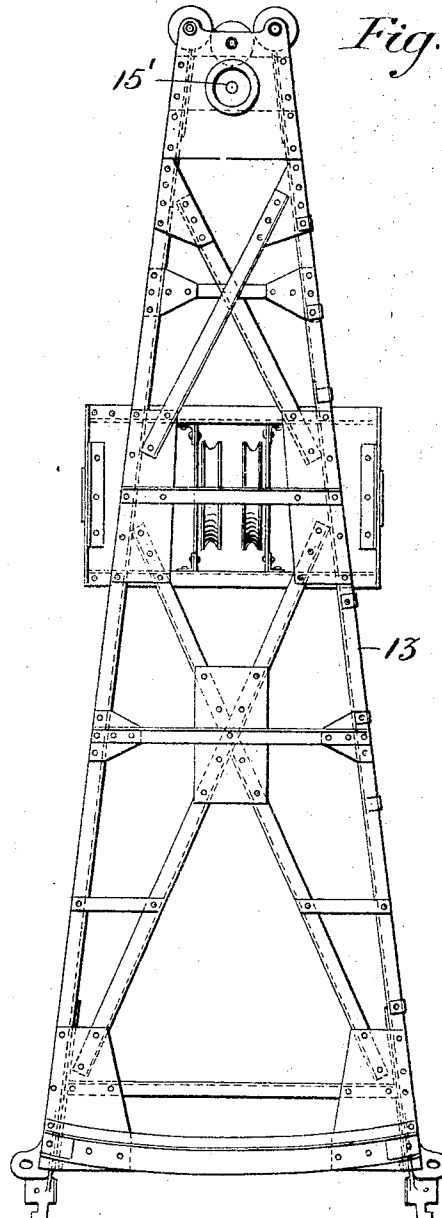
NO MODEL.

10 SHEETS—SHEET 6.

*Fig. 7.*



*Fig. 8.*



Witnesses:  
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No. 765,016.

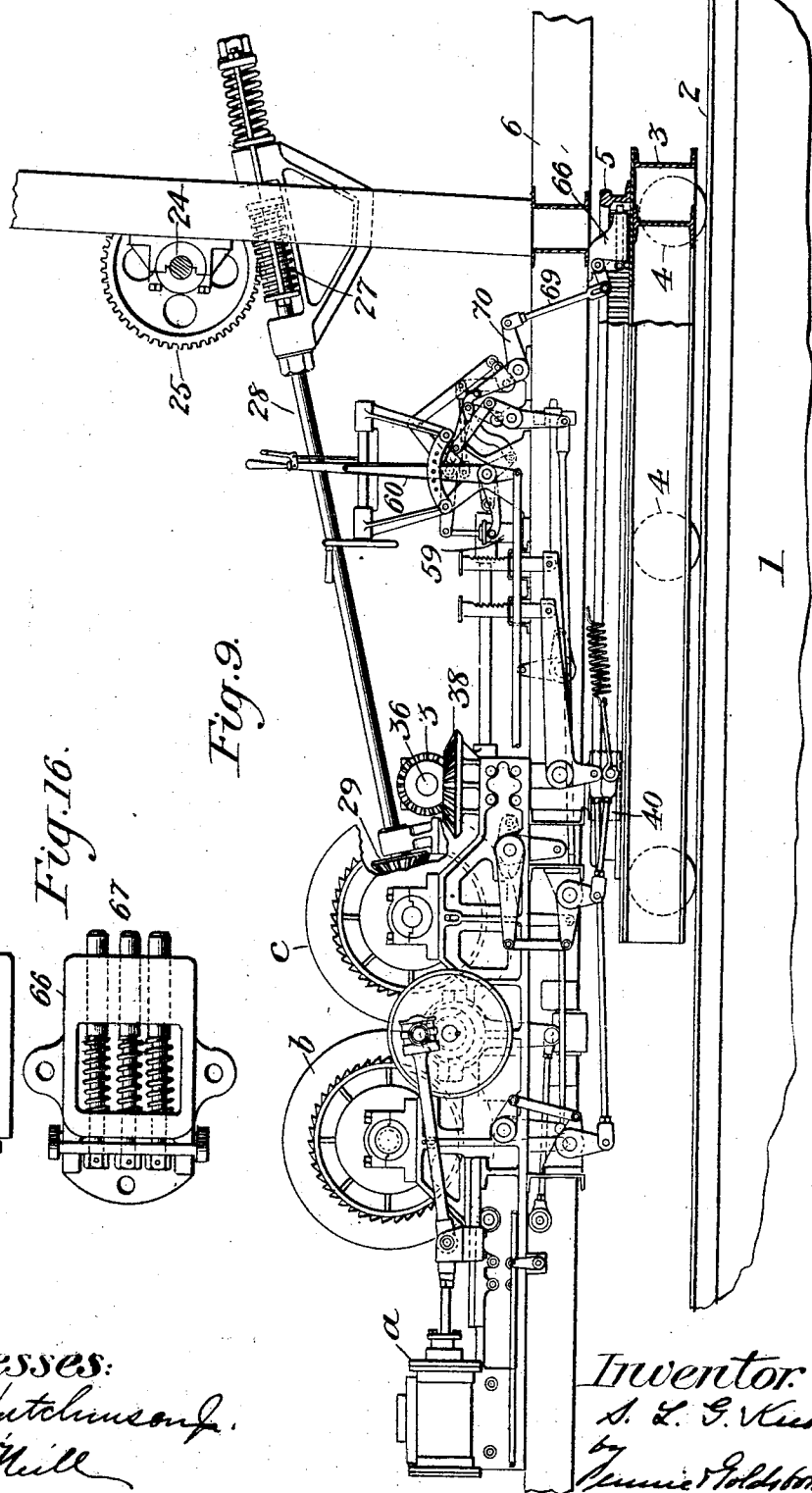
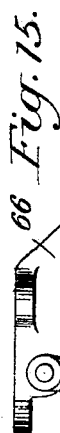
PATENTED JULY 12, 1904.

