Feb. 28, 1933. P. G. SANBORN 1,899,589

LOCOMOTIVE

Filed June 30, 1931 4 Sheets-Sheet 1

FIG. 1.

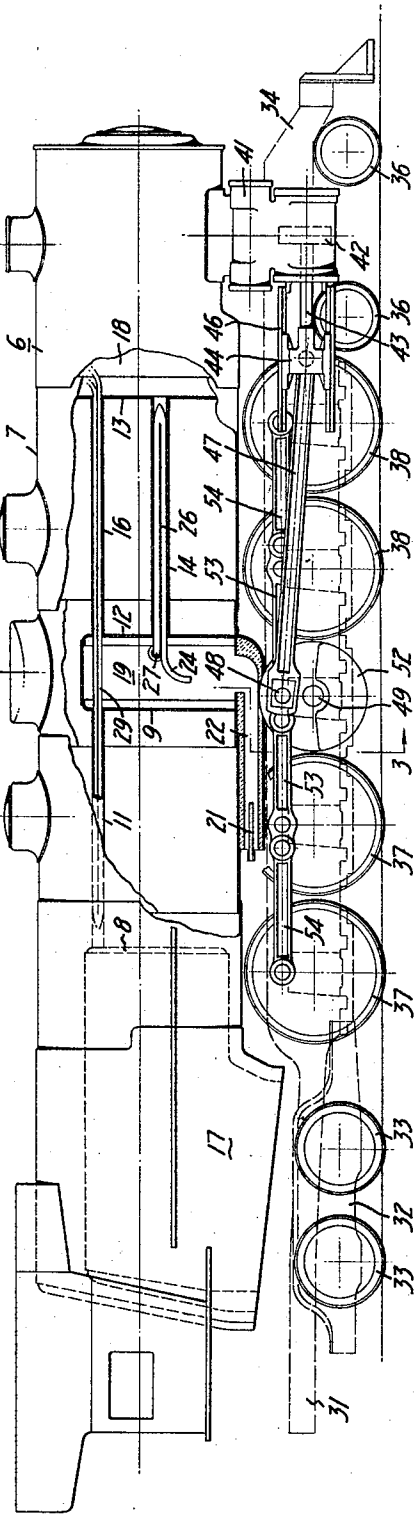
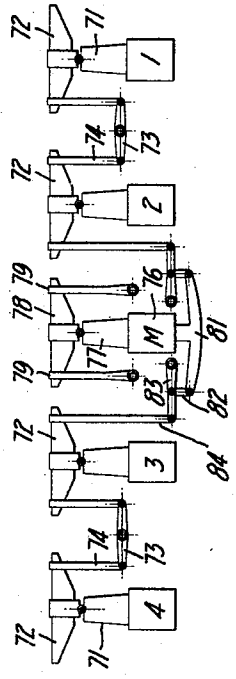


FIG. 2.



