W. FERRIS.

LOCOMOTIVE FOR SELF PROPELLED PILE DRIVERS AND THE LIKE.

APPLICATION FILED MAY 8, 1911.

1,017,624.

Patented Feb. 13, 1912.

5 SHEETS—SHEET 1.

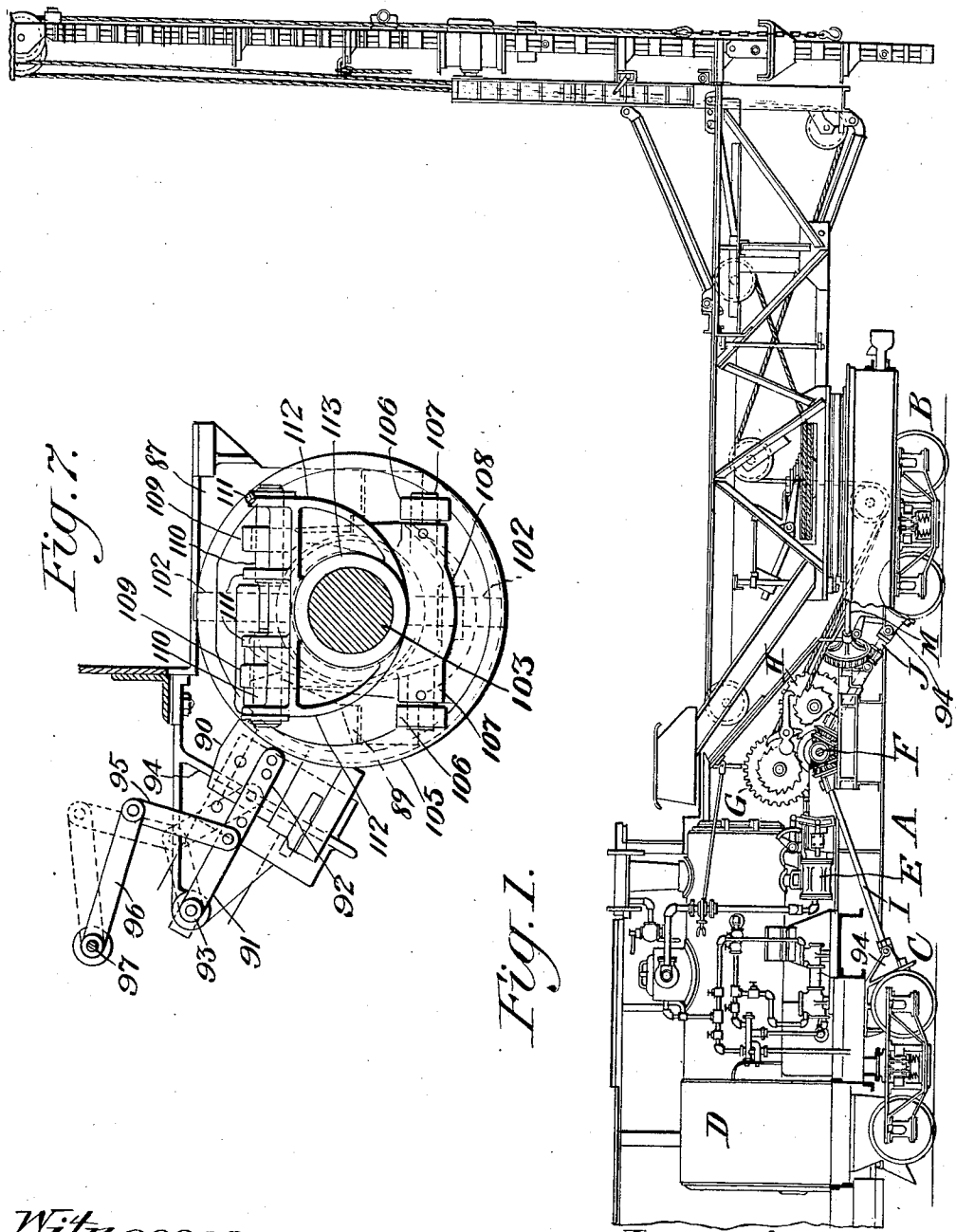

Fig. 1.

Fig. 2.

Witnesses.

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N. M. Dorn.