S. L. G. KNOX.  
PILE DRIVER.

APPLICATION FILED MAR. 8, 1904.

NO MODEL.

10 SHEETS—SHEET 7.



Witnesses:  
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No. 765,016.

PATENTED JULY 12, 1904.

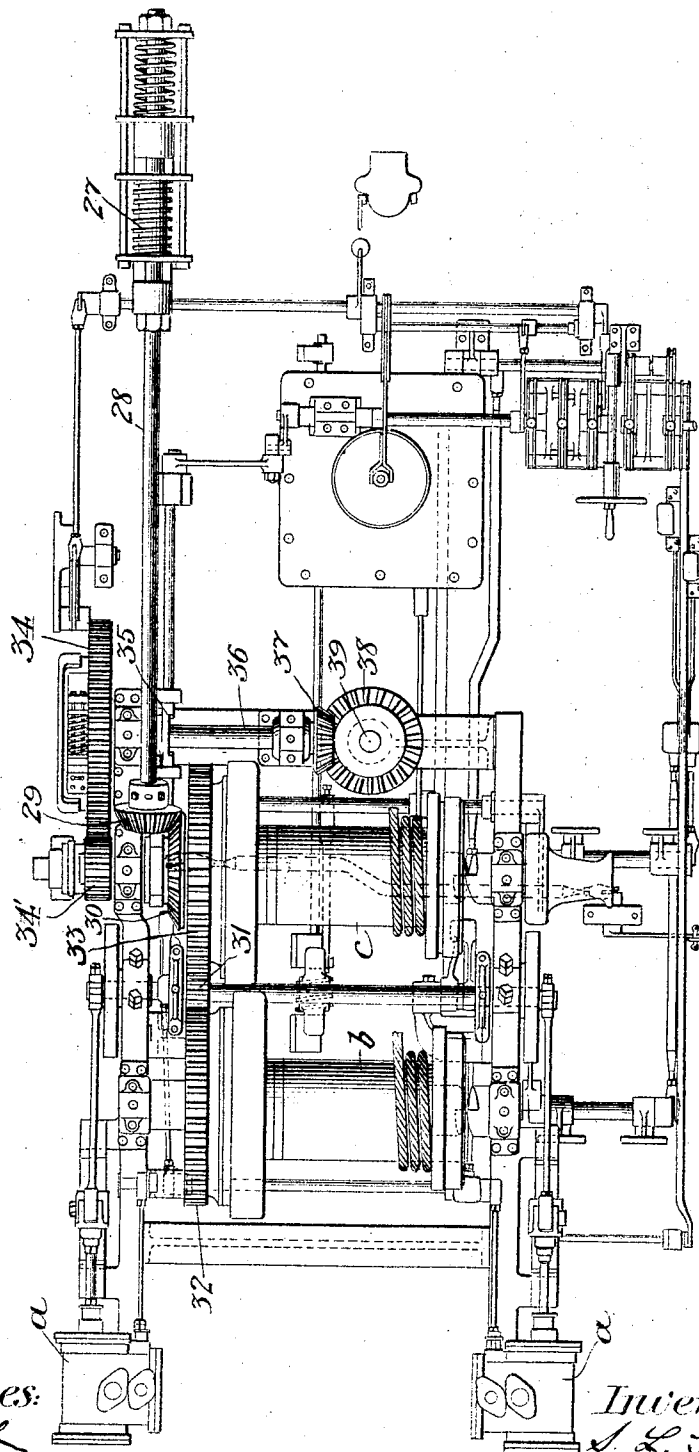
S. L. G. KNOX.  
PILE DRIVER.

APPLICATION FILED MAR. 8, 1904.

NO MODEL.

10 SHEETS—SHEET 3.

Fig. 10.



Witnesses:

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No. 765,016.

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S. L. G. KNOX.

