No. 638,113. Patented Nov. 28, 1899.

C. HAGANS.

LOCOMOTIVE WITH COUPLED BOGIES.

(Application filed Aug. 10, 1898.)

(No Model.) 4 Sheets—Sheet 1.

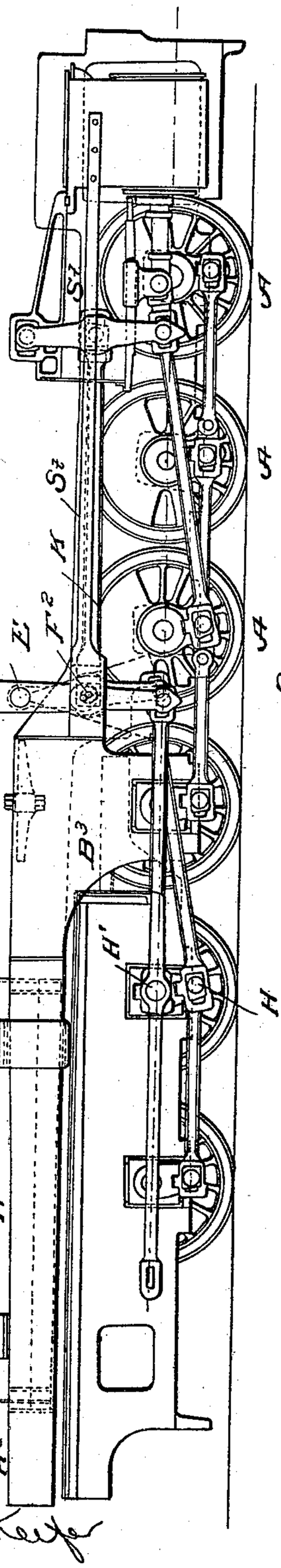

Fig. 1.

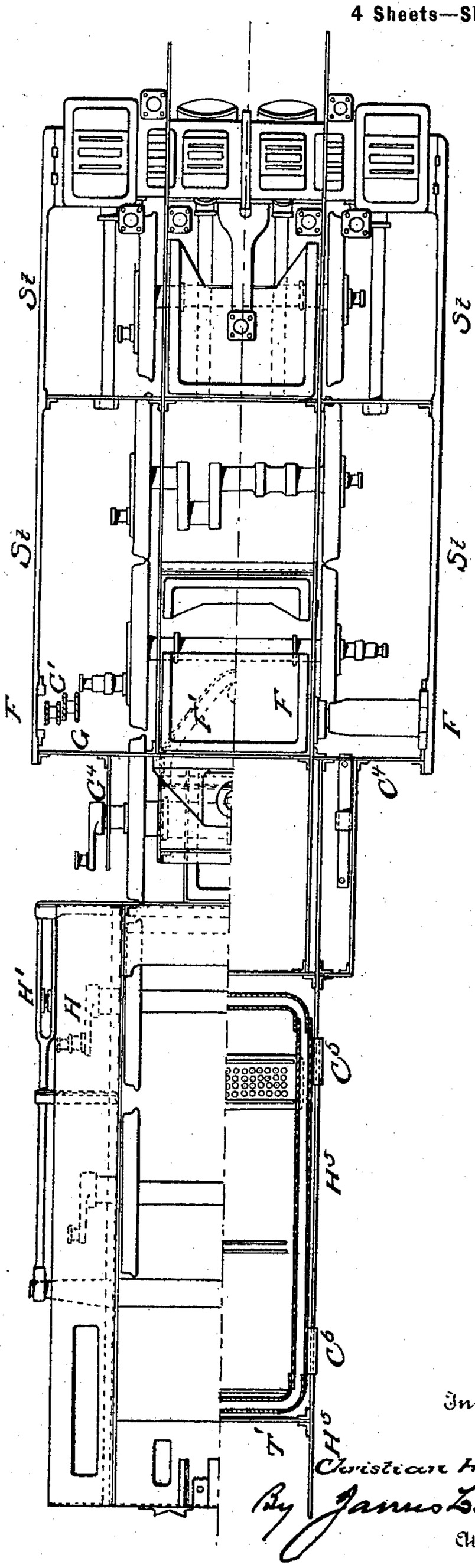

Fig. 3.

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(No Model.) 4 Sheets—Sheet 2.