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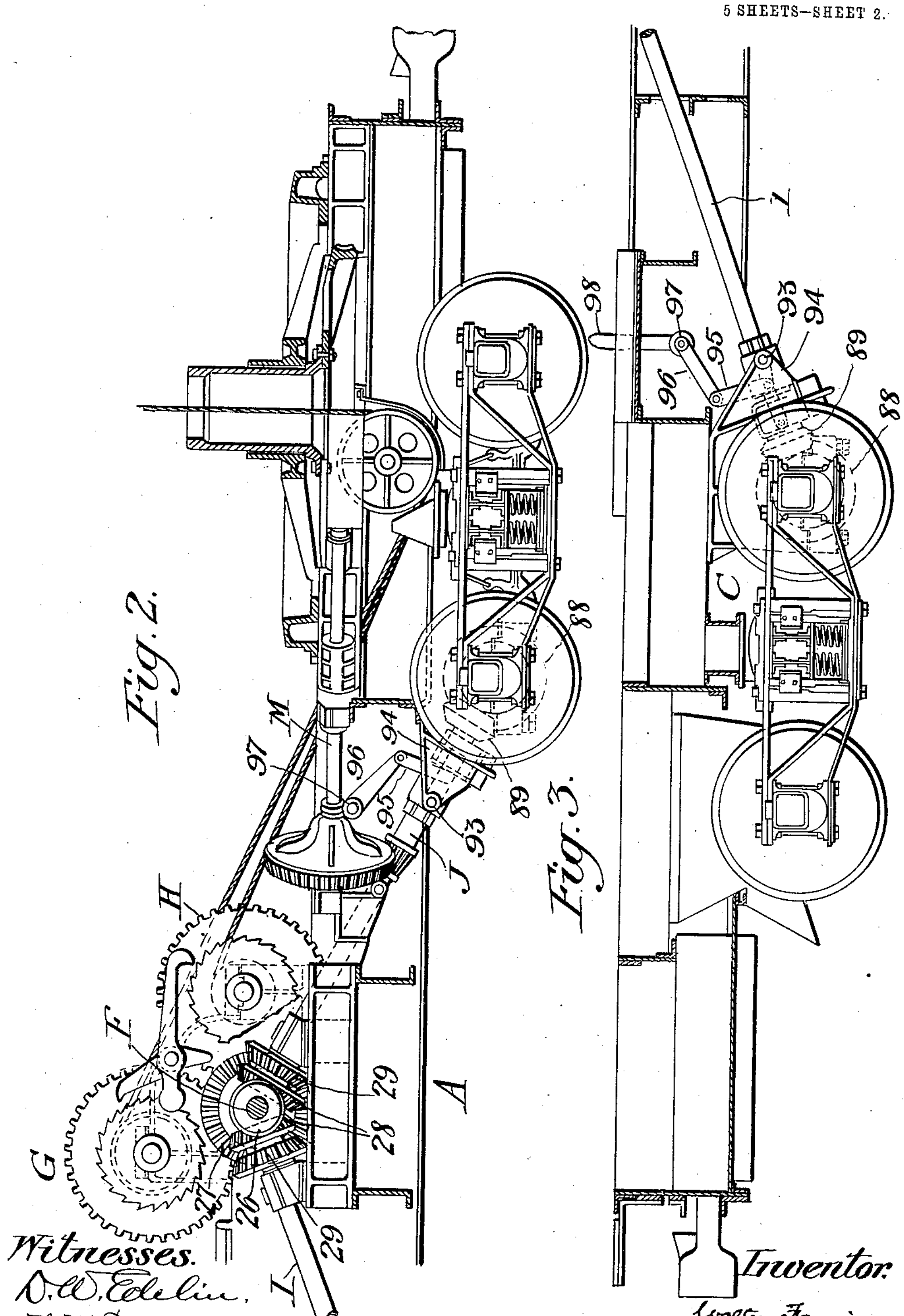