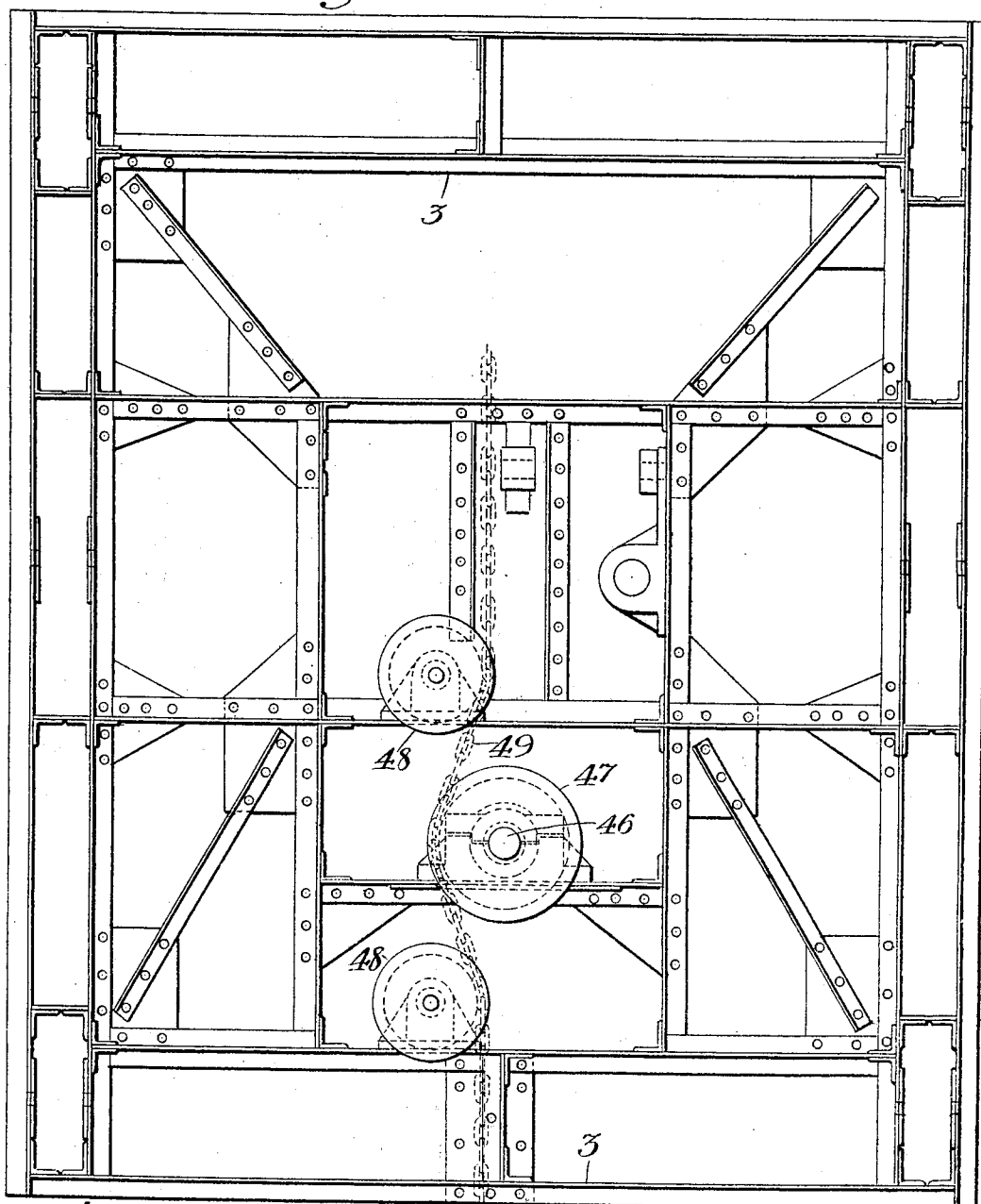
PILE DRIVER.

APPLICATION FILED MAR. 8, 1904.

NO MODEL.

10 SHEETS—SHEET 9.

*Fig. II.*



Witnesses:

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No. 765,016.

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S. L. G. KNOX.  
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APPLICATION FILED MAR. 8, 1904.

NO MODEL.