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FIG. 3

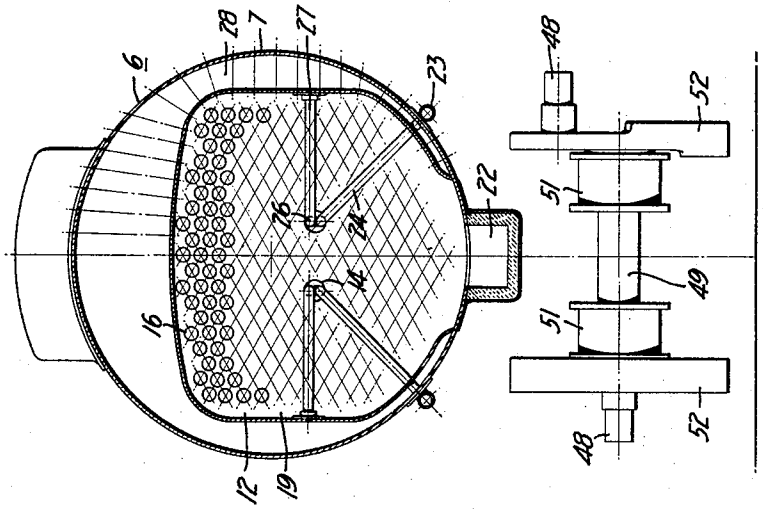


FIG. 4

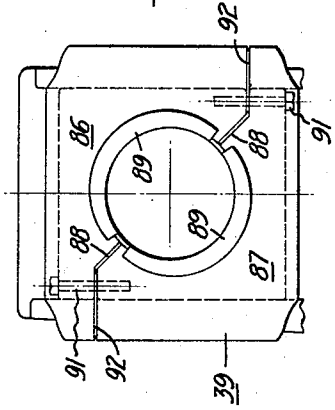
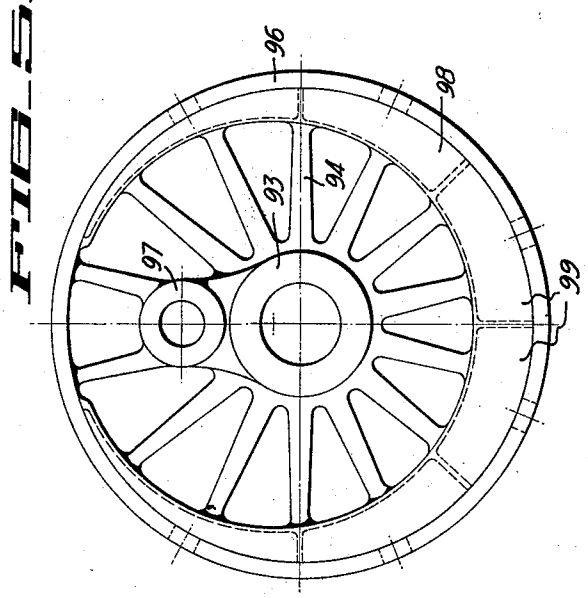


FIG. 5



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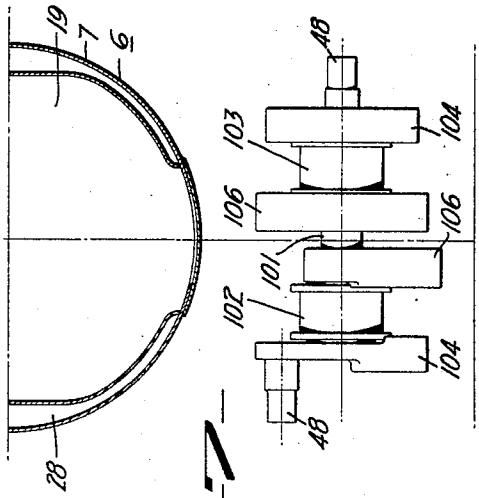


FIG. 7.

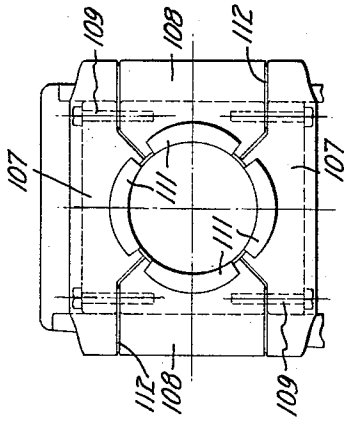


FIG. 8.