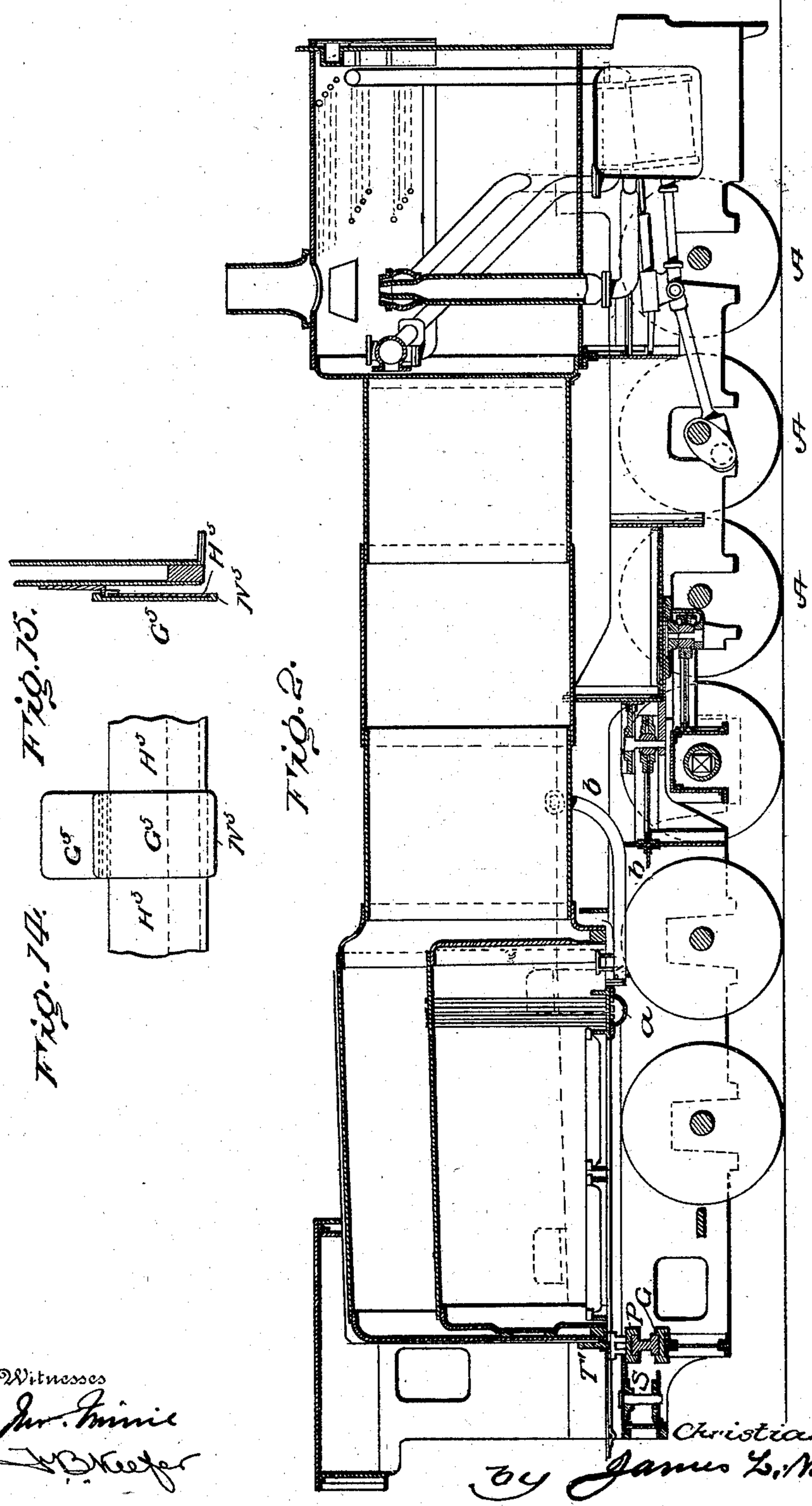

Fig. 2.

Fig. 1.

Fig. 1A.

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LOCOMOTIVE WITH COUPLED BOGIES.

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(No Model.) 4 Sheets—Sheet 3.

Fig. 4.