10 SHEETS—SHEET 10.

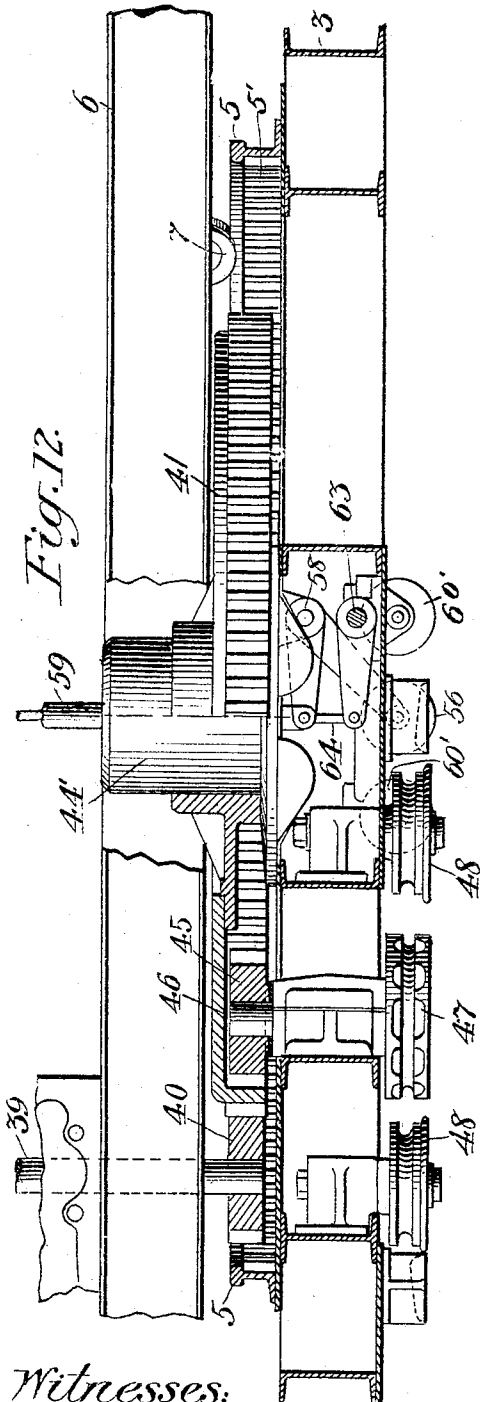


Fig. 12.

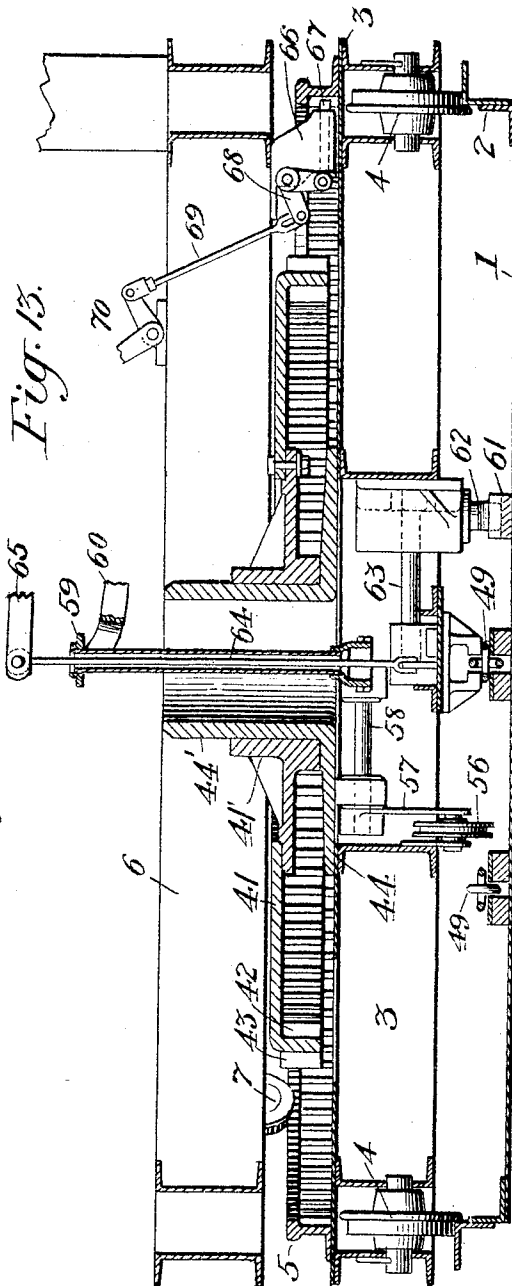


Fig. 13.

Witnesses:  
*J. E. Hutchinson*  
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Inventor:  
*S. L. G. Knox,*  
*by James Goldsmith*  
*Att'y*

# UNITED STATES PATENT OFFICE.

SAMUEL L. GRISWOLD KNOX, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO THE BUCYRUS COMPANY, OF SOUTH MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

## PILE-DRIVER.

SPECIFICATION forming part of Letters Patent No. 765,016, dated July 12, 1904.

Application filed March 8, 1904. Serial No. 197,080. (No model.)

*To all whom it may concern:*

Be it known that I, SAMUEL L. GRISWOLD KNOX, a citizen of the United States, residing in Milwaukee, county of Milwaukee, State of Wisconsin, have invented certain new and useful Improvements in Pile-Drivers; 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 appertains to make and use the same.

This invention relates to pile-drivers, and more particularly to railway pile-drivers in which the operating mechanism is mounted upon a flat-car for longitudinal and rotary adjustment and the pile-driver proper is designed to be folded back upon its supporting-deck to lie within the length of the car when the apparatus is to be transported or when the same is not in use.

The object of the invention is to improve and simplify the leader raising and controlling mechanism and to provide a more efficient and readily-operable apparatus for traversing the deck and its supporting-carriage longitudinally of the car-body, together with means for rotating the deck on its carriage, and to improve the several devices for locking the adjustable parts of the mechanism in any desired position, all so arranged that the apparatus when in use may be adjusted to properly drive vertical or batter piles through a comparatively wide range of action on all sides of the car and the leaders and their supporting-frame may be lowered and swung backward along the deck for transportation.