Witnesses.
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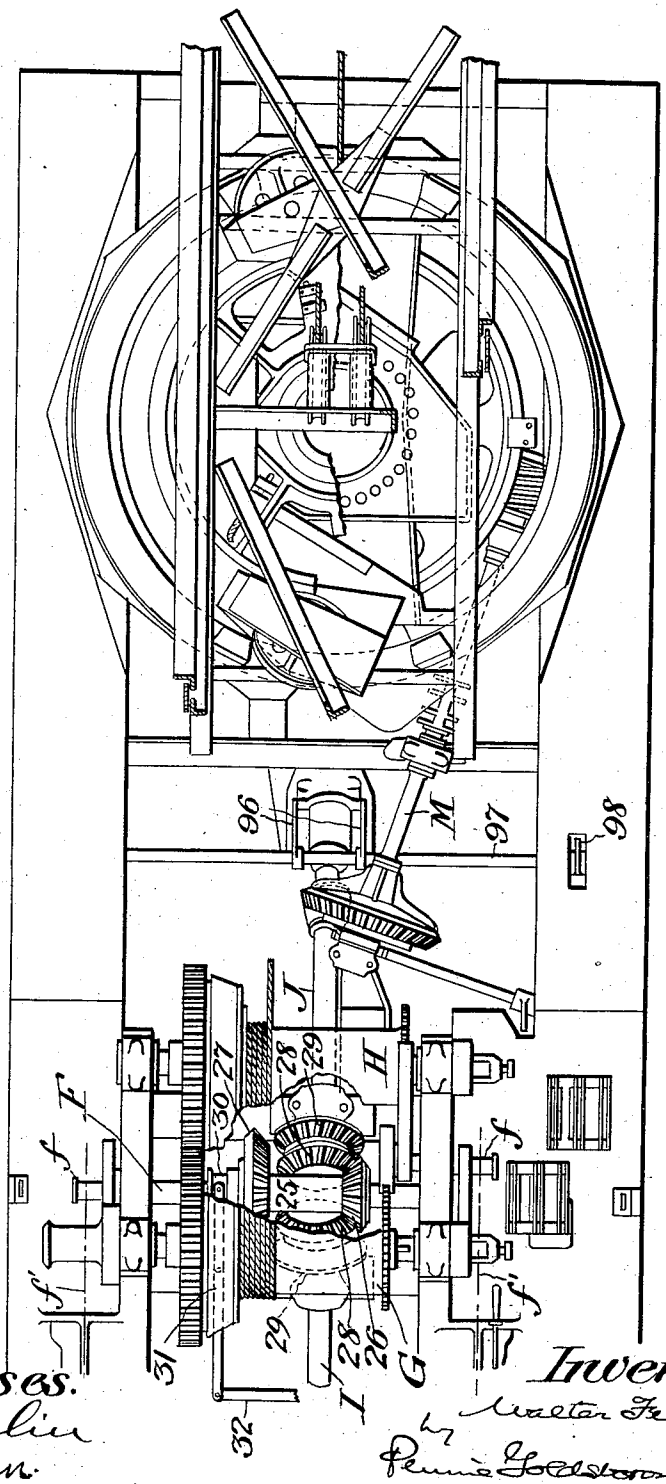
Fig. 4.



Witnesses.
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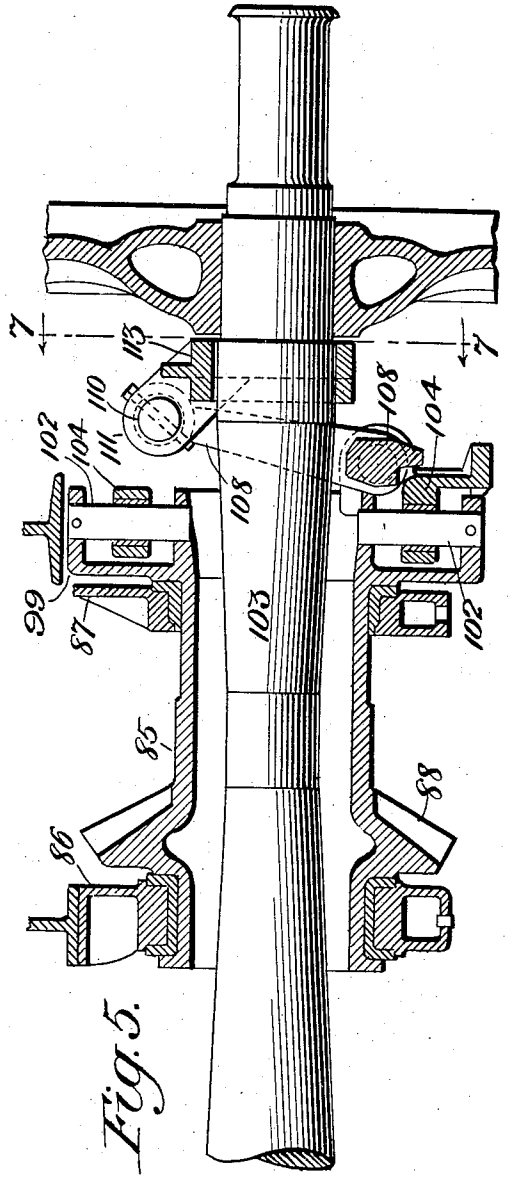

Fig. 5.