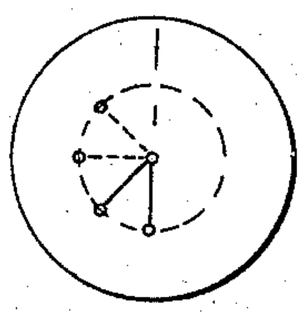


Fig. 5.

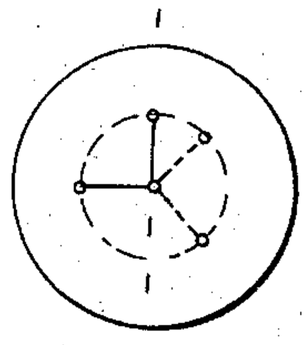


Fig. 6.

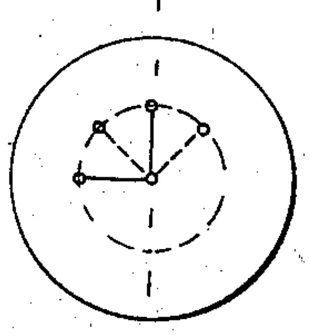


Fig. 7.

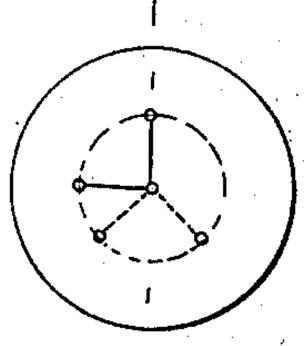


Fig. 8.

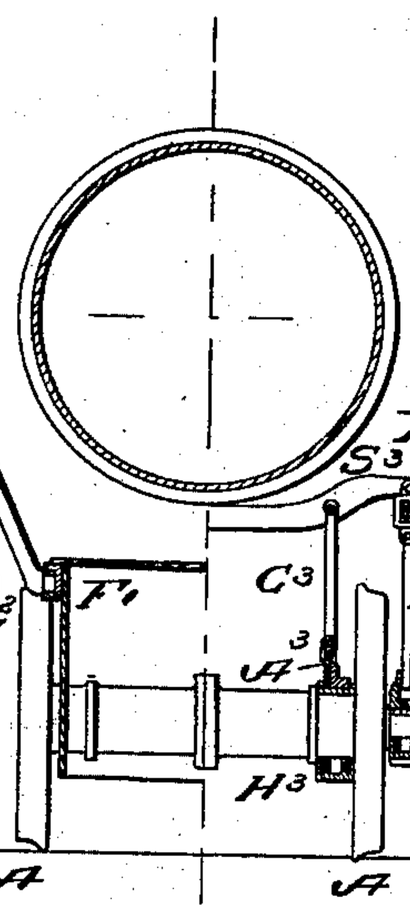


Fig. 9.

Fig. 10.

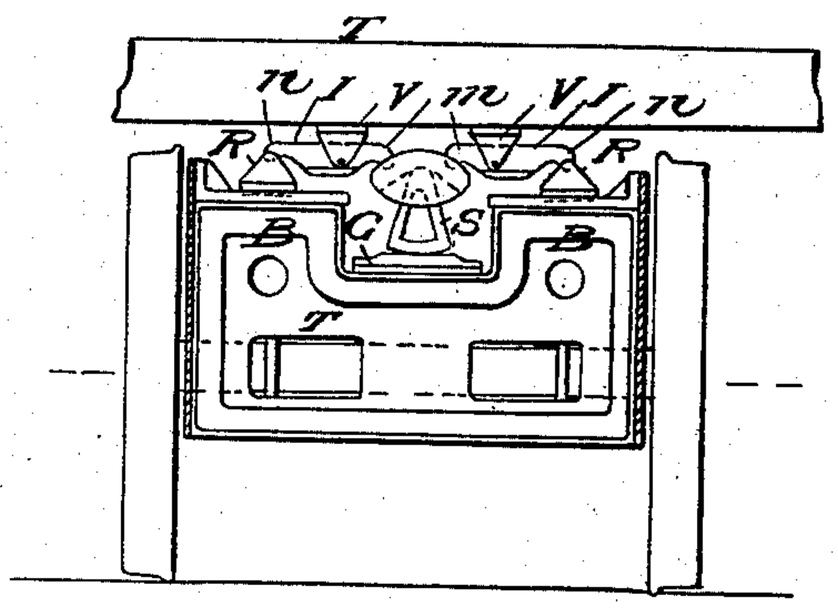
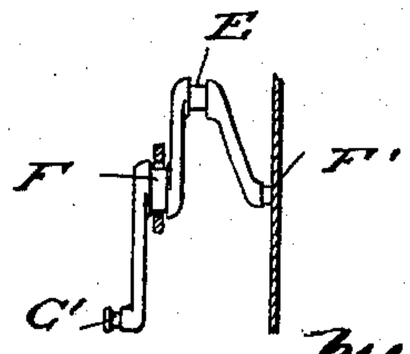


Fig. 16.