In the accompanying drawings, Figure 1 is a side elevation of the improved pile-driver, the leader mechanism being shown in full lines in its folded or lowered position and in one of its operative positions by dotted lines. Fig. 2 is a plan view of the deck and its appurtenances, showing the leaders folded for transportation. Fig. 3 is an enlarged end view of the apparatus. Fig. 4 is a side elevation, partly in section, of the leader end of the pile-driver, showing the relation of the leader apparatus in the operation of folding. Fig. 5 is an under plan view of the mechanism for driving the car, together with the

traversing and locking apparatus for the carriage. Fig. 6 is a vertical longitudinal section of the car and the carriage. Figs. 7 and 8 are side and front elevations, respectively, of the leader-frame. Fig. 9 is an enlarged side elevation of the power plant and the controlling apparatus on the deck. Fig. 10 is a plan view thereof. Fig. 11 is an enlarged under plan view of the carriage-frame, showing the relation of the main driving-chain and the chain-wheel operated thereby. Figs. 12 and 13 are longitudinal and transverse sections of the carriage and the deck, showing the actuating and controlling mechanism. Fig. 14 is a detail view of the chain-lock. Figs. 15 and 16 are side elevations and plan views, respectively, of the deck-lock.

Referring to the drawings, the numeral 1 indicates a flat-car provided on its top with rails 2, running longitudinally thereof, upon which is supported a carriage 3, having wheels 4. Secured to the upper side of the carriage is a circular track 5, provided with a rack 5' around its inner circumference below the head of the track-rail. Mounted for rotary movement upon said track by means of wheels or rollers 7 is a platform or deck 6 of substantially the length of the flat-car and provided with side trusses 6' to strengthen said deck and prevent it sagging at the ends. Mounted upon said deck adjacent to the forward end thereof is a framework 8, having tracks 9 along its top, said framework being rigidly secured to the trusses 6' by braces 9' 9'.

A rectangular framework 10, hinged to the deck near the forward end thereof by suitable pivots 11, constitutes a rocker-frame to which the leader-frame 13 is hinged at the other end. Said leader-frame consists of a tower-like structure having at its upper end a bearing-socket 15', to which the leaders 16, which may be of any preferred construction, are pivoted by means of a stub-shaft 15, so as to permit said leaders to be adjusted or slewed laterally to either side of the vertical, as is common in pile-driver constructions designed to operate upon batter-piles.

Connected to opposite sides of the leader-frame 13 and intermediate to the ends thereof, by means of suitable pins 18, are leader-operating arms 17 17', which are provided on the lower edges with racks 17'. The outer ends of the pivot-pins 18 are provided with rollers 19, which are adapted to engage the tracks 9 as the leader-frame is lowered.

A counter-shaft 24, journaled in pillow-blocks on the frame 8, is provided with a driving-gear 26, which meshes with a worm 27 upon a shaft 28, preferably taking power from the engine or other suitable motor of the pile-driver apparatus. Secured to said shaft 24 are gears 25, meshing with the rack 17' on the arms 17 and serving to advance and retract said arms in the operation of raising and lowering the leader-frame. In order to retain the racks in proper contact with the gears 25 and at the same time to allow the arms to have a free sliding motion in the line of their longitudinal axis, there are pivoted upon said shaft 24 two saddle-blocks 20, each comprising two side plates mounted upon opposite sides of its corresponding gear 25 and connected at their upper corners by pins 21, upon which are mounted antifriction rollers or sleeves 21', engaging the upper side of arm 17. The center of each block is pierced with a hole adapted to be brought into registry with any one of a series of holes 23 in the arm 17 and to receive a locking-pin 22, which passing through the registering holes secures the corresponding arm and the leader-frame and the leaders in any position to which they may have been adjusted.

In the form of my invention illustrated the power-shaft 28 is driven from the engine or other motor which operates the pile-driver mechanism, as illustrated in Figs. 9 and 10. Said shaft is provided at one end with a bevel-pinion 29, meshing with a corresponding bevel-gear 30, which is adapted to be coupled to the shaft of one of the winding-drums *c* by suitable clutch mechanism. Said drum *c* together with its companion drum *b* are adapted to be actuated in the manner common to apparatus of this character by gears 33 and 32, respectively, which are driven by a common gear 31 on the crank-shaft of engines *a a*. It is to be understood, of course, that the drums are coupled with and uncoupled from their respective driving-gears by the usual clutch mechanism.