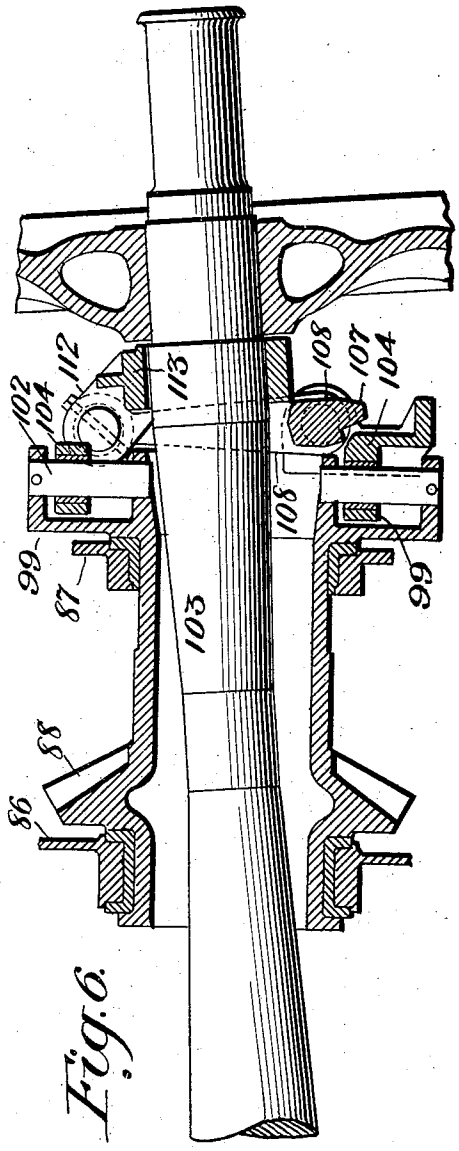

Fig. 6.

Witnesses.
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5 SHEETS—SHEET 5.

Fig. 8.

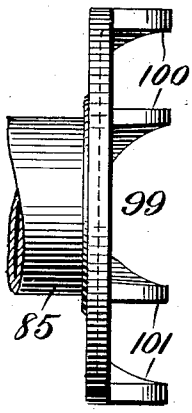


Fig. 9.

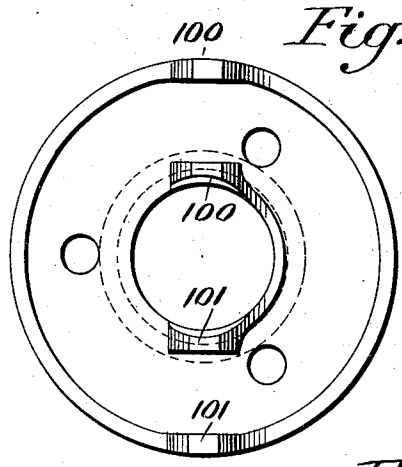


Fig. 10.

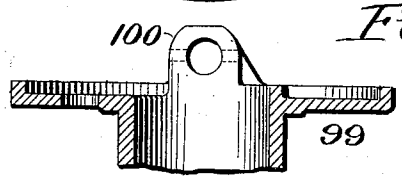


Fig. 11.

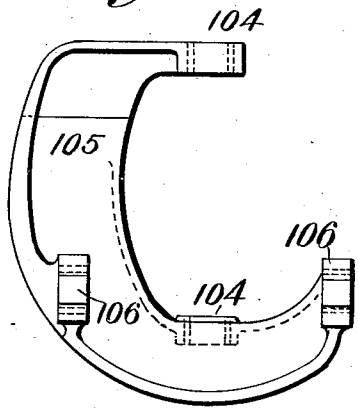


Fig. 12.

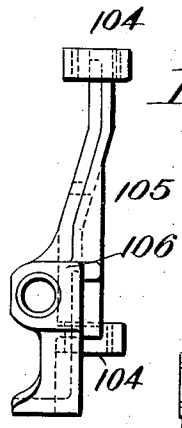


Fig. 13.

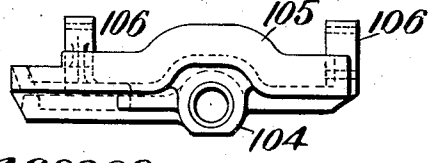
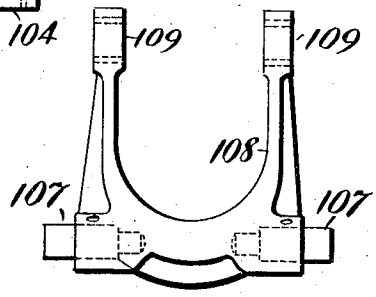


Fig. 14



Witnesses.

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UNITED STATES PATENT OFFICE.

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LOCOMOTIVE FOR SELF-PROPELLED PILE-DRIVERS AND THE LIKE.

1,017,624. Specification of Letters Patent. **Patented Feb. 13, 1912.**

Original application filed April 18, 1910, Serial No. 556,163. Divided and this application filed May 8, 1911. Serial No. 625,863.

To all whom it may concern:

Be it known that I, WALTER FERRIS, a citizen of the United States, residing at South Milwaukee, county of Milwaukee, State of Wisconsin, have invented certain new and useful Improvements in Locomotives for Self-Propelled Pile-Drivers and the Like; 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 locomotives of the type comprising a self propelled railway car carrying pile driving or similar mechanism.