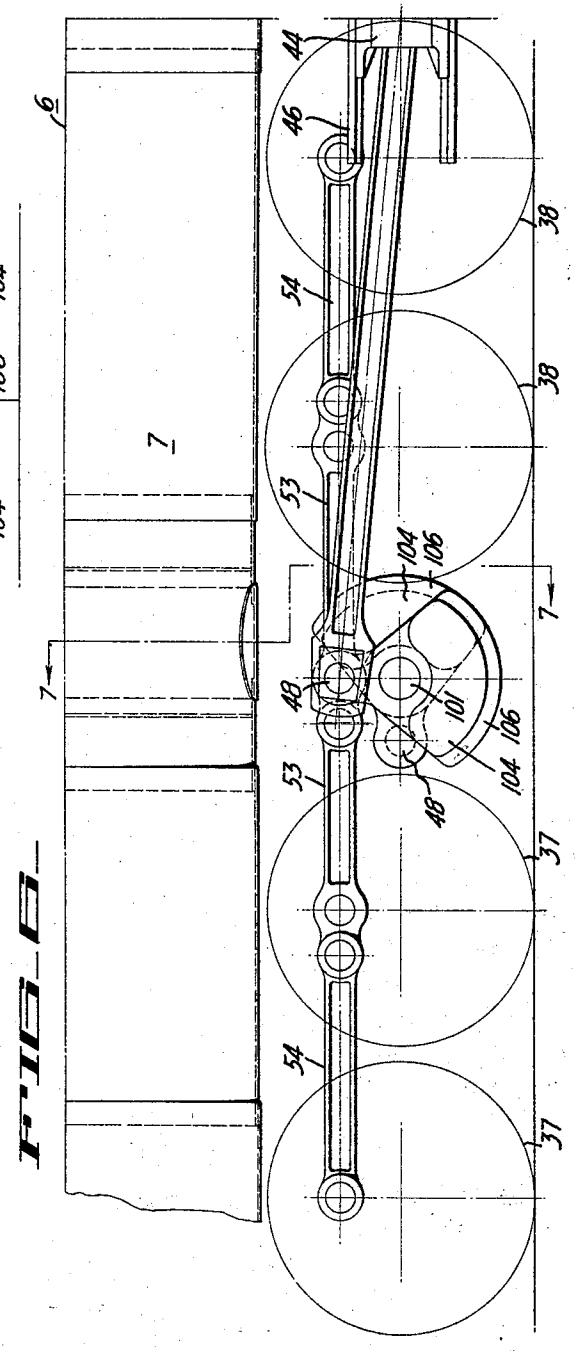


FIG. 9.

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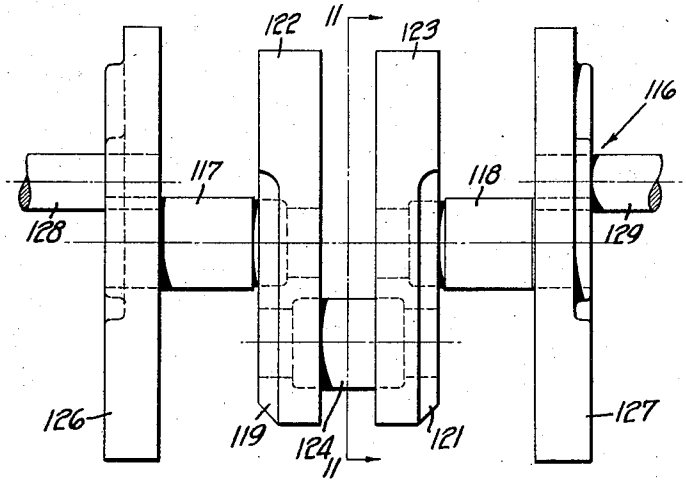


FIG. 9.

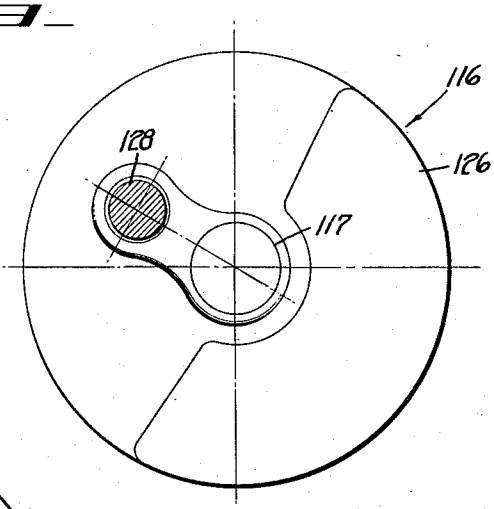


FIG. 10.

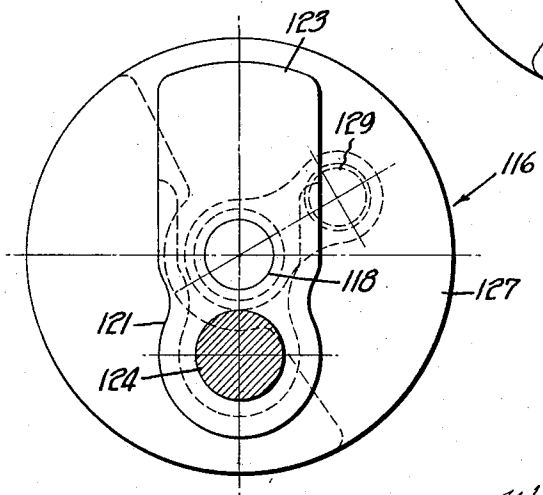


FIG. 11.