Journaled on the engine-frame just forward of the drums is a counter-shaft 36, to which motion is imparted by the pinion 34, meshing with gear 34'. The inner end of said shaft is provided with a bevel-gear 37, driving a bevel-pinion 38, mounted upon a vertical shaft 39, carried by the deck, and having on its lower end a gear 40, which meshes with the teeth on the outer periphery of a floating gear 41. Said floating gear comprises an annular casting having gear-teeth 42 and 43 on the inte-

rior and exterior sides of its rim and a central hub 41', which is journaled upon a central casting 44, bolted to the carriage-frame. Said casting 44 is provided with an enlarged hollow pintle 44', through which passes certain of the controlling-levers, hereinafter referred to. Journaled on the carriage-frame 3 is a vertical shaft 46, to the upper end of which is secured a pinion 45, meshing with the teeth on the inside of the floating gear 41. On the lower end of said shaft 46 and lying below the carriage-body is a chain-wheel 47, preferably formed as a pocket-sheave, and adjacent to the same are two idler-sheaves 48 48', which serve to hold a chain 49 in operative engagement with said pocket-sheave 47. The chain 49 is mounted on top of the car-body and passes around the idler chain-wheels or sheaves 50 and 51 at opposite ends of the latter, and intermediate the sheave aforesaid said chain engages a chain-wheel 80, mounted upon a horizontal shaft 81, upon which are secured chain-wheels 82 83, which latter are connected by drive-chains to loose chain-wheels 84 85 on the respective axles of the car. Said chain-wheels 84 and 85 are adapted to be coupled to the axles by means of suitable clutches 87 86, controlled by appropriate lever mechanism, and when said chain-wheels are clutched to the axles the car is driven in either a forward or a backward direction from the endless chain 49, which in turn receives its motion from the prime mover on the deck of the pile-driver.

Mounted upon the car-body adjacent to the idler 51 is a chain-lock 53, having a sliding member 53', adapted to engage the chain 49 and arrest the movement thereof. Said chain-lock is operated by a cable 54, secured at one end to the movable member 53' thereof by means of a bell-crank 53'' and at the other end to the rear of the car-body, as at 55, Fig. 5. Said cable between its attachments to the car-body and the chain-lock passes over a sheave or roller 56, which is mounted upon a crank-arm 57, secured to a shaft 58, mounted on the carriage-body and adapted to be rotated to lift the sheave 56, and thereby tighten the cable and set the chain-lock by means of a hollow link or rod 59, passing through the center casting of the carriage and connected with a suitable lever 60 on the deck. Idler-sheaves 60' 60', disposed on opposite sides of the tightener-sheave 56, serve to hold the cable in operative engagement therewith.

In order to prevent the rotation of the deck on the carriage, a deck-lock secured to the under side of the deck is adapted to engage the teeth on the inner side of the track-rail 5 at any position of the deck. Said deck-lock, which is illustrated in detail in Figs. 15 and 16, consists of a body portion 66, provided with a series of spring-pressed bolts 67, connected to a bell-crank 68, which in turn is

connected by a link 69 and a second bell-crank 70 to a controlling-lever on the deck.

For the purpose of securing the carriage to the car-body a rack 61 is secured to the latter throughout its length and is adapted to be engaged by a bolt 62 of a traversing lock, which bolt is adapted to be retracted from engagement with the rack by a bell-crank 63, connected thereto at one end and to a link 64 at the other, which latter link is operatively connected to a controlling-lever on the deck.

In the normal operation of my apparatus the leaders occupy the position shown in dotted lines in Fig. 1, under which conditions the pile-driver will drive the piles vertically. If, however, it is desired to drive batter or inclined piles, the leader-frame is slewed on its pivot 15, to the right or left as the case may be, or, if the inclination of the piles is forward—that is, away from the front end of the pile-driver—the leader-frame is given a slight backward inclination by retracting the rack-arms 17 and locking the latter to the saddle-blocks in the desired adjustment. To lower the leader-frame and the leaders, the shaft 28 is clutched to its driving-gear and shaft 24, with its pinions 25 25, rotated thereby, so that the rack-arms 17 are drawn backward toward the rear of the deck. This action first swings the leader-frame backward around the pivots 12 until the rollers 19 on the trunnions 18 rest upon the tracks 9. As soon as the trunnion-rollers strike the tracks the rocker-frame commences to rise, turning about the pivots 11, the feet of the leader-frame continuing to rise, swinging through an arc of a circle, the trunnions 18 moving backward in a straight path along the tracks 9 and the top of the leader-frame swinging downward and backward until the rocker-frame 10 is vertical and the leader-frame and the leaders are lying flat along the top of the deck-trusses and parallel with the top thereof, with the trunnions 19 engaging the tracks 9. By this means the leader-frame and the leaders are disposed of, so that when depressed and lying flat in shape for transportation they lie wholly within the length of the car and will not interfere with bridges or tunnels under or through which the pile-driver may pass. The lifting operation to restore the pile-driver to working relation is the reverse of the above.