Although my invention can be used advantageously in connection with steam shovels and various machines other than pile drivers, I have illustrated the same as embodied in a railway pile driver of the type shown in my application Serial Number 556,163, filed April 18, 1910, of which the present application is a division; and I shall describe the invention, by way of example, in that connection.

The invention purposes the provision of improved propelling mechanism interposed between one or more prime movers on the car body and a driving axle of the forward or rear truck or axles of both trucks. This mechanism preferably comprises inclined driving shafts extending downward from the transverse crank shaft of a prime mover and adapted to be coupled to the latter by mechanism that will produce a driving of said shafts at different speeds, it also being possible to uncouple the inclined shafts entirely from the operating crank shaft. At their lower extremities, the inclined driving shafts carry gears that mesh with other gears connected with the front axle of the rear truck and the rear axle of the front truck respectively, and means are provided to engage and disengage these gears so that the propelling mechanism may be uncoupled when the machine is being used to drive piles.

In particular, the improved propelling gear embodies a superior form of universal joint that is interposed between the car axle and a quill driven by one of the gears previously mentioned and rotatable in fixed bearings depending from the frame of the car body. The car axle passes through said quill with clearance in all directions, and the universal joint is so constructed that when the corresponding driving shaft is coupled to the quill, the proper torque will be transmitted to the axle irrespective of its different angular positions with respect to the quill, due to passing around curves and inequalities in the road bed, and irrespective of movements of translation of the car axle within the quill.

When the pile driver is to be shipped from place to place in a train, that is to say, not by its own motive power, the driving shafts of the propelling gear are disconnected and the rotation of the axles due to the rolling of the wheels on the track will only cause the rotation of the driving quills in their respective bearings.

In the accompanying drawings: Figure 1 is a side elevation, partly in longitudinal section, of a railway pile driver embodying my improvements. Fig. 2 is an enlarged side elevation, partly in section, of the main part of the propelling mechanism, illustrating its connection with the forward truck. Fig. 3 is a similar view showing the connection of the rear driving shaft to the rear truck. Fig. 4 is a top plan view of the parts shown in Fig. 2. Fig. 5 is a vertical longitudinal section of the driving mechanism associated with one of the car axles, including the universal joint. Fig. 6 is a horizontal longitudinal section through the parts shown in Fig. 5, the quill and universal joint being turned through 90° and the axle shown as on a curve. Fig. 7 is a section on line 7—7 of Fig. 5, showing the means for sliding the gear on the forward shaft into and out of engagement with that on the quill of the rear axle of the forward truck. Figs. 8, 9, 10 are detail views of the driving flange on the quill. Figs. 11, 12 and 13 are details of the toggle casting embodied in the universal joint, and Fig. 14 is a detail view of the yoke forming a further part of the universal joint.

The machine illustrated in the drawings comprises a car body A which carries the pile driving mechanism shown, but which might just as well carry a steam shovel or other mechanism. The car body travels on the railway track by means of front and

rear wheeled trucks B, C. One or more prime movers may be mounted on the car for effecting the propulsion thereof and the operation of the pile driver or other mechanism, and in the present instance I have illustrated two engines E arranged near the center of the car and at opposite sides thereof, said engines being supplied with steam from a suitable boiler D. The engines are connected by connecting rods (not shown) with a transverse crank shaft F which is not only adapted to operate the hoisting drums G, H, (which in the embodiment shown are adapted to hoist the pile hammer, and to hoist piles), but also to drive forwardly and rearwardly directed inclined driving shafts I, J, by means of which the front axle of the rear truck C and the rear axle of the front truck B are driven when it is desired to propel the machine for some distance by its own power or "spot" the same with respect to the piles. In the machine shown, the forward driving shaft J is adapted to be coupled to and uncoupled from a shaft M for operating the leaders of the pile driver, but of course this arrangement is not material to the purposes of the present application.