Witnesses

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No. 638,113. Patented Nov. 28, 1899.

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LOCOMOTIVE WITH COUPLED BOGIES.

(Application filed Aug. 10, 1898.)

(No Model.) 4 Sheets—Sheet 4.

FIG 11.

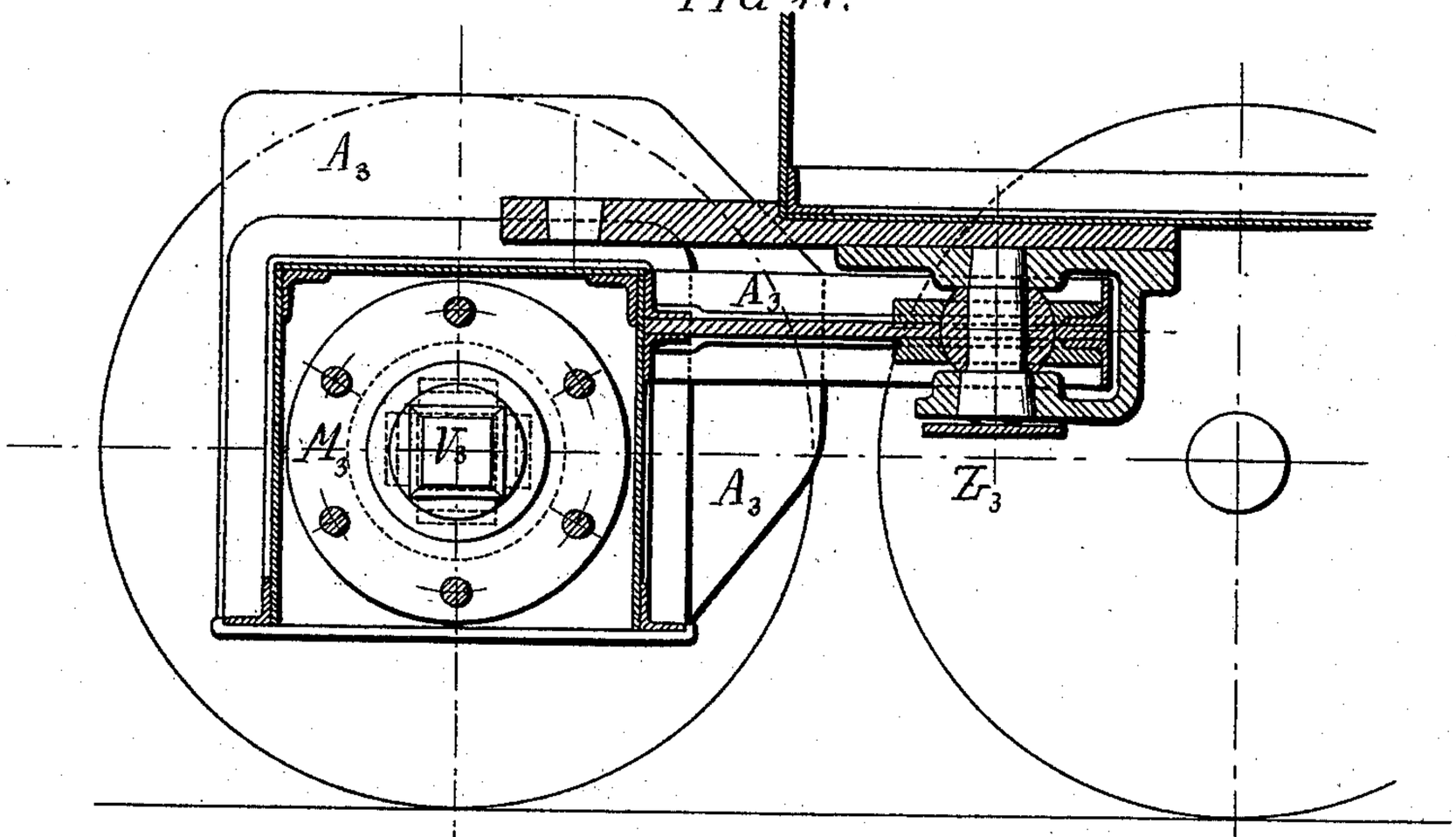

FIG 12

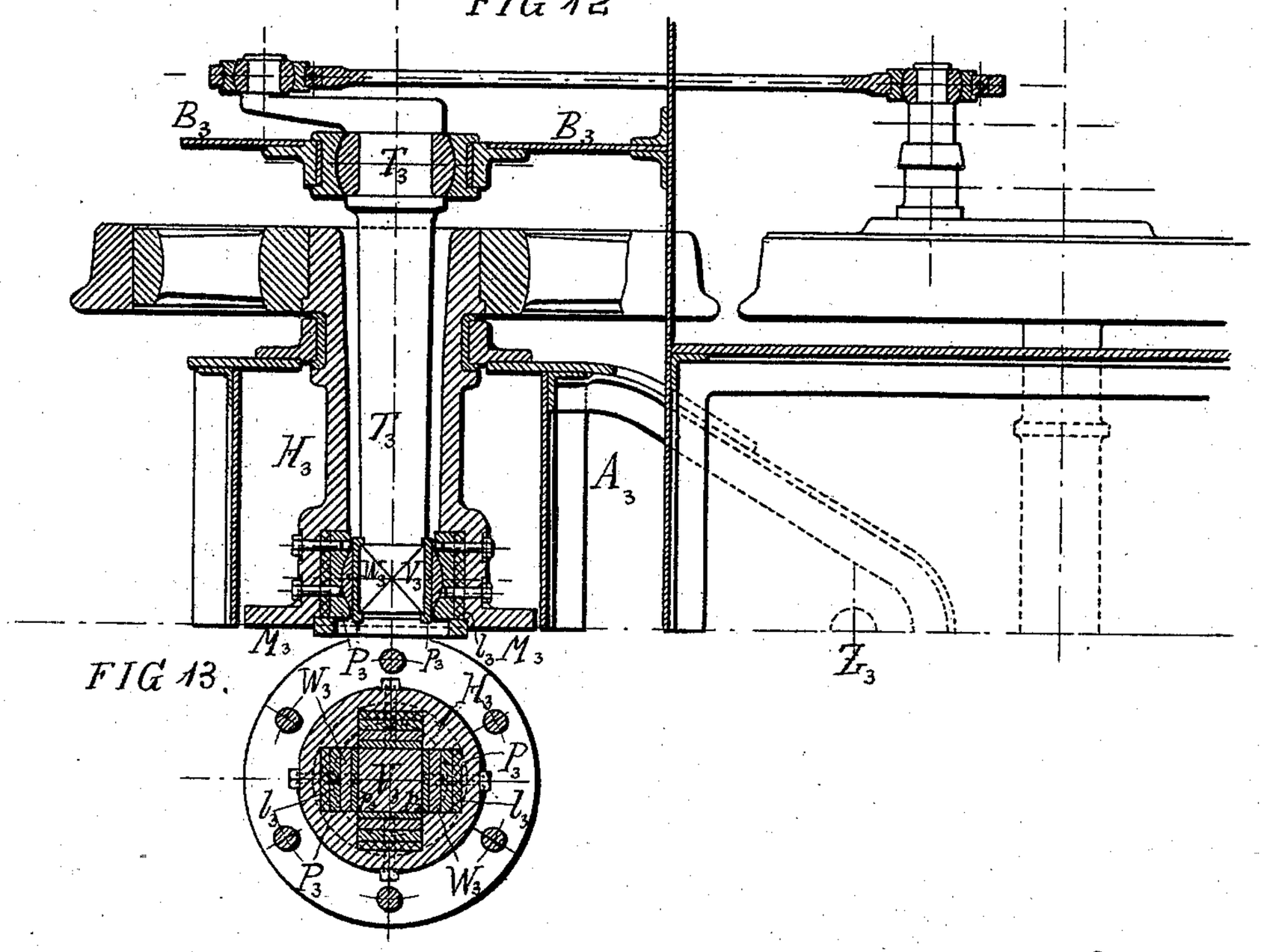

FIG 13.