As above described, the car is preferably self-propelling, and the operation of the mechanism to drive the car is substantially as follows: The deck-lock 66 is caused to engage the circular rack 5' on the track 5, which locks the deck to the carriage. Traversing lock 62 is engaged in the rack 61, thereby locking the carriage to the car-body. Chain-lock 53 is disengaged from the chain 49, and the latter is driven by chain-wheel 47, which is rotated with its shaft 46 and pinion 45 from the floating gear 41, which latter is rotated upon the center casting 44 by gear 40 meshing with the

teeth on the outside of said floating gear, rotation being imparted to said gear 40 by means of beveled gears 37 and 38, shaft 36, and gear 34, the latter being rotated by suitable gear connection with the prime mover on the deck and coupled to its shaft 36 by appropriate clutch mechanism, as heretofore described. The deck 6 is held immovable in respect to the carriage and the carriage immovable with respect to the car-body, while the floating gear drives the chain-wheel 47 and causes the chain 49 to move longitudinally of the car-body about the idler-sheaves 50 and 51 and at the same time to drive the horizontal shaft 81 by means of chain-wheel 80, and the rotary motion of said shaft is transferred by means of chain-wheels 82 and 83 and connecting drive-chains to the chain-wheels 84 and 85, which have been clutched to the respective car-axes. It will be apparent, of course, that by reversing the prime mover the direction of motion of the car may be reversed at will, and by disengaging the clutches 86 and 87 from the chain-wheels on the axles the movement of the car may be arrested.

By locking the deck-lock 66 and the chain-lock 53, leaving the traversing lock 62 open or disengaged from the rack 61, the deck is rendered immovable with respect to the carriage and the chain immovable with respect to the car-body. This converts the chain into a rack, along which the chain-wheel or pocket-sheave 47 travels, carrying with it the carriage when the shaft 46 is turned through pinion 45 and the floating gear 41, which latter is driven through gears 40, 38, 37, and 34, which are connected by clutch or other means with the prime mover, as hereinbefore described. By locking the traversing lock 62 and the chain-lock 53 and disengaging the deck-lock 66 from the circular rack 5' the chain and the carriage are rendered immovable with respect to the car-body. The pocket-sheave 47 is held immovable by the chain. The floating gear 41 is held immovable with respect to the carriage by the pinion 47. Pinion 40, however, which is driven by its shaft 39, which is geared to the prime mover, as above described, in its rotation travels around the circumference of the floating gear and causes the deck, to which said pinion and its shaft 39 are secured, to rotate on the carriage, and thereby to swing the leaders to any desired position about the casting 44 as a center.

What I claim is—

1. In a pile-driver, the combination of a supporting-platform or deck, a leader-frame, leaders carried thereby, a rocker-frame hinged to the leader-frame at one end and to the deck at the other end, and means connected to the leader-frame, whereby the latter may be raised and lowered.

2. In a pile-driver, the combination of a supporting-platform or deck, a leader-frame, leaders carried thereby a rocker-frame hinged

to the leader-frame at one end and to the deck at the other end, arms connected to the leader-frame, and means for retracting and advancing said arms to lower and raise the leader-frame.

3. In a pile-driver, the combination of a supporting-platform or deck, a leader-frame, leaders carried thereby, a rocker-frame hinged to the leader-frame at one end and to the deck at the other end, arms provided with racks connected to the leader-frame, and a power-shaft provided with gears meshing with said racks to raise and lower said leader-frame.

4. In a pile-driver, the combination of a supporting-platform or deck, a leader-frame, leaders carried thereby, a rocker-frame hinged to the leader-frame at one end and to the deck at the other end, arms provided with racks connected to the leader-frame, a power-shaft provided with gears meshing with said racks, and saddle-blocks pivoted on said shaft to retain the racks in engagement with the gears and guide the leader-frame-operating arms in their longitudinal movement.

5. In a pile-driver, the combination of a supporting-platform or deck, a leader-frame, leaders carried thereby, a rocker-frame hinged to the leader-frame at one end and to the deck at the other end, rack-arms pivoted to the leader-frame for raising and lowering the latter, rollers on the leader-frame, and tracks mounted above the deck and engaged by said rollers while the leader-frame is being moved to or from folded position.

6. In a pile-driver, the combination of a supporting-platform or deck, a leader-frame, leaders carried thereby, a rocker-frame hinged to the leader-frame at one end and to the deck at the other end, rack-arms pivoted to the leader-frame for raising and lowering the latter, rollers on the pivots connecting the rack-arms and the leader-frame, and tracks mounted above the deck and engaged by said rollers while the leader-frame is being moved to or from folded position.

7. In a pile-driver, the combination of a supporting-platform or deck, a leader-frame, leaders carried thereby, a rocker-frame hinged to the leader-frame at one end and to the deck at the other end, rack-arms pivoted to the leader-frame for raising and lowering the latter, a power-shaft having gears meshing with said rack-arms, saddle-blocks pivoted on said power-shaft to retain the racks in mesh with said gears, rollers on the leader-frame, and tracks mounted above the deck and engaged by said rollers while the leader-frame is being moved to or from folded position.

8. In a pile-driver, the combination of a supporting-platform or deck, a leader-frame, leaders carried thereby, a rocker-frame hinged to the leader-frame at one end and to the deck at the other end, arms provided with racks connected to the leader-frame, a power-shaft provided with gears meshing with said racks,

saddle-blocks pivoted on said shaft to retain the racks in engagement with the gears and guide the leader-frame-operating arms in their longitudinal movement, and means for locking the rack-arms and saddle-blocks together to hold the leader-frame in any desired position.

9. In a pile-driver, the combination of a car-body, a carriage mounted for longitudinal movement on said car-body, a deck revolvably mounted on said carriage, an endless chain carried on the car-body, means for driving the same, and means for locking the chain and carriage to the car-body and the deck to the carriage.