Referring to Fig. 4 it will be seen that the transverse operating shaft F is provided at its intermediate portion, beneath the hoisting drums, with a longitudinally slidable sleeve or quill 25 to the ends of which beveled gears 26, 27 are secured, the gear 26 being smaller than the gear 27. Although the sleeve 25 is slidable along the operating shaft it is suitably keyed thereon in order that it may be rotated by the rotation of said shaft. Coacting with the smaller gear are similar bevel gears 28 fixed at the upper ends of the driving shafts I, J, respectively, the upper ends of said shafts being suitably journaled in fixed bearings on the car body. Adjacent the end gears 28 on the driving shafts are similar gears 29 which are of about the same size as said gears 28 in the embodiment shown and are designed to coact with the larger sleeve gear 27. The sleeve 25 is provided at one end with a collar 30 that is secured to a pivoted forked rod 31, to which motion is transmitted by means of a rod 32 in connection with an appropriate lever (not shown), so that the sleeve 25 may be slid lengthwise on the operating shaft in order to engage its small gear 26 with the gears 28 of the driving shafts, in which case the driving shafts will be driven at a comparatively slow speed, or the larger gear 27 at the opposite end of said sleeve may be engaged with the gears 29 on the respective driving shafts, with the result that a much faster speed will be imparted to said shafts. The fast speed is used when it is necessary to propel the pile driver from place to place under its own motive power, while the slow speed is used in accurately spotting the machine with respect to the piles to be operated upon. It is evident that by suitably manipulating the lever connections 32—31, which are merely indicated by way of example, the sleeve 25 may be shifted to an intermediate position wherein its gears will not engage any of the gears on the driving shafts, so that the rotation of the main shaft F will have no effect on the driving shafts. Fig. 4 illustrates clearly the cranks *f* on the ends of the shaft F, and the positions of the connecting rods, which are omitted in this view, are indicated by the dotted lines *f'*.

Turning now to the detailed construction of the mechanism to transmit movement from the inclined driving shafts I, J, to the driving axles of the respective trucks, it will be noted that each of said axles extends through a quill 85 (Figs. 5 and 6) which is journaled at its ends in suitable fixed hangers 86, 87 extending down from the under frame of the car.

The quills of the forward axle of the rear truck and of the rear axle of the forward truck are similarly constructed and arranged, and a description of one will suffice. Each quill is formed with an integral bevel gear 88 that is adapted to be engaged by a smaller bevel gear 89 keyed to the lower extremity of the corresponding inclined driving shaft but slidable therealong.

Referring particularly to Fig. 7, which illustrates the connections with the driving axle of the forward truck, it will be observed that the driving gear 89 is carried by a sliding bearing 90 that slides along in machined ways formed on bracket 94 and said bearing is connected by means of toggle levers 91—92 with a fixed pivot 93 carried by housing or bracket 94, which supports and protects the shifting mechanism of the bevel gear 89. The toggle levers 91—92 are connected to an operating lever 95 that is actuated from a crank 96 applied to a transverse shaft 97 journaled in the car frame, as shown in Figs. 4 and 7. The toggle levers 91, 92 and 95, and the operating cranks 96 are arranged in pairs at opposite sides of the sliding sleeve 90, and when the cross shaft 97 is rocked by means of a suitable hand lever 98 (Fig. 4), in such a direction as to raise the cranks 96, the toggle joint will be collapsed, thereby raising the gear 89 out of engagement with the gear on the quill. On the other hand, a movement imparted to the lever 98 in the opposite direction will restore the parts to the position shown in full lines in Fig. 7, wherein the toggle is shown as spread in order to effect the engagement of the gears and the driving of the quill from the driving shaft. Substantially the same arrangement of parts is used in connection with the driving axle of the rear

truck, and I have used the same reference characters to apply to the parts. It might be said, however, that the described arrangement of the rock shafts and the operating levers for the toggles is entirely immaterial to the invention.

At one end of the quill 85, viz., the end nearest the car wheel, said quill has formed thereon a driving flange 99, which is shown in detail in Figs. 8 to 10. It will be noted that this flange is provided with diametrically arranged pairs of perforated lugs 100, 101, and in the lugs of each pair is fitted a pin 102 that is offset from the face of the flange and extends radially thereof. At its central portion, the driving flange 99 is hollow to enable the car axle 103 to pass therethrough with clearance in all directions, and it should also be stated that the quill is of considerably greater diameter than the car axle, so that the latter may take different angular positions in said quill which, of course, has a fixed center of rotation. The pins 102 of the driving flange serve as guides for diametrically arranged perforated lugs 104 formed on a toggle casting 105 (Figs. 11 to 13), said toggle casting being of substantially crescent shape, so that it may be readily placed over the car axle and removed from the same. The perforated lugs 104 of said toggle casting are alined with the center of the quill and they both slide diametrically and rotate on the guide pins 102 of the driving flange, permitting the toggle casting either to swing or slide in any direction on said pins. The toggle casting 105 is also furnished with oppositely placed perforated lugs 106, as best shown in Fig. 11, and it will be noted that while a line connecting these last named lugs is located at right angles to a line connecting the lugs 104, the first mentioned line is offset from the center of the quill, for a purpose to be presently explained. Said bars 106 serve to position pins 107 that are set in the corners of the U-shaped yoke 108, thereby permitting the yoke to swing toward and away from the toggle casting 105 about the pins 107 as pivots. The U-shaped yoke 108 is shown in detail in Fig. 14, from which it will be seen that the extremities of the legs of the yoke are provided with alined perforated lugs 109, the axes of which are parallel to the pins 107. These lugs embrace pins 110 that are arranged in pairs between alined perforated lugs 111 carried by a driving collar 112 that drives the car axle 103 by means of a hub 113 embracing the latter and formed integral with said collar, as indicated in Fig. 7. The yoke 108 embraces the car axle, between the toggle casting and the driving collar 112 (Fig. 5).