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By James L. Norris.
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UNITED STATES PATENT OFFICE.

CHRISTIAN HAGANS, OF ERFURT, GERMANY.

LOCOMOTIVE WITH COUPLED BOGIE.

SPECIFICATION forming part of Letters Patent No. 638,113, dated November 28, 1899.

Application filed August 10, 1898. Serial No. 688,287. (No model.)

To all whom it may concern:

Be it known that I, CHRISTIAN HAGANS, engineer, a subject of the King of Prussia, German Emperor, residing at Erfurt, in the Kingdom of Prussia and German Empire, have invented certain new and useful Improvements in Locomotives with Coupled Bogies, of which the following is a specification.

My invention relates to improvements in locomotives with coupled bogies.

In the accompanying drawings, forming a part of this specification, Figure 1 is a view in side elevation of my improved locomotive. Fig. 2 is a vertical longitudinal sectional view thereof. Fig. 3 is a partial top plan and horizontal sectional view. Figs. 4 to 7 are diagrammatic views illustrating the relative angles at which the cranks are set. Figs. 8 and 9 are detail sectional views illustrating the means for driving the bogie-axles from the main axles. Fig. 10 is a detail view of the arched supporting structure. Figs. 11 and 12 are detail sectional views illustrating the manner of supporting one of the front axles in a separate frame to permit the locomotive to pass around curves of small radii. Fig. 13 is a detail view of the bearing-support for said axle. Fig. 14 is a detail view of one of the extensions of the main frame and its hanger and bracket. Fig. 15 is a vertical sectional view of the same. Fig. 16 is a detail view of the arch F′ E G′ and arm F G′.

The locomotive illustrated by way of example in the accompanying drawings is provided, according to the present invention, with four cylinders, Figs. 3 and 9, which can work in pairs as compound engines, or all four cylinders can work as high-pressure cylinders. The cranks on the axles are arranged in such relative position that when working with all the four cylinders as high-pressure cylinders the exhaust takes place eight times for each revolution of the wheel for the purpose of increasing the combustion and the air-draft. When all four cylinders work as high-pressure cylinders, eight exhausts for each revolution of the wheel are obtained by arranging the cranks or crank-pins of the axles not at angles of ninety degrees or approximately ninety degrees, as usual, but at angles of forty-five degrees or approximately of forty-five degrees to each other, as indicated in Fig. 4. The two thicker lines indicate the centers of the cranks on one side of the locomotive, the dotted lines being those on the other side, or the cranks on each side of the locomotive placed at an angle of ninety degrees or approximately ninety degrees, as usual, may be placed at an angle of forty-five degrees or approximately forty-five degrees relatively to each other, as indicated in Figs. 5 to 7. By means of these eight regular exhausts the draft of the combustion-gases becomes much better and more uniform and the heating area of the boiler of the locomotive is utilized better than in existing locomotives with two, four, or six uniform or irregular exhausts for each revolution of the wheels, because a more energetic draft is produced in the funnel with eight regular actions per wheel revolution than when there is a smaller number of actions per wheel revolution. In consequence more coal is consumed in the furnace and more heat carried to the heating-surface of steam in the boiler. When the locomotive travels on a level ground and works as a compound locomotive with normal steam generation, the number of exhausts for each revolution of the wheels becomes four, as usual.

In order not to decrease the ability of the locomotive to travel on curves in spite of its increased number of axles, the fore frame is provided with three or four coupled axles A, and at the rear is arranged a bogie with two or more axles driven from the axles A, Figs. 1, 3, and 8. This bogie is driven in the following manner: A rod K, one end of which engages with an oscillating lever driven from the cylinder, engages at its opposite end at the point F^2 with an oscillating lever E G, and thus causes it to oscillate. With the lower end of the lever E G engages a rod G H, by means of which the bogie-wheel cranks are driven. The lever E G is pivoted on a pin carried in the bend of the bent crank F E F′, Fig. 8, which is supported by means of its pin F in the outer frame and by its pin F′ in the inner frame and is held in position at its lower extension by the rod G′ H′.