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UNITED STATES PATENT OFFICE

PERCY G. SANBORN, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF ONE-HALF TO FRANK E. MADDEN, OF OAKLAND, CALIFORNIA

LOCOMOTIVE

Application filed June 30, 1931. Serial No. 547,922.

My invention relates primarily to steam propelled locomotives for use in hauling trains and for other railroad uses and relates particularly to locomotives operated by reciprocating steam engines as is now almost universally the practice.

Due to the weight of the reciprocating parts of the customary locomotive in which the driving pitmen are connected to or journaled on pins on the driving wheels, there is a considerably unbalanced force due to the reciprocation of the parts which is immediately communicated to the track or rails and which results in a destructive pounding on the rails, shortening their life and necessitating the use of much heavier stock or material than would be necessary were there no unbalanced forces acting upon them. As customarily constructed in this country, locomotives usually include a frame on opposite sides of which there is disposed a steam cylinder, having a piston acting on wheels on the same side of the vehicle through the medium of connecting and pitmen rods and since it is necessary to insure that a start from rest can be made, the pistons in cylinders on opposite sides of the locomotive are usually "quartered" with respect to each other and are connected through axles joining the wheels. This means that the axles must be strong enough not only to support the weight of the vehicle on the wheels but also of sufficient size to transmit the full propulsive torque of the working cylinder from the wheels on one side of the vehicle to the wheels on the opposite side.

It is, therefore, an object of my invention to provide a locomotive in which the deleterious pounding effect of unbalanced parts is eliminated.

Another object of my invention is to provide a locomotive in which the axles are relieved of a large part of their work.

The foregoing and other objects are attained in the embodiment of the invention shown in the drawings, in which

Figure 1 is a side elevation of a locomotive constructed in accordance with my invention, portions being broken way to disclose the interior construction.

Figure 2 is a diagram showing a side elevation of the equalizer arrangement of the locomotive of my invention.

Figure 3 is a cross section on the line 3—3 of Figure 1.

Figure 4 s a detail showing a suitable axle journal.

Figure 5 is a side elevation of a wheel constructed for the locomotive of my invention.

Figure 6 is a portion of a modified form of locomotive constructed in accordance with my invention.

Figure 7 is a cross section on the line 7—7 of Figure 6.

Figure 8 is a side elevation of a modified form of journal.

Figure 9 is a side elevation of a modified form of crankshaft especially for locomotives having three cylinders.

Figure 10 is an end elevation of the crankshaft of Figure 9, the crank pin being shown in cross section.

Figure 11 is a cross section, the plane of which is indicated by the lines 11—11 of Figure 9.

In its preferred form the locomotive of my invention comprises a frame mounted on rotatable wheels and having a crankshaft connected to the wheels by driving rods and connected to impelling pistons by pitman rods, the crankshaft being provided with weights for balancing the pitman rods.

In the form of my invention disclosed in Figures 1 to 5 inclusive, I provide a locomotive, generally designated 6, having the usual characteristics. Within the customary boiler shell 7 is a plurality of tube sheets 8 and 9 for fixing the location of boiler tubes 11. In a comparable fashion a pair of tube sheets 12 and 13 fix the location of additional boiler tubes such as 14 and 16. The rear of the tube sheet 8 is the customary firebox 17, while ahead of the tube sheet 13 is the customary smokebox 18. Between the sheets 9 and 12 is an intermediate combustion chamber 19 into which an auxiliary burner 21 discharges its products of combustion through a refractory lined duct 22. I preferably utilize some of the tubes

such as 14 to preheat the water entering the boiler and for this purpose connect a water inlet 23 by conduits 24 to pre-heater tubes 26 extending through the tubes 14 and returning through the same tubes to an outlet conduit 27 discharging into the water zone 28 within the boiler shell 7. In a similar manner, superheater tubes 29 are extended through the tubes 11 and 16 adjacent the upper portion of the tube sheets 8 and 9, and 12 and 13.