Fig. 6 is a horizontal section showing how the universal joint takes care of the lateral movement of the axle when the truck is rounding a curve. This shows both the swinging of the yoke on the pins 107 and the sliding of the toggle casting along the pins 102 of the driving flange. If the same movement of the trucks were taking place with the universal joint turned through 90 degrees from the position shown, the swinging of the yoke would be the same except in degree, but the horizontal sliding would take place along the pair of pins 110 of the driving collar 112, while the lugs 104 of the toggle casting would be at the center of the pins 102. A slight turning of lugs 104 on pins 102 would also take place, as the axis of lugs 106 remains always normal to the axis of the car axle. Fig. 5 is a vertical section through the parts in the position just described except that the axle is shown in the same vertical plane as the quill and without the angular displacement due to a curved track. Any displacement in a vertical direction with respect to the quill such as would be occasioned by inequalities in the road bed is taken care of by vertical slip on pins 102 in position shown in Fig. 5 and by vertical slip on pins 110 in position shown in Fig. 6. If the axle were given a movement toward the left with respect to this figure, combined with the swinging movement which it would have around the truck center, it will be understood that the yoke 108 would slide along the pins 110 of the driving collar to take care of the fore and aft displacement while the toggle casting would turn slightly around the pins 102. This turning would be the same as the horizontal angle of deflection of the axle as shown in Fig. 6.

In any intermediate position, during the revolution of the universal joint, the motion of the various parts is a combination of the two motions described above, and the lugs are continually sliding and rotating on their respective pins. The offsetting of the lugs 106 from the center of the axle, together with the introduction of a third axis parallel to the second, and the swinging yoke, connecting these two last named axes, enables the universal joint to take care not only of angular deflections, but of translations of the various parts in any directions. The described arrangement of the U-shaped yoke and the driving flange with the center part of the latter removed, permits a continuous axle to pass through the center of the universal joint without interference. The open or crescent form of the toggle and the open form of the U-shaped yoke enable these parts to be put in place or removed without interference with the car axle. Thus repairs can be made to pins or to bushings in which the pins are placed, without taking off the wheel.

When the pile driver is being shipped from place to place, in a freight train, the

sliding bevel gears 89 on the lower ends of the inclined driving shafts I, J are moved, by means of the lever operated toggle mechanism described, out of engagement with the bevel gears on the axle quills, so that the rotation of said quills will have no effect on the driving shafts, as before indicated. When the pile driver is taken out of the train and is to be propelled a comparatively short distance by its own motive power the gears on the driving shafts are engaged with those on the axle quills and the sleeve or quill 25 on the main operating shaft F is slid into such a position that its larger gear 27 will mesh with the gears 29 on the driving shafts. This will produce the propelling of the pile driver at a relatively fast speed when the engines E are operated for that purpose.

When the machine is to be driven at a comparatively slow speed, in order to spot the machine with respect to the piles or to enable it to haul heavy loads up grades, the quill or sleeve 25 is moved into such a position that the smaller gear 26 thereon will be brought into operation, as will be understood. After the machine has been properly located, and it is desired to swing the deck or raise the leaders, the bevel gears 89 at the lower ends of the driving shafts are uncoupled from the trucks, by suitably manipulating the levers 98, and the transmitting shaft M is then coupled to the shaft J, in order that the rotation of said last named shaft, at either of two speeds, may produce the rotation of the transmitting shaft and the operation of the swinging deck and leaders or other mechanism mounted on the car. When it becomes necessary to move the machine again, this is produced by uncoupling or unclutching the transmitting shaft from the forward driving shaft and then clutching in the bevel gears on the lower ends of the driving shafts with those on the respective car axle quills.

It will be understood that I have not attempted to describe all the numerous modifications of the construction of the machine which may be made without departing from the scope of my invention as defined in the claims.

In particular, I wish it to be understood that the form of the connection between the universal joint and the car axle, and the arrangement of this connection with respect to said parts, to produce a more or less direct drive of the car wheels, are susceptible of numerous modifications.