In Hagan's locomotives, constructed according to Patents Nos. 501,616 and 525,205, the back coupling-rod was mounted by means of a frame-like guide-lever. Such guide-

lever could not, however, be used with more than four axles and only when the axle distances were abnormally great. Besides the construction of such frames or levers was very difficult and expensive and could not be produced in a reliable manner. In order to avoid said faulty and in many cases impossible "frame-like guide-levers" and at the same time to enable locomotives to be constructed with five and six coupled axles and with axles arranged as close together as possible, the bent crank according to this invention is used. (See Figs. 1 and 8.)

The arched structure F′ E G′, Fig. 8, is supported in bearings by its journals F and F′. The bend or journal E serves to carry the lever E G, which connects the rear coupling-rod with crank H of the rear bogie, Figs. 1 and 3. The arm F G′ of this arch F′ E G′ may not be connected directly to the pin E, but the crank may be continued beyond the point E in rectangular cross-section and the coupling-rod connected to a special pin G′, Fig. 16. As according to my invention there is no inner connection in the crank between the end pins F′ and G′, the coupling-rod can freely move in the free inner space of said crank. This enables the Hagans bogie construction to be extended to five and six coupled locomotives, while allowing the axles to be very close together.

A crank according to my invention is desirable, as it can be constructed with certainty and made very strong and reliable by bending a well-forged straight rod, as when thus manufactured the fibers lie in the direction of the strain. In the possibility of a reliable calculation as to elasticity or springiness lies the safety of the point of attachment E of the rear lever E G.

In order to regulate the resistance of the bogie to lateral movement, the following device is employed, Figs. 2 and 10: It consists of a combination of parts which have partly a rolling and partly a sliding frictional motion. The parts are chosen or may be regulated so that either rolling or sliding friction is caused to predominate, as desired. The device is as follows: On a cross-bar T of the bogie-frame is arranged a plate C, on which rests a sector S. On the sector S rests a cup P, with which engage on both sides double-armed levers I, having blunt knife-edges *m*. With their outer blunt knife-edges *n* said levers engage with slide-blocks R, adapted to slide on surfaces B. These latter are also situated on the cross-bars T. The whole weight of the main frame rests on this device by means of two supports or bearings B, secured to the cross-bar T′ of the main frame, Figs. 2 and 3. According as these bearings V are arranged nearer to *m* or *n* the side movement of the bogie will be accompanied by greater or smaller rolling or sliding friction—that is to say, there will be required more or less force to produce such movement.

The driving device illustrated produces in the bearings F, Figs. 1 and 3, a very considerable pressure forward and backward. In order to take up this pressure, these bearings F are connected with the cylinders by means of the rods S*t*. The brackets C^4, Figs. 1 and 3, serve to support the bearings F. The main frame is continued to the back by extensions H^5 beyond the brackets and over the pivoted frame or bogie. The extensions H^5 serve to support the back portion of the boiler and to enable the frame to be raised at the back when required. As it is extremely difficult in such construction to make the main frame sufficiently strong to enable the locomotive to be raised from behind, and as, on the other hand, such a strong frame would be very clumsy and would cause a large amount of dead-weight, the main frame is strengthened at the back by the boiler and the boiler-supports C^6, and the hangers C^5 (shown in Figs. 1 and 3) serve to effect this strengthening. These supports are secured to the longitudinal sides of the outer walls of the fire-box, so that said supports rest, as usual, only on the back portion of the frame, but in such manner that when the locomotive is being raised the extensions H^5 of the main frame cannot bend vertically. For this purpose the end H^5 is connected with the support C^5 by means of the projection N^5, as shown in Figs. 14 and 15. If the frame is raised by its rear end H, the turning strain on the frame will be taken up by the outer walls of the fire-box. In this way the arrangement described very greatly reduces such strain on the frame, which need not therefore be made any stronger than usual.