The boiler shell 7 is supported on a frame 31 extending throughout the length of the locomotive and resting at its rearward end on a trailing truck 32 provided with rail engaging wheels 33 and on a leading truck 34 provided with rail engaging wheels 36. Suitably mounted on the frame 31 to support the weight of the locomotive are driving wheels 37 and 38, there being in the present instance, two pairs of the driving wheels 37 under the rearward portion of the boiler and on opposite sides of the frame 31 and two pairs of the driving wheels 38 on opposite sides of the frame and under the forward portion of the boiler 7. Preferably, the wheels 37 and 38 on opposite sides of the frame are connected by axles in the customary fashion and are mounted in journal boxes such as the one generally designated 39 and disclosed in Figure 4.

In order that the various wheels 37 and 38 may be driven, I preferably locate on the forward end of the frame 31 and on opposite sides thereof, cylinders 41 within which suitable pistons 42 are adapted to operate. Each piston is provided with a piston rod 43 joined to a cross head 44 operating in guides 46 in the customary fashion. For transmitting the thrust of the cross head and the piston I provide a pitman rod 47 at one end connected to the cross head 44 and at the other end connected to a crank pin 48 projecting from a crankshaft 49, extending transversely of the frame 31 and suitably mounted thereon by journals 51. The crankshaft 49, by being connected to the pitmen 47, receives directly the thrust of the pitmen and is subject to the unbalanced forces set up by the motion thereof. Since the crankshaft is not directly in contact with the rails, it cannot transmit directly thereto any such unbalanced forces. However, I preferably so fabricate the crankshaft 49 that the unbalanced forces due to the pitmen 47 and its related parts are minimized and to this end the crankshaft 49 is provided with a plurality of balancing weights 52, sometimes called counterweights. Likewise connected to the crankshaft 49 are driving rods 53 and 54 joined to the various wheels 37 and 38 to cause them to rotate in unison.

Since all of the wheels on one side of the frame 31 are connected by driving rods, and since all of the wheels on the opposite side are connected by driving rods and, further, since the crankshaft 49 extends between the two sets of driving rods, the crankshaft 49 is the only shaft in the vehicle which need be designed to transmit the torque from one piston 42 on one side of the vehicle to the driving wheels on the opposite side. Therefore, the axles on which the wheels themselves are mounted can be only sufficiently large to carry the weight imposed upon them and need not be designed to take care of any driving torque.

Since in locomotives it is customary to support the frame 31 on the driving wheels by means of an equalizing system, I preferably provide such an arrangement in the locomotive of my invention. Each of the axles for the driving wheels 37 and 38 is mounted in a suitable journal connected by an intermediate member such as 71 to a spring 72. Each of the axles being provided with such a mechanism, there are a plurality of springs 72 which are interconnected by a suitable linkage including levers 73 and links 74.

Inasmuch as the axles rise and fall going over an undulatory track, I provide a means for raising and lowering the crankshaft 49 in accordance with the rising and falling movement of the axles. To this end the crankshaft 49 is mounted in a suitable journal 76 provided with a spacing member 77 connected to a spring 78 at each end provided with a link 79 fastened to the frame 31. The journal 76 is likewise provided with an extension 81 connected by shackles 82 to levers 83 fastened to links 84 connected to suitable ones of the springs 72 so that loads transmitted to the journals 76 by the crankshaft 49 are transmitted through the entire equalizing system and are distributed over all of the driving wheels 37 and 38. An additional effect of this mechanism is to cause the crankshaft 49 to move in consonance with the movement of the wheels, particularly the adjacent wheels 37 and 38, to avoid undue stresses on the driving rods 53 and on the pitmen 47.

Although the individual journals can be constructed in any manner desired, I preferably utilize a journal such as is shown in Figure 4. This journal includes two somewhat similar parts 86 and 87 having adjacent facing surfaces 88 and each containing a portion of a bearing brass 89. Suitable fastenings such as bolts 91 secure the portions together and shims 92 in between the portions 86 and 87 allow adjustment of the journal.