10. In a pile-driver, the combination of a car-body, a carriage mounted for longitudinal movement on said car-body, a deck revolvably mounted on said carriage, a floating gear mounted between the carriage and the deck, an endless chain carried on the car-body, gearing carried by the deck cooperating with said floating gear, gear connections between said floating gear and the endless chain, and means for locking the chain and carriage to the car-body and the deck to the carriage.

11. In a pile-driver, the combination of a car-body, a carriage mounted for longitudinal movement on said car-body, a deck revolvably mounted on said carriage, a floating gear mounted between the carriage and the deck, an endless chain carried on the car-body, gearing carried by the deck cooperating with said floating gear, gear connections between said floating gear and the endless chain, a chain-lock to hold the chain immovable with respect to the car-body, a deck-lock to secure the deck to the carriage, a traversing lock to lock the carriage to the car-body, and independent means for controlling the several locks.

12. In a pile-driver, the combination of a car-body, a carriage mounted for longitudinal movement thereon, a deck revolvably mounted on said carriage, a floating gear having inner and outer peripheral teeth interposed between the deck and the carriage, a shaft journaled on the deck, geared at one end with a prime mover and having at the other end a pinion meshing with the outside rim of said floating gear, a shaft journaled on the carriage and provided on one end with a pinion meshing with the inside rim of the floating gear and a chain-wheel on the other end, an endless chain on the car-body engaging said chain-wheel, and locks by means of which the chain and carriage may be rendered immovable with respect to the car-body and the deck immovable with respect to the carriage.

13. In a pile-driver, the combination of a car-body, an endless chain mounted thereon, a chain-wheel engaging said chain and geared to the car-axles, a carriage mounted on said car-body, a deck carried by said carriage, a floating gear between the deck and the carriage, a prime mover on said deck, gearing

connecting said prime mover and said floating gear, gearing connecting the floating gear and the endless chain, a lock to hold the carriage immovable with respect to the car-body, and a lock to hold the deck immovable on the carriage, whereby the axles of the car may be driven from the prime mover through the floating gear and the endless chain.

14. In a pile-driver, the combination of a car-body, an endless chain mounted thereon, a chain-wheel engaging said chain and geared to the car-axles, a carriage mounted on said car, a deck carried by said carriage, a floating gear having teeth on the interior and exterior of its periphery, a prime mover on the deck, a shaft on the deck geared to the prime mover and the exterior of the floating gear, a shaft on the carriage geared to the interior of the floating gear and the endless chain, a lock to hold the carriage immovable on the car-body, and a lock to hold the deck immovable on the carriage, whereby the car-axles are driven from the prime mover through the floating gear and the endless chain.

15. In a pile-driver, the combination of a car-body, an endless chain mounted thereon, a carriage mounted on said car-body, a deck carried by said carriage, a floating gear between the deck and the carriage, a prime mover on said deck, gearing connecting said prime mover and said floating gear, gearing connecting the floating gear and the endless chain, a lock to hold the endless chain immovable on the car-body, and a lock to hold the deck immovable on the carriage, whereby the prime mover acting through the floating gear and the stationary chain will move the carriage longitudinally of the car-body.

16. In a pile-driver, the combination of a car-body, an endless chain mounted thereon, a carriage mounted on said car-body, a deck carried by said carriage, a floating gear between the deck and the carriage, having teeth on the interior and exterior of its periphery, a prime mover on the deck, a shaft on the deck

geared to the prime mover and the exterior of the floating gear, a shaft on the carriage geared to the interior of the floating gear and the endless chain, a lock to hold the endless chain immovable on the car-body and a lock to hold the deck immovable on the carriage, whereby the prime mover acting through the floating gear and the stationary chain will move the carriage longitudinally of the car-body.

17. In a pile-driver, the combination of a car-body, an endless chain mounted thereon, a carriage mounted on said car-body, a deck carried by said carriage, a floating gear between the deck and the carriage, a prime mover on said deck, gearing connecting said prime mover and said floating gear, gearing connecting the floating gear and the endless chain, a lock to hold the chain immovable on the car-body, and a lock to hold the carriage immovable on the car-body, whereby the floating gear will be held stationary and the deck will be rotated on the carriage by the prime mover.

18. In a pile-driver, the combination of a car-body, an endless chain mounted thereon, a carriage mounted on said car-body, a deck carried by said carriage, a floating gear having teeth on the interior and exterior of its periphery, a prime mover on the deck, a shaft on the deck geared to the prime mover and the exterior of the floating gear, a shaft on the carriage geared to the interior of the floating gear and to the endless chain, a lock to hold the chain immovable on the car-body, and a lock to hold the carriage immovable on the car-body, whereby the floating gear will be held stationary and the deck will be rotated on the carriage by the prime mover.

In testimony whereof I affix my signature in presence of two witnesses.

SAMUEL L. GRISWOLD KNOX.

Witnesses:

W. J. RYAN,  
PHILIP KNOLL.