In some cases the curves to be passed are of very small radius. Then it is necessary for one of the three or four front axles of the locomotive to come into the radial position on said curves. In order to render this possible, the fourth axle is, as shown in Figs. 2, 3, 9, 11, and 12, supported in a separate frame A^3, pivoted about a pin Z^3, Figs. 11 and 12. In order to enable this axle to be coupled with the other axles in the main frame, the wheels of said axle are mounted in a hollow shaft H^3, through which passes the driving-axle T^3, supported in the main frame or in a portion B^3 of it, said axle consisting of right and left hand halves. The rotations of the halves of the driving-axle are transmitted by any suitable coupling device to the hollow shaft H^3; but the pressure of the locomotive-body resting by means of springs on the hollow shaft H^3 is not transmitted to the halves of the driving-axle T^3, which result is attained by means of a special balancing device. The coupling device shown in the drawings is as follows, referring to Figs. 13, 14, and 15: The halves of the driving-axle T^3 are provided with square portions V^3. On the faces of these square portions are placed plates p^3, and on the latter are placed plates P^3. The plates P^3 are secured to the inner surface of

the hollow shaft H^3 by means of screws or bolts and are provided with cylindrical recesses, into which fit segment-pieces W^3. The hollow shaft H^3 can then move slightly in a lateral direction, together with the segment parts W^3 on the plates p^3, secured to the halves of the driving-axle T^3, and has, owing to the clearance provided between the plates P^3 and p^3 and to the cylindrical form of the segments W^3, sufficient space for turning slightly when the locomotive travels on a curve.

In order to make the halves of the driving-shaft and the coupling devices more easily accessible and to facilitate their introduction and removal, the hollow shaft consists of two parts connected by flanges M^3. For the purpose of facilitating the maintenance and mounting of the coupling device there are placed between the plates P^3 and the hollow shaft H^3 additional plates I^3, Figs. 12 and 13.

The means of supporting the locomotive on the hollow shaft H^3 or on the frame A^3 by means of springs is, as shown in Fig. 9, as follows: The two lateral springs F^3 support the parts B^3 of the main frame with their bolts and are connected by a cross part S^3, supported by means of a spring-bolt G^3 on the brackets supporting the hollow shaft H^3 or on the frame A^3.

The balancing device of the halves of the driving-axle T^3, which are vertically movable in the main frame part B^3, as in ordinary locomotive axle-boxes, consists in each axle-bearing L^3, Fig. 9, of the halves of the driving-axle T^3 being connected by a rod St^3 with the cross-piece S^3. Thus the pressure of the springs and the pressure of the hollow shaft H^3 on the halves of the driving-axle T^3 are prevented.

No claim is made herein to the arrangement of tubes in the fire-box or the superheater in the smoke-box, as the same will form the subject-matter of a separate application.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In locomotives with coupled bogies an arch F′ E G′ the journals F F′ of which are supported in bearings and the arm E G of which is situated opposite the bend E, for the purpose of allowing free passage of a coupling-rod in locomotives, with five and six coupled axles.

2. In locomotives of the class described, an arch F′ E G′, the journals F F′ of which are supported in bearings and the arm E G of which is situated opposite the bend, and the crank-pin lies outside of the bearing of the journals F E and opposite the journal E, substantially as specified.

3. A device for enabling the bogie-frame to be turned with an adjustable resistance comprising a sector as S and a cup as P coöperating with it in combination with sliding surfaces B and blocks as R producing sliding friction substantially as described.

4. In a locomotive of the character described the connection of the bearing F with the cylinder by means of a rod S*t* substantially as and for the purpose described.

5. The construction of frame consisting in the arrangement of extensions H^5 at both sides of the outer walls of the fire-box, which extensions are directly secured to the latter in such manner, that a turning strain produced in them when the locomotive is being raised, is taken up by the hanger C^5 the supports C^6 carrying the fire-box.

6. In a locomotive of the character described a hollow axle carried in a pivoted frame said axle containing a divided driving-axle supported in the main frame and having the pressure on it relieved by a balancing device so that only the hollow shaft carries the corresponding weight of the engine at points close to the wheels and transmit to the hollow shaft only the rotation of the divided driving-axle by means of any suitable coupling device substantially as described.

7. The combination with the driving-axle in sections having polygonal portions, of plates thereon, a hollow shaft, plates on the inner surface thereof and having recesses, and segmental pieces fitted to said recess, substantially as specified.

8. The combination with the driving-shaft in sections having polygonal portions, of plates thereon, a hollow shaft in two parts with connecting-flanges, plates on the inner surface of the hollow shaft and having recesses, and segmental pieces fitted to said recesses, as and for the purpose specified.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CHRISTIAN HAGANS.

Witnesses:
LOUIS POSERN,
WILHELM MONEGUIN.