Although any standard type of wheel such as 37 and 38 can be employed, I preferably employ for the driving wheels, one such as is shown in Figure 5. In this instance, the wheel is provided with a hub 93 from which radiate a plurality of spokes 94 in the customary fashion, connecting to a circumscribing rim 96 adapted for contact with the rail. An eccentric boss 97 is provided on the wheel for reception of a pin to which the driving

rods 53 and 54 are connected. Rather than have a localized counterweight disposed adjacent the rim of the wheel diametrically opposite the boss 97 I preferably provide a counterweight of generally lunar form 98 extending substantially entirely around the periphery of the wheel and thickened gradually from adjacent the boss 97 to the opposite side of the rim. Preferably, the counterweight is divided into a plurality of compartments, such as 99, which are filled with any substance having a relatively great specific gravity. In this form of driving wheel the counterweight comes into juxtaposition with the track relatively gradually and thus obviates any excessive pounding which otherwise might occur.

In Figure 6 I disclose a somewhat modified form of the locomotive of my invention, the general characteristics of which are similar to the characteristics of the locomotive shown in Figure 1, but in which the crankshaft 101 is journaled as at 102 and 103 and is provided with a portion of the balancing counterweights 104 exteriorly of the journals 102 and 103 while the remainder of the balancing counterweights such as 106 is provided interiorly of the journals 102 and 103. Although the crankshaft shown has but two "throws" any number can be employed in accordance with the design of the locomotive. In this fashion, the shaft 101 itself is in better dynamic balance with respect to rocking couples and the load on the journals 102 and 103 is lessened.

In Figure 8 there is disclosed a modified form of journal in some respects similar to the journal shown in Figure 4 but in the present instance, incorporating four separable portions 107 and 108. The portions 107 are secured to the portions 108 by any suitable fastening such as studs 109 while each of the four quadrants is provided with a bearing brass 111 and shims 112 are preferably interposed between the several sections to permit suitable relationship of the parts and adjustment of the journal.

In Figures 9 to 11, inclusive, there is shown a crankshaft, generally designated 116, especially adapted for use with a locomotive having three cylinders with their axes parallel and adjacent each other. The crankshaft 116 is mounted in suitable journals and for this purpose has proper bearing surfaces 117 and 118. Between the surfaces 117 and 118 are crank throws 119 and 121 which are extended to provide counterweights 122 and 123. The throws 119 and 121 carry a central crank pin 124 for connection to the pitman rod of the center one of the three cylinders. Mounted on counterweighted discs 126 and 127 at opposite extremities of the crankshaft are crank pins 128 and 129, respectively, disposed at 120 degrees to the crank pin 124, and adapted to receive the pitman rods of the outer two of the three cylinders.

In general, a locomotive constructed in accordance with my invention is provided with means for minimizing unbalanced forces and with means for transmitting any remaining unbalanced forces from the reciprocating pitman rod not only to two wheels but to all of the driving wheels of the locomotive to the end that destructive pounding on the track can be greatly reduced or entirely obviated and to the further end that the axles of the wheels can be designed solely for supporting purposes and not with any regard to torque transmission.

It is to be understood that I do not limit myself to the form of the locomotive shown and described herein, as the invention, as set forth in the following claims may be embodied in a plurality of forms.

I claim:

1. A locomotive comprising a frame, rotatable wheels, an equalizing system connecting said wheels and said frame, a crankshaft connected to said frame through said equalizing system, means for driving said crankshaft, and means for connecting said crankshaft and said wheels for simultaneous rotation.

2. A locomotive comprising a frame, rotatable wheels, an equalizing system connecting said wheels and said frame, a crankshaft connected to said frame through said equalizing system, a driving pitman on said crankshaft, said pitman and said crankshaft being in substantial balance, and driving rods connecting said crankshaft and said wheels.

3. A locomotive comprising a frame, rotatable wheels adapted to move up and down with respect to said frame, a power transmitting shaft adapted to move up and down with respect to said frame in accordance with the movement of said wheels, means for transmitting power to said shaft, and means for transmitting power from said shaft to said wheels.

In testimony whereof, I have hereunto set my hand.

PERCY G. SANBORN.