What I claim is:—

1. In a locomotive for self-propelled pile drivers and the like, a car having front and rear wheeled trucks, a prime mover on the car having a transverse operating shaft above the deck or floor of the car and between the trucks, inclined driving shafts operatively connected with said operating shaft and extending down into proximity to the rear axle of the forward truck and the forward axle of the rear truck respectively, and shiftable mechanism to couple the driving shafts with the respective axles.

2. In a locomotive for self-propelled pile drivers and the like, a car having front and rear wheeled trucks, a transverse operating shaft on the car, a sliding quill on said shaft having beveled gears at the respective ends, and driving shafts interposed between said operating shaft and axles of the respective trucks and having bevel gears to mesh with the respective gears of the quill, all of said gears being so arranged as to drive the car at different speeds according to the position of said quill on its shaft.

3. In a locomotive for self-propelled pile drivers and the like, a wheeled car, a transverse operating shaft, a quill slidable along said shaft and carrying oppositely located bevel gears, a driving shaft interposed between said operating shaft and one of the car axles, and bevel gears on one end of said driving shaft and interposed between the gears on the quill, all of said gears being so arranged as to drive the car at different speeds according to the position of said quill on its shaft.

4. In a locomotive for self-propelled pile drivers and the like, a wheeled car, a driving shaft operatively connected at one end with one of the axles thereof and equipped at the opposite end with a plurality of gears, a power shaft on the car, a quill slidable on said power shaft, and gears on the quill arranged to mesh with the respective gears on the driving shaft, said quill having an intermediate position in which all of the gears are disengaged.

5. In a locomotive for self-propelled pile drivers and the like, a wheeled car, a driving shaft to drive one of the axles, and equipped with bevel gears, a power shaft on the car, and a sliding quill or sleeve on said last named shaft carrying bevel gears to mesh with the respective gears on the driving shaft and thereby propel the car at different speeds.

6. In a locomotive for self-propelled pile drivers and the like, a wheeled car, a transverse power driven shaft thereon, driving shafts connected with the car axles and carrying a plurality of gears, and a sliding quill on said power driven shaft carrying a plurality of gears to mesh with the respective driving shaft gears and thereby propel the car at different speeds.

7. The combination with a car axle, of a power driven quill surrounding the same, and a universal joint connection between the quill and the axle.

8. The combination with a car axle, of a quill surrounding the same with clearance in

all directions, a driving flange on the quill, and a universal joint connection between said driving flange and the axle.

9. The combination with a car axle, of a quill surrounding the same with clearance in all directions, and a universal driving connection between the quill and the axle which permits angular movements of the axle within the quill and also movements of translation.

10. The combination with a car axle, of a driving quill surrounding the same, and a driving connection between the quill and axle which permits the latter to move angularly with respect to the former and also lengthwise thereof.

11. The combination of a car axle, a driving quill embracing said axle and of considerably greater diameter than the same, and a universal driving connection between said quill and axle having three pivoted axes, one of which permits movements of translation of the axle within the quill.

12. The combination of a driving quill having a fixed axis of rotation, gearing to drive the quill, an axle extending through the quill, and a universal connection between the quill and axle.

13. The combination of a driving quill having a fixed axis of rotation, an axle extending through the quill with clearance in all directions, a driving flange carried by the quill, a toggle casting having a swinging and sliding connection with said flange and embracing the axle, and a yoke embracing the axle and having a swinging movement with respect to said toggle casting, said yoke being connected with the axle to drive the same.

14. The combination of a driving quill, an axle extending therethrough, and a universal joint forming a driving connection between said quill and said axle, said joint having right angularly disposed pivotal axes, one of which at least is offset from the center of the quill.

15. The combination of a driving quill, a car axle extending therethrough, and a universal driving connection embracing the axle and secured to the quill.

16. The combination of a driving quill, an axle extending therethrough, and a universal joint connection between the axle and one end of the quill, said connection embracing the axle and comprising three pivotal axes, one of which permits movement of the axle longitudinally of the quill.

17. The combination of a driving quill, a solid one-piece car axle extending therethrough, a universal driving connection interposed between the axle and the quill, and means to drive the quill directly.

18. The combination of a driving quill having a driving flange at one end, a car axle extending through the quill and through said driving flange, a toggle casting having a sliding and swinging movement on radial pins carried by the driving flange, a U-shaped yoke having a swinging relation with the toggle casting in the plane of the pins of the driving flange, and a collar applied to the axle and having a swinging connection with said yoke, said collar being slidable in a direction at right angles to the pins of the driving flange.

19. The combination of a car axle having a driving gear associated therewith, a driving shaft, a gear slidable on said shaft into and out of engagement with said first gear, toggle mechanism for shifting said second gear on its shaft, and means to operate said toggle mechanism.

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

WALTER FERRIS.

Witnesses:
L. A. CHRISTENSEN,
HARRY B. HAYDEN.